District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 S. First St., Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-141
Revised August 8, 2011

Submit 1 Copy to appropriate District Office in accordance with 19.15.29 NMAC.

Release Notification and Corrective Action

OPERATOR

☒ ~~Initial~~ Subsequent Report ☐ Final Report

Name of Company: BP	Contact: Steve Moskal
Address: 200 Energy Court, Farmington, NM 87401	Telephone No.: 505-326-9497
Facility Name: Mudge LS 006	Facility Type: Natural gas well

Surface Owner: Federal	Mineral Owner: Federal	API No. 3004510843

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County: San Juan
A	11	31N	11W	1,033	South	869	West	

Latitude 36.90884 **Longitude** -107.96561

NATURE OF RELEASE

Type of Release: condensate and produced water	Volume of Release: Unknown	Volume Recovered: none
Source of Release: Flow line and BGT	Date and Hour of Occurrence: unknown	Date and Hour of Discovery: August 8, 2014; 1:30 PM
Was Immediate Notice Given? ☐ Yes ☒ No ☐ Not Required	If YES, To Whom?	
By Whom?	Date and Hour	
Was a Watercourse Reached? ☐ Yes ☒ No	If YES, Volume Impacting the Watercourse.	

OIL CONS. DIV DIST. 3
NOV 15 2016

If a Watercourse was Impacted, Describe Fully.*

Describe Cause of Problem and Remedial Action Taken.* During construction operations to replace the onsite BGTs impacted soil was discovered. The impacted soil was excavated and transported off site for landfarm treatment. To date approximately 6,000 yards^3 have been removed from the site. Groundwater monitoring wells were installed and sample results received on July 1, 2015 confirmed impacts. Additional monitoring wells were installed following an approved remediation work plan during the first half of August 2016. The details and results of the August activities are detailed in the attached report.

Describe Area Affected and Cleanup Action Taken.* Onsite hydrocarbon impacted soil was excavated. The excavated soil comprising of approximately 6,000 cubic yards were removed from the site. Additional monitoring wells recently installed suggested groundwater impacts are confined to a perched water zone. BP suggests purging the water from this zone in an effort to determine whether the water is perched or not. The attached report details the proposed activities.

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to NMOCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the NMOCD marked as "Final Report" does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

Signature:

Printed Name: Steve Moskal

Title: Field Environmental Coordinator

E-mail Address: steven.moskal@bp.com

Date: November 14, 2016 Phone: 505-326-9497

OIL CONSERVATION DIVISION

Approved by Environmental Specialist:

Approval Date: 11/27/17 Expiration Date:

Conditions of Approval: Attached ☐

Continue to purge AND Analyze Water From MW As Described in the Recommendations. Additional water delineation MAY Be Required, Soil Delineate South of Site Still Required.

3R-469

* Attach Additional Sheets If Necessary

161

SOIL AND GROUNDWATER INVESTIGATION REPORT
MUDGE LS 6 WELLSITE

UNIT M (SW ¼ SW ¼), SECTION 11, TOWNSHIP 31 NORTH, RANGE 11 WEST
WELLSITE COORDINATES: 36.90884, -107.96561
SAN JUAN COUNTY, NEW MEXICO
API #: 30-045-10843; 3RP-469-0

September 13, 2016

OIL CONS. DIV DIST. 3
NOV 15 2016

Submitted To:
BP America Production Co.
200 Energy Court
Farmington, NM 87401

Submitted By:
Souder, Miller & Associates
401 West Broadway
Farmington, NM 87401
(505) 325-7535

Table of Contents

Figures:

Tables:

Appendices:

1.0 Executive Summary

On behalf of BP America Production Company, Souder, Miller and Associates (SMA) has prepared this soil and groundwater investigation report. The work was performed on the Mudge LS 6 wellsite, an active gas-producing wellsite in San Juan County, New Mexico, north and west of Aztec, New Mexico. This report describes the drilling of and sample collection from 10 boreholes and the subsequent construction of 8 monitoring wells.

A spill of condensate from production equipment was found on the wellsite pad in August 2014. In October/November 2014 approximately 184,680 cubic feet of impacted soil was removed from the approximate center of the wellsite pad. The soil was excavated to depths of up to 25 feet below ground surface (bgs). Contaminant staining was noted in the soil between 10 to 17 feet bgs. The excavated area was backfilled with a brown sand.

From December 2014 through March of 2015 hand auger borings and geoprobe investigations were conducted to delineate approximately 3300 cu ft. of impacted soil at depths of 15 to 18 feet bgs downslope from the wellsite.

Three monitoring wells were drilled and constructed on the wellsite pad in 2015 (MW-1, 2 & 3). These monitoring wells were drilled targeting the depressions on the surface of the blue sandstone where water had been observed to pool during 2014 excavation. These wells were drilled into the blue sandstone to total depths of 25 to 30 bgs. These monitoring wells were screened across the lower portion of the brown sand and the upper portion of the blue sandstone. These wells have a water level (at the time of this report) of approximately 20 feet bgs.

The soils at this site consist of loose brown sands of varying thickness overlying a blue/gray cemented sandstone. The brown sand/blue sandstone contact is an erosional unconformity that has been disturbed and made more irregular by the above-stated excavation. The soil was excavated to the top of the blue sandstone and into the upper surface of the blue sandstone in some areas where water was noted to have pooled.

SMA was contracted by BP to drill and construct additional monitoring wells to help determine whether a water-bearing zone or zones exist. If water-bearing zones exist, the investigation was to determine if the zone(s) constitute a continuous aquifer or if the groundwater was located in an isolated, seasonally perched groundwater feature.

The work was begun August 1, 2016. Some of the new monitoring wells were screened in the brown sand body, some were screened in the blue sandstone. These two completions provide the ability to separately monitor groundwater in the brown sand body and in the blue sandstone.

Ten boreholes were drilled during this project. A deep borehole (SB-6D) was drilled through the blue sandstone into a dark brown fractured shale. An artesian water flow was encountered at 29 ft. bgs in the dark brown fractured shale; this borehole was plugged and abandoned. The decision was made by BP to only drill 8 feet into the blue sandstone on subsequent deep boreholes to minimize the risk of encountering the artesian shale zone. Another borehole (SB-7A) was plugged and abandoned in favor of a more suitable location. Eight of the boreholes, 5 shallow brown sand boreholes and 3 deeper blue sand boreholes, were ultimately constructed as monitoring wells.

Samples of soil were collected from the brown sand in the shallow boreholes by split spoon sampling. Cores were cut throughout the blue sandstone section of the deep boreholes. The borehole lithology was logged using USCS standard description, samples were collected and field screened with a calibrated photo ionization detector (PID). Selected samples were gathered from all of the boreholes, jarred, preserved and submitted to Hall Environmental Analysis Laboratories (Hall) for analyses. The samples were analyzed for benzene, toluene, ethylbenzene, total xylenes (BTEX), diesel range organics (DRO) and gasoline range organics (GRO). Motor oil/ lube range organics (MRO) was later added to the analyses request.

Table 2 contains the summary of the laboratory analyses. Most of the soil samples had non-detectable levels of the analytes.

Groundwater was not found in any of the 8 newly constructed monitoring wells at the date of this report.

Monitoring wells 1, 2 & 3 were initially dry when drilled in 2015, but the water level rose after a period of significant rainfall. The water samples from these wells initially indicated elevated levels of BTEX, but no free phase petroleum product. During this project MW-3 was abandoned and replaced by a pair of new monitoring wells, MW-3S & MW-3D.

The following conclusions and recommendations are made without the benefit of all of the data previously collected from the geoprobe and hand augered sample collections, or the historical water analyses from monitoring wells 1, 2, & 3.

SMA concludes that:

1. During excavation of the soil from the wellsite in 2014, water was noted to be pooling in low areas revealed by, and potentially deepened by, the excavation. These low areas are apparently depression(s) in the erosional unconformity at the upper surface of the blue sandstone. The drilling program executed for this investigation confirms the presence of these depressions in the upper surface of the blue sandstone. The groundwater observed in existing monitoring wells 1, 2, & 3 may be entering the wellbores from these depressions.
2. The elevation of the localized groundwater in the erosional unconformity depressions may rise and fall based on the amount of precipitation. The brown sand is permeable enough to allow the transmission of water to the top of the less permeable blue sandstone and pool in the low-lying areas.
3. The first deep soil boring (SB-6D) located in the north edge of the Mudge wellsite outside the 2014 excavation area. An artesian water flow was encountered in this soil boring at a depth of 29 feet bgs. The artesian water flow in SB-6D was encountered below the blue sandstone and is isolated from the monitoring wells constructed in the blue sandstone. It is very likely that the water table in the 2015 monitoring wells (MW-1,2&3) is a perched water table located within the depressions in the erosional unconformity at the upper surface of the blue sandstone. This is believed to be a confined regional aquafer.
4. Groundwater has not been observed in any of the monitoring wells installed for this investigation, either in wells completed in the unconsolidated brown sand or in the blue sandstone. An areally extensive aquifer does not exist at the brown sand/blue sandstone contact interface.
5. No analytical results for soil samples collected for this investigation exceed the NMOCD site specific soil standards for the site.

6. The condensate released in the 2014 spill apparently traveled vertically through the brown sand vadose zone. The condensate encountered perched groundwater in the depressions and the upper surface of the less permeable blue sandstone. The contamination noted in the monitoring wells constructed in 2015 (MW-1,2&3) may have collected in the depressions on the upper surface of the blue sandstone.

SMA recommends that:

1. The water in the MW-1 & 2 be pumped off not less than once a month or as determined based on periods of precipitation, for a period of 6 months. Monitor and record the water column prior to each pumping event to evaluate the recharge rate for these monitoring wells. This data will help determine if the water table is a perched seasonal zone that is solely recharged by surface precipitation transmission through the brown sand and collected in the depressions on the upper surface of the blue sandstone.
2. Ground water collected from these pumping events should be analyzed to determine if the contamination is being removed from the water. If so, then continual pumping may help eliminate the contamination from within the perched water table. Additional ground water samples may be collected and analyzed if the water column rises significantly following periods of precipitation.
3. After the 6-month pump-off period, the monitoring wells (new and existing) be monitored for a period of 1 year. Local precipitation should be also monitored during that period. The water level data should be compared to precipitation amounts to establish if the water table changes substantially with seasonal precipitation. This data will be evaluated in conjunction with the data from recommendation # 1 & 2 above.
4. The geoprobe and hand augered soil boring data be included in an additional study south and east of the wellsite to more completely delineate the extent of the impacted soil. This will help determine not only the extent of the impacted areas but also help determine the remedial actions that may be required. It is recommended that the additional study include the area extending from the wellsite south and south east to the point where the wash crosses the access road, then following the wash approximately 20 yards beyond the crossing.

SMA's services were performed in accordance with SMA's standard operating procedures.

2.0 Introduction

In August of 2015, BP contacted SMA regarding BP's scope of work (SOW) for a soil and groundwater investigation on the Mudge LS 6 wellsite. The SOW detailed the drilling of the boreholes, geologic logging, soil sampling, documentation and soil sample analyses requirements. The SOW further detailed the construction of the monitoring wells, the monitoring well development procedure, and the subsequent groundwater sampling, testing and reporting.

The site has an elevation of approximately 6,012 feet above sea level. The wellsite was built at the head of an ephemeral stream that drains an area of steep slopes of sandy/silty soil and sandstone outcrops partially covered by well-established sage brush with some pinon and juniper cover. The intermittent stream is located approximately 250' to the south of the wellsite.

The site is located land under the surface jurisdiction of the Department of the Interior Bureau of Land Management (BLM). The Rules and Regulations of the NM Oil Conservation Commission are locally enforced by the District III office in Aztec, NM. The NM Office of the State Engineer Rules and Regulations are in force for the drilling and construction of the groundwater monitoring wells.

The wellsite was originally graded and used to drill a gas well in 1953. The Mudge LS 6 well is currently an active natural gas producer.

A spill of condensate from production equipment was found on the wellsite pad in August 2014. Approximately 184,680 cubic feet of impacted soil was removed from the approximate center of the wellsite pad. The soil was excavated to depths of up to 25 feet below ground level (bgs). Contaminant staining was noted in the soil between 10 to 17 feet bgs. The soil was excavated to the top of the blue sandstone and into the upper surface of the blue sandstone in some areas.

SUMMARY OF PRIOR WORK

	BP Mudge LS 6 Wellsite				
Wellsite Location	Latitude/Longitude		Section, Township, Range		
	36.90884°	-107.96561°	SW/SW (Unit M)	Section 11	T31N, R11W
Date	ACTIVITY				
1953	The MUDGE LS 6 well was drilled and completed as a Mesa Verde gas producer				
August 2014	Condensate spill identified				
Oct-Nov 2014	Approx. 184,680 cu ft of impacted soil was excavated from the surface to the top foot of the "blue sandstone". Excavated area was backfilled with clean soil.				
December 2014	Hand augered samples collected and analyzed from the area between the production pad and the adjacent wash				
March 2015	Fourteen geoprobe samples taken between the road and the production pad.				
June 2015	3 groundwater monitoring wells (MW-1, 2, 3) installed in areas where water accumulation was noted during the 2014 excavation.				

3.0 Drilling Permits and Clearances

SMA contacted the New Mexico Office of the State Engineer (OSE) on behalf of BP and obtained the required permit to drill the monitoring wells. The *"Application for permit to drill a well with no consumptive use of water"* and the approval of same (file # SJ-4205 POD1 - POD9) are attached in Appendix C.

The SOW was modified after the issuance of the permit. The MW-4 well had originally been permitted as a single well, however the revised SOW changed that to a pair of MW-4 wells. A single well, MW-8, was eliminated on the revised SOW. The NMOSE permit had inadvertently not been modified to reflect those changes. SMA has subsequently contacted the NMOSE to obtain an additional permit for the MW-4D well and delete the undrilled MW-8 well. This approved permit (file # SJ-4205 POD 12) is attached in Appendix C.

Two plugging records were required to be filed with the NMOSE. The SB-6D borehole was plugged due to an artesian flow. MW-3, drilled in 2015, was plugged and replaced by a pair of wells. These plugging Records are attached in Appendix C.

BP contacted the NMOCD and BLM regarding the notice of intent and start work notification.

4.0 Summary of Field Activities

Yellow Jacket Drilling was mobilized to the site with a CME 95 drill rig equipped with 5" Stratex downhole pneumatic hammer with casing advance equipment, as well as the required split spoon soil sampling tool strings and coring equipment. The rig and crew arrived on site on August 1, 2016.

SMA oversaw the drilling and construction of 10 soil borings, resulting in the construction of 8 monitoring wells. Two of the soil borings (SB-6D and SB-7A) were not constructed and were plugged.

One of the existing (2015) monitoring wells (MW-3) was plugged prior to the drilling and completion of a twinned pair of replacement monitoring wells (MW-3S and MW-3D). While drilling out the existing casing in the MW-3, potentially explosive vapors were detected on the driller's 4 gas monitor, which detects methane. The rig was shut down and the area was checked with PID and gas monitor. There was no further detection of potentially explosive or hazardous vapors.

The borehole drilling and monitoring well construction phase of the project began August 1, 2016 and concluded August 8, 2016.

Figure 1 illustrates the vicinity of the area.

Figure 2 illustrates the site map of the wellsite, production facilities and existing groundwater monitoring wells that were installed in 2015.

Figure 3 illustrates the site map after the completion of the August 2016 work. This includes the wellsite, production facilities, previous ground water monitoring wells and the newly drilled and constructed ground water monitoring wells. The plugged boreholes and monitoring well are also included in figure 3.

As the boreholes were drilled all sampling and documentation refers to these as soil borings and designated with a SB identification and number i.e., SB-3S. The boreholes that were constructed as monitoring wells were then designated with an MW identification and number i.e., MW-3S. The borehole/monitoring well pairs are designated with an "S" or "D" suffix indicating either shallow or deep.

Soil Boring Locations:

The BP SOW indicated the approximate locations of the planned monitoring wells. The locations of the proposed monitoring wells were chosen to locate 4 monitoring wells outside the 2014 excavation area and 4 inside the excavated area.

The paired monitoring wells were designed to allow the isolated monitoring of the brown sand body in the shallow wells and the blue sandstone body in the deep wells.

Some monitoring well locations were changed from the SOW locations based on topography, proximity to surface facilities, underground pipelines and communication cables. The BP engineer was consulted with regards to the location of each monitoring well prior to drilling. Several sites that were near BP facility communication lines, or Enterprise pipelines were cleared by hydrovac units prior to drilling. An Enterprise representative was present while locating the pipelines and during the drilling of boreholes near the pipelines.

Drilling and Sampling:

Beginning August 1 and concluding August 8, 2016, 10 boreholes were drilled on the Mudge LS 6 wellsite ranging in depth from 7.0 to 30.0 feet bgs.

Planned Drilling and Sample Collection Scope of Work: The BP SOW directed that 9 boreholes be drilled: 4 pairs of shallow and deep boreholes and 1 single borehole.
The shallow wells (S suffix) twins were to be drilled through the brown sand to the brown sand/blue sand contact. These wells were to be drilled with a 5 inch outside diameter (OD) Statex downhole pneumatic hammer with casing advance. Split spoon samples were to be collected every 5 feet (3 feet in the SB-5S) for field screening. The sample physical, lithologic and geologic descriptions were to be logged using the USCS. The samples were to be field screened with a calibrated photo ionization detector (PID). A minimum of 2 samples were to be collected for laboratory analysis from each soil boring from within the brown sand.

When the brown sand/blue sand contact was determined, these wells were to be plugged back above the brown sand/blue sand contact with cement grout and constructed as a shallow monitoring well for the brown sand only.

The deep wells (D suffix) were to be drilled to the brown sand/blue sand contact (as determined by the shallow soil boring), then continuously cored in the blue sand to a total depth of 30 feet. The core physical, lithologic and geologic descriptions were to be logged using the USCS. Samples were to be selected from the cores and field-screened with a calibrated photo ionization detector (PID). Samples were then to be collected for laboratory analysis based on field screening results, visual observation and physical characteristics.

These wells were then to be constructed so as to properly isolate the brown sand from the blue sandstone and be constructed as monitoring wells for the blue sandstone.

The samples collected for analyses were to be properly jarred, preserved and submitted to Hall Environmental Analysis Laboratory (Hall) for analysis via EPA Method 8021 for BTEX, EPA Method 8015 for GRO/DRO/MRO.

Additional samples were to be collected from the SB-3D and SB-4D boreholes for additional analysis beyond the Method 8021 and 8015:

- TPH fractions
- TOC
- Grain Size Distribution
- Nitrate, Ammonia, Total Phosphate
- SO4, Total Fe and Mn
- Heavy Metals
- Natural Oxidant Demand

Executed Drilling and Sample Collection Scope of Work
Some departures from the SOW were made during the course of the project due to site-specific field conditions. All changes to the BP SOW were discussed with, and approved by, BP.

The SOW had directed that the SB-6 well was to be drilled to determine the brown sand/blue sandstone contact and that the SB-6D was to be drilled to a depth of 30 feet bgs. At 29 feet bgs, the borehole had advanced through the blue sandstone and into a dark brown fractured shale. An artesian water flow was encountered from the shale. Within 20 minutes the water level rose from 29 feet to 5 feet bgs. The BP representative and the NMOSE were notified. BP decided to plug this borehole immediately. SMA contacted the NMOSE office and obtained verbal approval to plug and abandon this borehole.

The borehole was plugged with Type I/II Portland cement grout with 3% bentonite Quick Gel. Discussions were held between BP and SMA regarding the remaining deep borehole drilling. It was decided to drill the shallow boreholes to identify the brown sand/blue sandstone contact. That information would then be used to determine the depth of the deep twin borehole. To avoid the potential penetration of another artesian flow it was decided to drill only to 8 feet below the brown sand/blue sandstone interface.

The shallow boreholes (other than SB-4S) were drilled into the brown sand/blue sandstone contact, then plugged back with cement grout to a point above the contact prior to construction as a monitoring well.

The field screening of the split spoon samples and cores was conducted as spelled out in the SOW. Samples for laboratory analysis were selected based on PID readings, as well as the geologic and lithologic observations.

The SOW indicated that additional samples be collected and analyzed from the SB-3D and SB-4D boreholes. The additional samples were actually collected from the SB-4D and SB-5S boreholes. These samples were selected as representative brown sand/blue sandstone contact samples. The amount of sample material available from these boreholes was also sufficient for the additional analysis required.

Monitoring Well Construction:

Shallow Monitoring Well Construction. The soil borings that were drilled to be used as brown sand monitoring wells were drilled into the blue sandstone (except SB-4S). The brown sand/blue sandstone contact was determined, the soil borings were then plugged back to a point above the contact and constructed as brown sand monitoring wells as follows:

Casing/screen: 1 foot sump with cap, 5 foot screen (2-inch schedule 40 PVC, 0.010-inch factory cut slots), 2 inch schedule 40 blank PVC to surface + 2' riser.
Sand Pack and Sealing: The sump and primary sand pack was made from 20/40 mesh sand from the plugged back bottom of the well to 6" above the screen, 12" of choke sand pack of 85 mesh sand, 12" of ¼" bentonite pellets. Cement grout (Type I/II Portland Cement + 3% bentonite) was placed from the top of the bentonite seal to surface.
Surface Completion: A 3 foot tall 6-inch diameter steel well shroud with locking cap was installed and a 4" thick x 3' diameter concrete pad was poured surrounding the steel shroud.
Note: Due to the shallow depth of the MW-5S a 3' screen was used rather than the 5' screen.

Deep Monitoring Well Construction. The soil borings that were drilled to be used as blue sandstone monitoring wells were drilled to the blue sandstone and cored from the top of the blue sandstone to total depth. To avoid drilling into the brown artesian shale as in SB-6D it was decided to cut only 8 feet of core in the blue sandstone. The deep wells were constructed as blue sandstone monitoring wells as follows:
Casing/screen; 1' sump with cap, 5' pre-packed screen (2 inch PVC, 0.010" slots), 2 inch schedule 40 PVC to surface + 2' riser.
Sand Pack and Sealing; The sump and primary sand pack was made from 20/40 mesh sand from the bottom of the well to 6" above the screen, 12" of choke sand pack of 85 mesh sand, 24" of ¼" bentonite pellets. Cement grout (Type I/II Portland Cement + 3% bentonite) was placed from the top of the bentonite seal to surface.
Surface Completion: A 3-foot-tall 6-inch diameter steel well shroud with locking cap was installed and a 4" thick x 3' diameter concrete pad was poured surrounding the steel shroud.

Soil Boring / Monitoring Well IDs Cross Reference			
Soil Boring ID	Constructed as Monitoring Well ID	Total Depth	Comments
SB-3S	MW-3S	14.5'	Brown sand
SB-3D	MW-3D	19.5'	Blue sandstone
SB-4S	MW-4S	10.5'	Brown sand, Outside excavation
SB-4D	MW-4D	19.0'	Blue sandstone, Outside excavation
SB-5S	MW-5S	7.3'	Brown sand
SB-5D	MW-5D	14.0'	Blue sandstone
SB-6	MW-6	12.5'	Brown sand, Outside excavation
SB-6D	N/A	30.0'	Plugged, Outside excavation
SB-7A	N/A	7.0	Plugged, Outside excavation
SB-7B	MW-7	12.0'	Brown sand, Outside excavation

Monitoring Well Survey:

Souder Miller and Associates conducted a location and elevation survey of all the monitoring wells on the Mudge LS 6 wellsite on August 11, 2016. The latitude, longitude and 2 inch PVC casing elevation was recorded on Table 1.

Geology:

The Mudge LS 6 wellsite is located near the head of a small intermittent stream. The wellsite was originally built on brown sand and silts that overlay a dense blue/gray sandstone. The blue/gray sandstone is semi consolidated to hard due to non-calcareous cementation. The contact surface of the brown sand and the blue/gray sandstone appears to be an erosional surface of the blue/gray sandstone with subsequent brown sand deposition.

Drainage of rain water flows around the wellsite along a road ditch to the east and through a small wash on the west. These drainages join in an intermittent wash on the south side of the wellsite flowing to the Animas River approximately 1.8 miles to the southeast.

A cross section constructed from all soil borings on the wellsite indicate that the brown sand/blue sandstone contact is bowl-shaped at the center of the wellsite. During the 2014 excavation it was noted that water was pooling at low points of the surface of the blue sandstone. This may be a part of an erosional feature following a north-south line that was filled with the native brown sand prior to the grading of the wellsite in 1953. The 2014 excavation and disturbance may have deepened what was already a low feature on the surface of the blue sandstone.

Geologic cross sections are found on Figures 17, 18 and 19.

Fluid Level and Groundwater Sampling:

No groundwater was encountered while drilling any of the soil borings with the exception of SB-6D, which was abandoned, as noted above.

The fluid levels in the newly constructed monitoring wells were first monitored on August 9, 2016. Fluid levels were measured against the mark on the north edge of the well casings. The casings had not yet been surveyed. Six of the new wells were dry, and 2 of the new wells had measurable water columns. MW-3D had 1.39 feet of water and MW-4D had 0.07 feet of water. The water in these 2 wells was believed to be residual water from the bentonite pellet hydration.

Following discussion with BP, the fluid levels were checked again on August 11, 2016. All of the new wells were dry except for the MW-3D and MW-4D wells. MW-3D still had 1.39 feet of water. As agreed upon with BP, the water was pumped out of the well with a peristaltic pump to total depth. MW-4D well had 0.04 feet of water. The 2 remaining existing wells installed in 2015 were also checked; MW-1 had a fluid level of 20.45 feet and MW-2 had a fluid level of 21.21 feet.

The fluid levels were checked again on August 19, 2016. All of the new wells were dry except for the MW-3D and MW-4D wells. MW-3D had a fluid level of 20.35 feet bgs (0.76 feet of water), this water was pumped out of the well with a peristaltic pump to TD. MW-4D well had a fluid level of 21.05 feet (0.04 feet of water). The fluid level of MW-3D was checked after 30 minutes; no water entry was measurable. The 2 wells previously installed in 2015 were also checked. MW-1 had a fluid level of 20.35 feet, the MW-2 had a fluid level of 21.01 feet.

5.0 Results and Interpretation

Soil Sample Laboratory Analyses: The selected soil samples were submitted to Hall Environmental Laboratories for analysis. The only analytical results above laboratory detection limits are GRO and DRO in SB-5D, and B, T, and X detections in SB-7A. None of these results exceed the NMOCD site specific soil standards for the site, indicating very little contamination present within the portion of the wellsite included in this project. The soil analyses are included in Appendix B.

Monitoring for Water in New Wells: As stated previously, one borehole was drilled through the blue sandstone into a fractured shale encountering an artesian water flow, this well was plugged. None of the subsequent boreholes were drilled as deep and none encountered groundwater during the drilling. The newly constructed monitoring wells have been checked for fluid level several times utilizing a groundwater probe. No groundwater influx has been indicated in any of these wells. Measurable water in MW-3D appears to be residual water from the bentonite seal hydration. As of the last monitoring on August 19, 2016, there was no measurable water column in MW-3D.

6.0 Conclusions and Recommendations

The following conclusions and recommendations are made without the benefit of all of the data previously collected from the geoprobe and hand augered sample collections, or the historical water analyses from monitoring wells 1, 2, and 3.

SMA concludes that:

1. During excavation of the soil from the wellsite in 2014, water was noted to be pooling in low areas revealed by, and potentially deepened by, the excavation. These low areas are apparently depression(s) in the erosional unconformity at the upper surface of the blue sandstone. The drilling program executed for this investigation confirms the presence of these depressions in the upper surface of the blue sandstone. The groundwater observed in existing monitoring wells 1, 2, & 3 may be entering the wellbores from these depressions.
2. The elevation of the localized groundwater in the erosional unconformity depressions may rise and fall based on the amount of precipitation. The brown sand is permeable enough to allow the transmission of water to the top of the less permeable blue sandstone and pool in the low-lying areas.
3. The first deep soil boring (SB-6D) located in the north edge of the Mudge wellsite outside the 2014 excavation area. An artesian water flow was encountered in this soil boring at a depth of 29 feet bgs. The artesian water flow in SB-6D was encountered below the blue sandstone and is isolated from the monitoring wells constructed in the blue sandstone. It is very likely that the water table in the 2015 monitoring wells (MW-1,2&3) is a perched water table located within the depressions in the erosional unconformity at the upper surface of the blue sandstone. This is believed to be a confined regional aquafer.
4. Groundwater has not been observed in any of the monitoring wells installed for this investigation, either in wells completed in the unconsolidated brown sand or in the blue sandstone. An areally extensive aquifer does not exist at the brown sand/blue sandstone contact interface.
5. No analytical results for soil samples collected for this investigation exceed the NMOCD site specific soil standards for the site.
6. The condensate released in the 2014 spill apparently traveled vertically through the brown sand vadose zone. The condensate encountered perched groundwater in the depressions and the upper surface of the less permeable blue sandstone. The contamination noted in the monitoring wells constructed in 2015 (MW-1,2&3) may have collected in the depressions on the upper surface of the blue sandstone.

SMA recommends that:

1. The water in the MW-1 & 2 be pumped off not less than once a month or as determined based on periods of precipitation, for a period of 6 months. Monitor and record the water column prior to each pumping event to evaluate the recharge rate for these monitoring wells. This data will help determine if the water table is a perched seasonal zone that is solely recharged by surface precipitation transmission through the brown sand and collected in the depressions on the upper surface of the blue sandstone.
2. Ground water collected from these pumping events should be analyzed to determine if the contamination is being removed from the water. If so, then continual pumping may help eliminate the contamination from within the perched water table. Additional ground water samples may be collected and analyzed if the water column rises significantly following periods of precipitation.
3. After the 6-month pump-off period, the monitoring wells (new and existing) be monitored for a period of 1 year. Local precipitation should be also monitored during that period. The water level data should be compared to precipitation amounts to establish if the water table changes substantially with seasonal precipitation. This data will be evaluated in conjunction with the data from recommendation # 1 & 2 above.
4. The geoprobe and hand augered soil boring data be included in an additional study south and east of the wellsite to more completely delineate the extent of the impacted soil. This will help determine not only the extent of the impacted areas but also help determine the remedial actions that may be required. It is recommended that the additional study include the area extending from the wellsite south and south east to the point where the wash crosses the access road, then following the wash approximately 20 yards beyond the crossing.

7.0 Closure and Limitations

The scope of our services consisted of; obtaining NMOSE permits, BP scope of work review, on-site drilling monitoring, sample description, sample collection as well as oversight of monitoring well drilling and construction. In addition to the project management, SMA has reviewed the soil sample analysis in the preparation of this summary report. All work has been performed in accordance with generally accepted professional environmental consulting practices.

If there are any questions regarding this report, please contact either Loren L. Diede or Reid Allan at 505-325-7535.

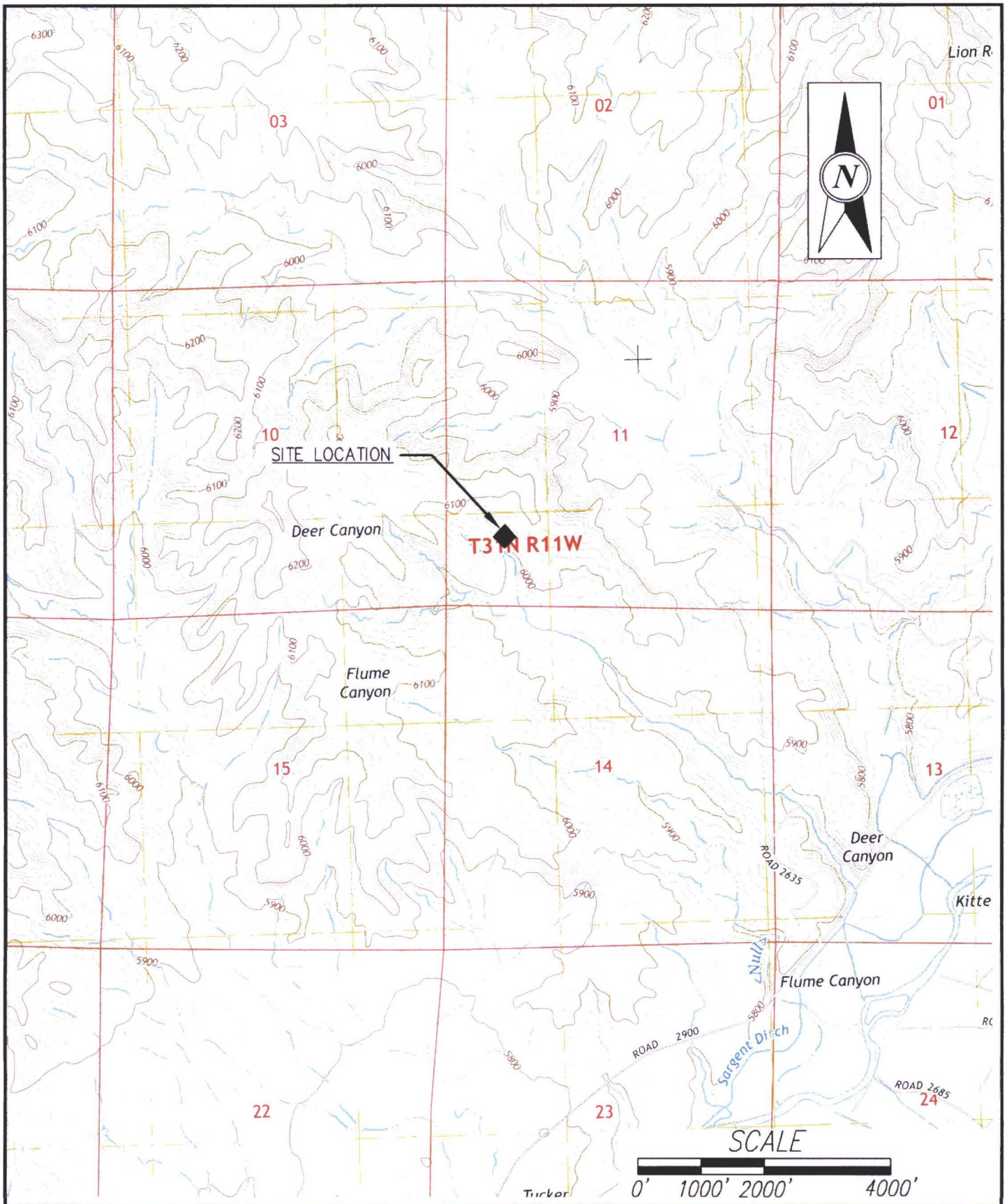
Submitted by:

SOUDER, MILLER & ASSOCIATES

Loren L. Diede
Senior Scientist

Reviewed by:

Reid S. Allan, PG
Principal Scientist



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VICINITY MAP
MUDGE LS6
SECTION 11, T31N, R11W

SAN JUAN COUNTY, NEW MEXICO

Designed	Drawn	Checked
SH	DJB	RSA

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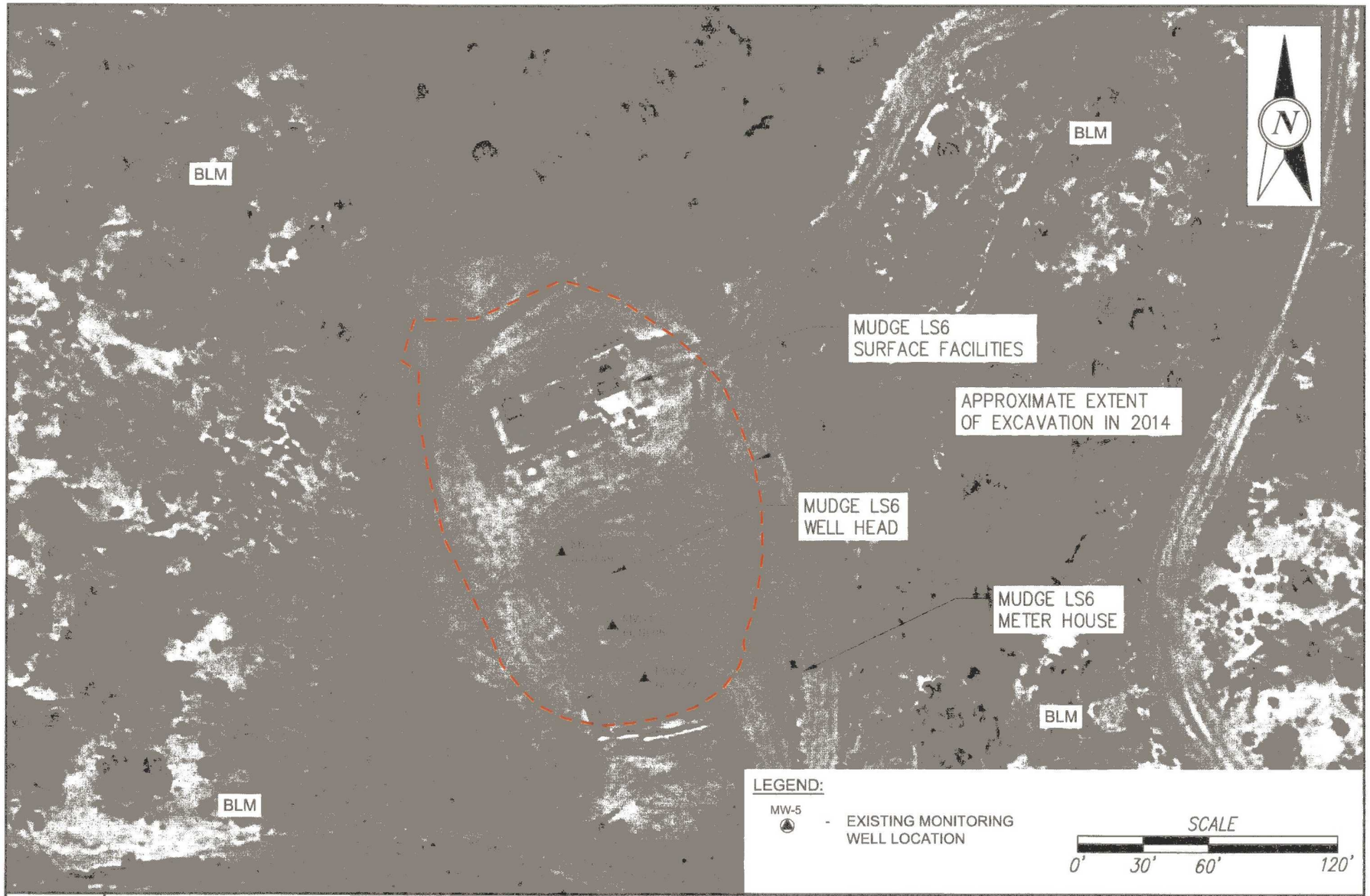

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MUDGE LS6
PREVIOUS SITE MAP
SECTION 11, T31N, R11W

SAN JUAN COUNTY, NEW MEXICO

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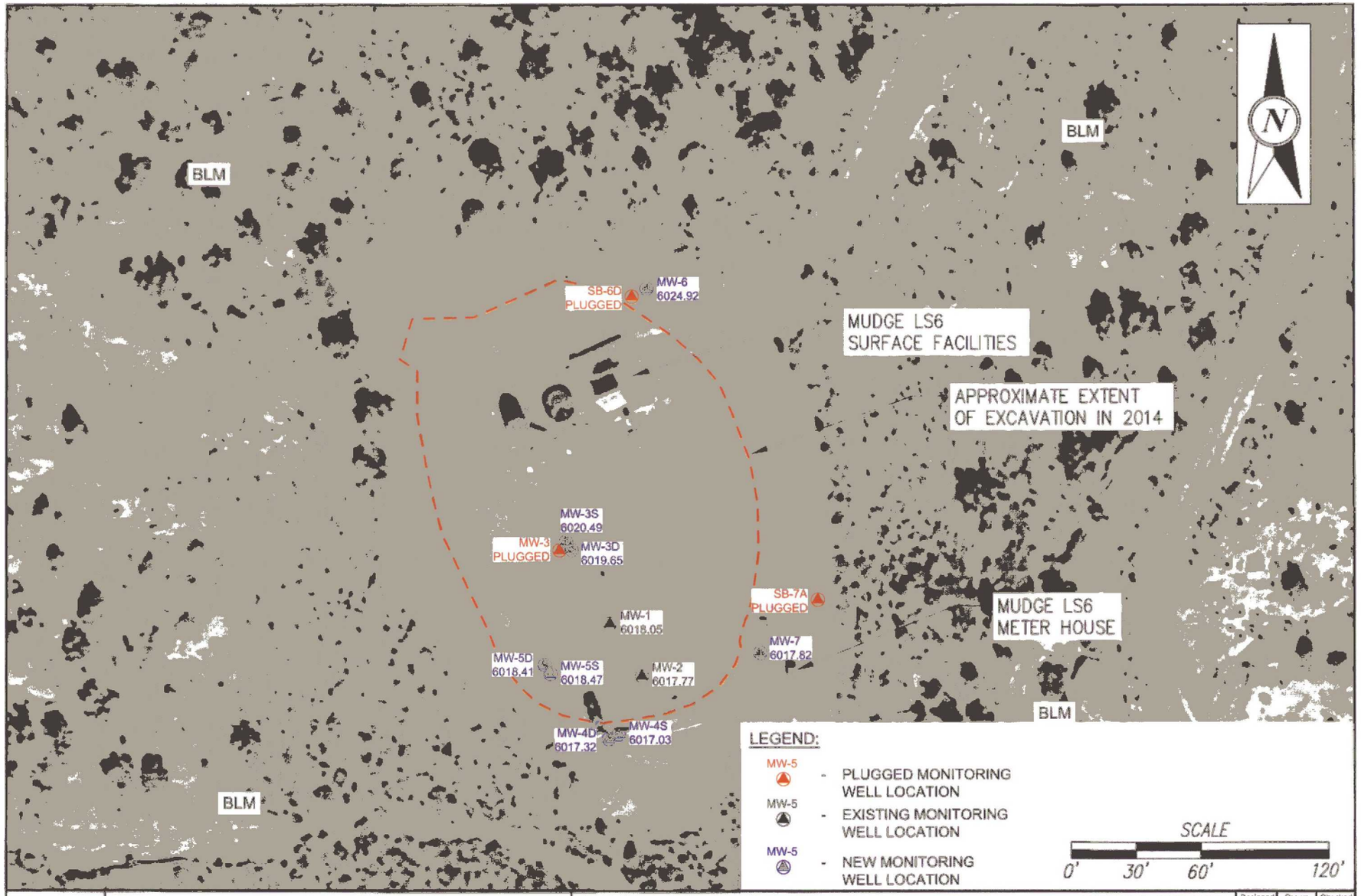

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MUDGE LS6
CURRENT SITE MAP
SECTION 11, T31N, R11W

SAN JUAN COUNTY, NEW MEXICO

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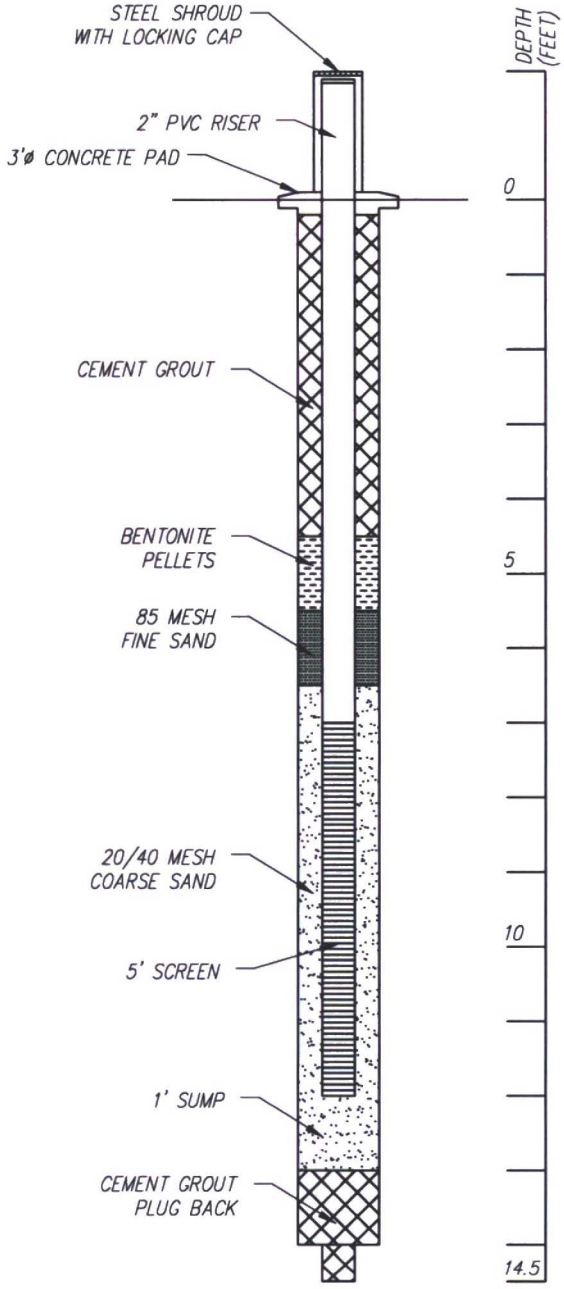

DEPTH (FEET)	SOIL TYPE	PID (PPM)	COLOR	SAMPLE DESCRIPTION
0				BROWN UNCONSOLIDATED SAND BACKFILL NO SAMPLE COLLECTED, OBSERVED DRILLING RETURNS
5		0.4	5YR 4/3	DARK BROWN SAND, POOR TO MODERATE SORTING, MEDIUM TO FINE, UNCONSOLIDATED, SLIGHTLY PLASTIC, CLAYEY, SLIGHTLY CALCAREOUS, 80–90% QUARTZ SPLIT SPOON SAMPLE #1 (17 blows, 12")
				BROWN UNCONSOLIDATED SAND, NO SAMPLE COLLECTED OBSERVED, DRILLING RETURNS
10		1.1	5YR 4/3	DARK BROWN SAND, MODERATE SORTING, MEDIUM TO FINE, WITH SOME PEBBLES, UNCONSOLIDATED, SLIGHTLY CALCAREOUS, 80–90% QUARTZ SPILT SPOON SAMPLE #2 (14 blows, 16")
				NO SAMPLE COLLECTED
		0.3	5YR 4/3	DARK BROWN SAND, MODERATE POORLY SORTED, MEDIUM TO FINE, CLAYEY, SLIGHTLY PLASTIC, SLIGHTLY CALCAREOUS, TOP OF SPILT SPOON SAMPLE #3 (7 blows, 16")
14.5		2.0	10YR 6/1	LIGHT GRAY SAND, WELL SORTED, MEDIUM, SEMI CONSOLIDATED, ANGULAR TO SUBANGULAR, MINOR MICA, MINOR ROSE QUARTZ, NON CALCAREOUS. BOTTOM OF SPILT SPOON SAMPLE #3 (70 blows, 4")

BROWN SAND/BLUE SANDSTONE CONTACT 14.0'

LOG LEGEND

SAND | CLAY | SAND w/ MINOR PEBBLE | BACKFILL SAND | SANDSTONE

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BP FARMINGTON, NEW MEXICO

MW-3S MONITORING WELL LOG
MUDGE LS6
SECTION 11, T31N, R11W
SAN JUAN COUNTY, NEW MEXICO

Designed	Drawn	Checked
LLD	DJB	RSA

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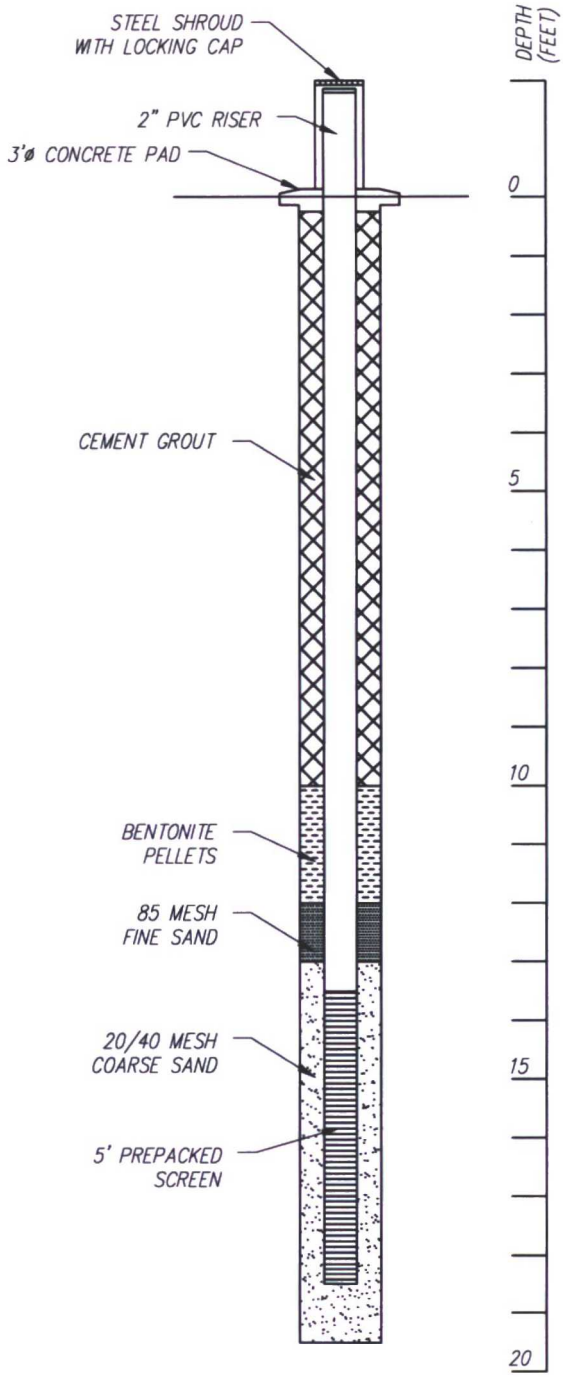

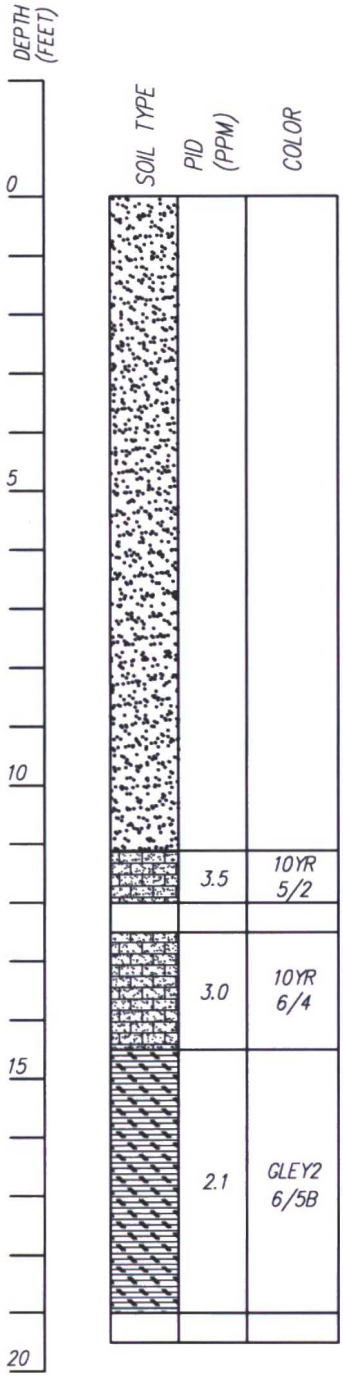

SAMPLE DESCRIPTION

BROWN UNCONSOLIDATED SAND BACKFILL
NO SAMPLE COLLECTED, OBSERVED DRILLING RETURNS

BROWN SAND/BLUE SAND CONTACT
OBSERVED WHILE DRILLING TO CORE POINT

BLUE GRAY SAND STONE, MODERATE TO FINE WELL SORTED, SEMICONSOLIDATED, MINOR MICA, SOME LARGE QUARTZ FRAGMENTS. SPLIT SPOON SAMPLE =1
(100 blows, 12")

CORE 1: LIGHT GRAY BROWN SANDSTONE, MODERATELY SORTED, COARSE TO MEDIUM, SEMICONSOLIDATED, ANGULAR TO SUBANGULAR, MINOR MICA, NON CALCAREOUS CEMENT

CORE 2: GRAY BLUE SANDSTONE, MODERATELY SORTED, COURSE TO MEDIUM, SEMICONSOLIDATED, SOME LARGE COAL INCLUSIONS, GYPSUM STREAKS, NON CALCAREOUS CEMENT

BROWN SAND/BLUE SANDSTONE
CONTACT = 11.0'
CONTACT WAS NOT SAMPLED, DATA FROM MW-3S INDICATED THAT CONTACT WAS TO BE AT ±14.0'

LOG LEGEND

SAND | SANDSTONE | BACKFILL SAND | SANDSTONE w/COAL INCLUSIONS

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MW-3D MONITORING WELL LOG
MUDGE LS6
SECTION 11, T31N, R11W
SAN JUAN COUNTY, NEW MEXICO

Designed	Drawn	
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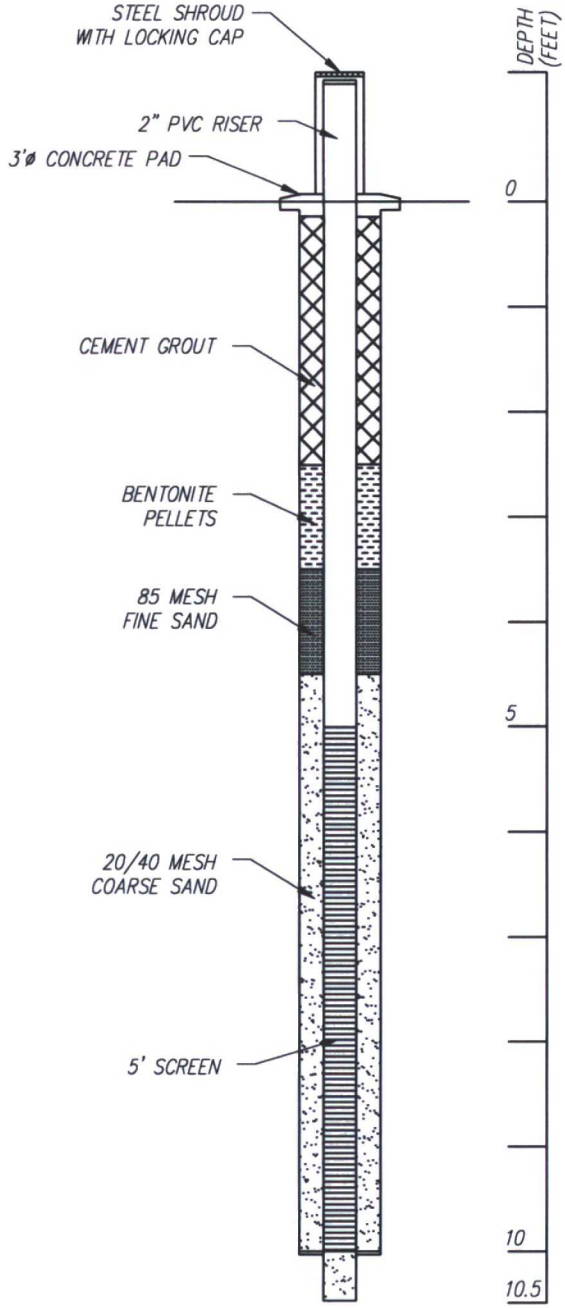

DEPTH (FEET)	SOIL TYPE	PID (PPM)	COLOR	SAMPLE DESCRIPTION
0				BROWN UNCONSOLIDATED SAND NO SAMPLE COLLECTED, OBSERVED DRILLING RETURNS
5		2.0	10YR 4/3	BROWN SAND, POORLY SORTED, COARSE TO VERY FINE, UNCONSOLIDATED, SOME PEBBLES, SUBROUNDED SPLIT SPOON SAMPLE #1 (8 blows, 18")
				BROWN UNCONSOLIDATED SAND NO SAMPLE COLLECTED, OBSERVED DRILLING RETURNS
10		3.1	2.5Y 5/2	BROWN SAND, POORLY SORTED, MEDIUM TO VERY FINE, UNCONSOLIDATED, SOME WHAT PLASTIC, HIGH CLAY CONTENT, SUBANGULAR, SUBROUNDED TOP OF SPILT SPOON SAMPLE #2 (12 blows, 18")
10.5		3.0	10YR 4/3	GRAY BROWN SAND, POORLY SORTED, UNCONSOLIDATED, SUBROUNDED TO ROUNDED, COARSE TO VERY FINE. BOTTOM OF SPILT SPOON SAMPLE #2 (12 blows, 18")
				BROWN SAND/BLUE SAND CONTACT NOT REACHED

LOG LEGEND

SAND | CLAY | SAND w/ MINOR PEBBLE

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MW-4S MONITORING WELL LOG
MUDGE LS6
SECTION 11, T31N, R11W
SAN JUAN COUNTY, NEW MEXICO

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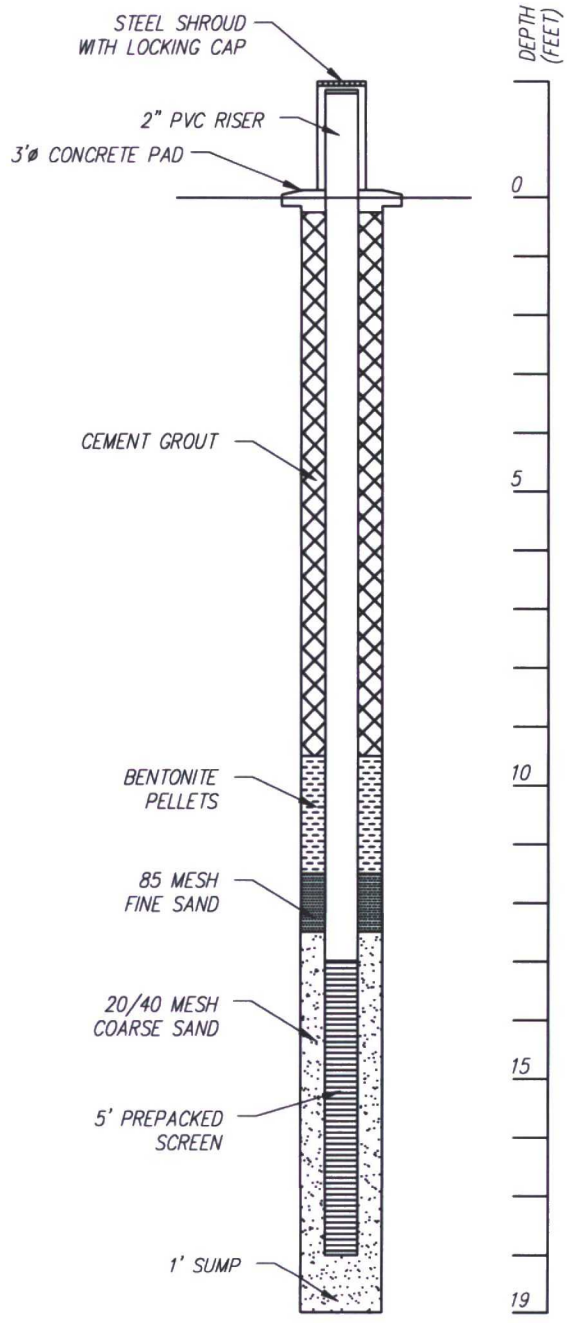

DEPTH (FEET)	SOIL TYPE	PID (PPM)	COLOR	SAMPLE DESCRIPTION
0				BROWN UNCONSOLIDATED SAND NO SAMPLE COLLECTED, OBSERVED DRILLING RETURNS
5		1.7	10YR 5/3	BROWN SAND, MODERATELY SORTED, MEDIUM TO FINE, UNCONSOLIDATED, SUBROUNDED, CLAY FILM. SPLIT SPOON SAMPLE #1 (15 blows, 18")
				NO SAMPLE
10		1.2	10YR 5/3	BROWN SAND. MODERATELY SORTED, MEDIUM TO FINE, UNCONSOLIDATED, CLAY MODULES. SPLIT SPOON SAMPLE #2 (11 blows, 18")
		2.6	10YR 5/3	GRAY BROWN SANDSTONE MODERATELY SORTED, MEDIUM TO FINE, SEMI CONSOLIDATED, CLAY FILM, MINOR MICA. SPLIT SPOON SAMPLE #3 (114 blows, 12")
				NO SAMPLE
15		10.3	GLEY2 5/5BG	CORE 1: MISSING 3.0' OF 4.0' CORE GRAY BROWN SANDSTONE, MODERATELY SORTED. MEDIUM TO FINE, SEMICONSOLIDATED, MINOR MICA
				NO SAMPLE
				NO SAMPLE
19		53	GLEY 5/10B	CORE 2: MISSING 3.5' OF CORE DARK GRAY SANDSTONE, POORLY SORTED, COARSE TO MEDIUM, UNCONSOLIDATED, SOME VERY DARK GRAY SHALE
				BROWN SAND/BLUE SAND CONTACT = 11.5'

NOTE:
SAMPLE FROM 11.5' WAS JARRED TO BE USED FOR ADDITIONAL ANALYSIS

LOG LEGEND

SAND CLAY SAND STONE

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MW-4D MONITORING WELL LOG
MUDGE LS6
SECTION 11, T31N, R11W
SAN JUAN COUNTY, NEW MEXICO

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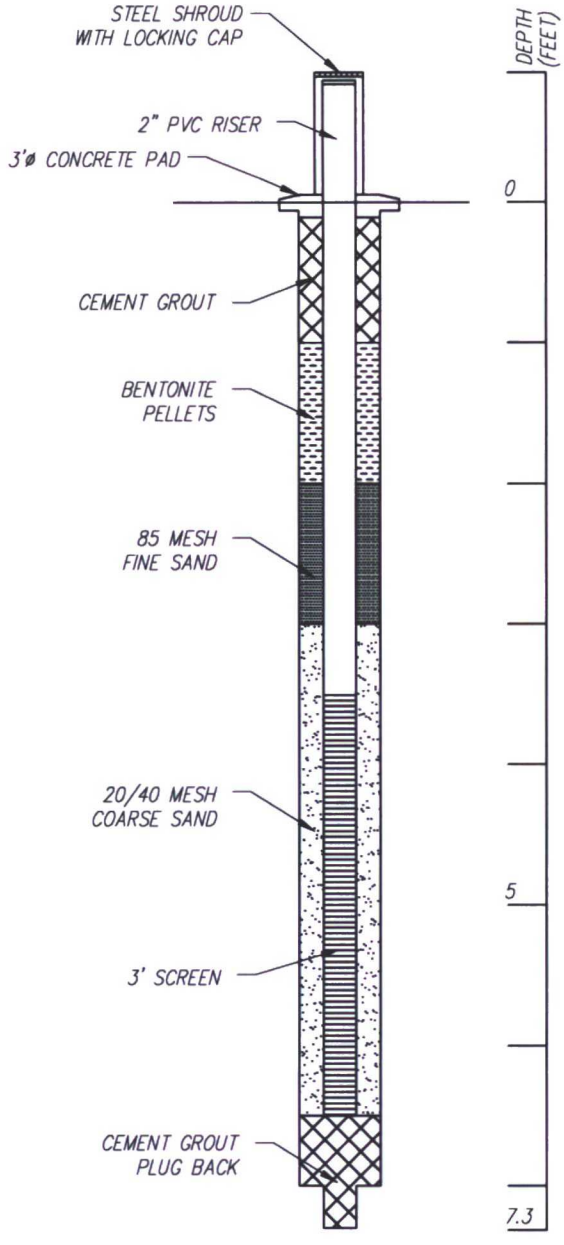

SOIL TYPE	PID (PPM)	COLOR	SAMPLE DESCRIPTION
			BROWN UNCONSOLIDATED SAND BACKFILL NO SAMPLE COLLECTED, OBSERVED DRILLING RETURNS
	6.4	10YR 5/4	BROWN SAND, POORLY SORTED, FINE TO COARSE, UNCONSOLIDATED, ARKOSIC, CLAY FILMS, NON CALCAREOUS CEMENTATION. SPLIT SPOON SAMPLE #1 (28 blows, 18")
			NO SAMPLE COLLECTED
	1.3	2.5Y 6/2	BROWN/GRAY SAND, MODERATELY SORTED, FINE TO VERY FINE, SEMICONSOLIDATED, SUBROUNDED SOME MICA, NON CALCAREOUS CEMENTATION. TOP OF SPLIT SPOON SAMPLE #2 (20 blows, 6")
	1.3	2.5Y 5/2	BROWN/GRAY SAND, WELL SORTED, MEDIUM TO FINE, SEMICONSOLIDATED, SUBROUNDED TO SUBANGULAR, CLAYEY CEMENTATION. BOTTOM OF SPILT SPOON SAMPLE #2 (80 blows, 6")
			BROWN SAND/BLUE SAND CONTACT 6.8'

NOTE:
SAMPLE FROM 6.8' CONTACT JARRED FOR ADDITIONAL ANALYSIS

A 3' SCREEN WAS USED INSTEAD OF 5' SCREEN DUE TO THE SHALLOW DEPTH OF THIS WELL

LOG LEGEND

SAND CLAY BACKFILL SAND

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MW-5S MONITORING WELL LOG
MUDGE LS6
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SAN JUAN COUNTY, NEW MEXICO

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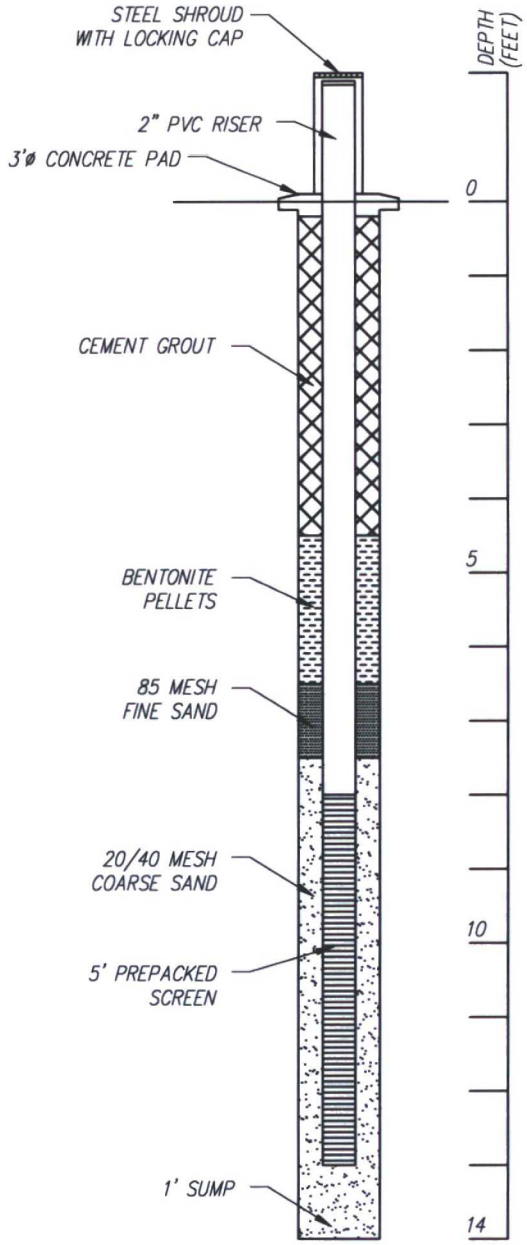

DEPTH (FEET)	SOIL TYPE	PID (PPM)	COLOR	SAMPLE DESCRIPTION
0				BROWN UNCONSOLIDATED SAND BACKFILL NO SAMPLE COLLECTED, OBSERVED DRILLING RETURNS
5				BROWN SAND, POORLY SORTED, VERY COARSE TO MEDIUM, UNCONSOLIDATED, MINOR GRAY CLAY INCLUSIONS, SUBANGULAR.
		6.3	5YR 5/4	BROWN GRAY SAND, MODERATE TO WELL SORTED, FINE TO VERY FINE SEMICONSOLIDATED, ANGULAR TO SUBANGULAR, MINOR MICA, CLAYEY, NON CALCAREOUS CEMENT. SPLIT SPOON SAMPLE #1 (100 blows, 7")
			2.5Y 5/1	
		NO SAMPLE COLLECTED		
		2.3	2.5Y 5/1	CORE 1: BROWN GRAY SANDSTONE, MODERATELY SORTED, FINE TO VERY FINE, SEMICONSOLIDATED, MINOR MICA, NON CALCAREOUS CEMENT, ANGULAR TO SUBANGULAR
10		128.7	2.5Y 6/3	BROWN GRAY SANDSTONE, MODERATELY TO WELL SORTED, FINE TO VERY FINE, SEMICONSOLIDATED, MINOR MICA, NON CALCAREOUS CEMENT, ANGULAR TO SUBANGULAR
		21.7	10YR 6/2	BROWN GRAY SANDSTONE, MODERATELY TO WELL SORTED, FINE TO VERY FINE, SEMICONSOLIDATED, MINOR MICA, NON CALCAREOUS CEMENT, ANGULAR TO SUBANGULAR
		112.2	GLEY2 5/10B	GRAY SANDSTONE, MODERATELY SORTED, MEDIUM TO FINE, SEMICONSOLIDATED, ABUNDANT MICA, NON CALCAREOUS CEMENT
		NO SAMPLE COLLECTED		
		148.2	2.5Y 5/3	CORE 2: BROWN SANDSTONE, MODERATION TO POORLY SORTED, MEDIUM TO VERY FINE, SEMICONSOLIDATED, MINOR MICA, ANGULAR TO SUBANGULAR
		64.3	2.5Y 5/2	GRAY BROWN SAND, MODERATELY SORTED, MEDIUM TO FINE, SEMICONSOLIDATED, MINOR MICA, NON CALCAREOUS CEMENT
14		10.6	GLEY2 6/5BG	GRAY SANDSTONE, MODERATELY SORTED, MEDIUM TO FINE, SEMICONSOLIDATED, ANGULAR TO SUBANGULAR, HEAVILY CLAY CEMENTED

BROWN SAND/BLUE SAND CONTACT 6.0'

NOTE:
SAMPLE FROM 6.8' CONTACT JARRED FOR ADDITIONAL ANALYSIS

A 3' SCREEN WAS USED INSTEAD OF 5' SCREEN DUE TO THE SHALLOW DEPTH OF THIS WELL

LOG LEGEND

SAND | CLAY | SAND STONE

BACKFILL SAND | MICACIOUS SANDSTONE

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MW-5D MONITORING WELL LOG
MUDGE LS6
SECTION 11, T31N, R11W
SAN JUAN COUNTY, NEW MEXICO

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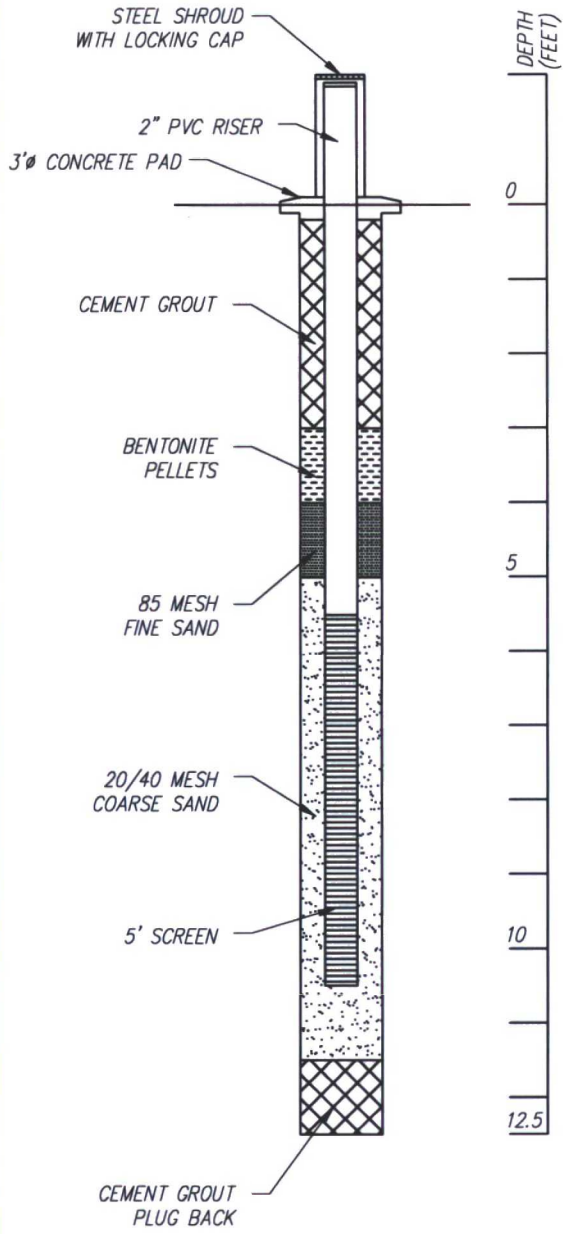

SOIL TYPE	PID (PPM)	COLOR	SAMPLE DESCRIPTION
			BROWN UNCONSOLIDATED SAND NO SAMPLES COLLECTED, OBSERVED DRILLING RETURNS
	4.6	10YR 4/4	BROWN SILTY SAND, MODERATE SORTING, MEDIUM TO FINE, UNCONSOLIDATED, SOME FELDSPAR, CLAY FILM COATING. SPLIT SPOON SAMPLE #1 (14 blows, 8")
			BROWN UNCONSOLIDATED SAND NO SAMPLES COLLECTED, OBSERVED DRILLING RETURNS
	4.4	10YR 4/4	BROWN SILTY SAND, MODERATE SORTING, MEDIUM TO FINE, UNCONSOLIDATED, SOME FELDSPAR, CLAY FILM COATING. SPLIT SPOON SAMPLE #2 (16 blows, 18")
			BROWN UNCONSOLIDATED SAND NO SAMPLES COLLECTED OBSERVED DRILLING RETURNS

BROWN SAND/BLUE SAND CONTACT 12.5'

LOG LEGEND

SAND

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BP FARMINGTON, NEW MEXICO

MW-6 MONITORING WELL LOG
MUDGE LS6
SECTION 11, T31N, R11W
SAN JUAN COUNTY, NEW MEXICO

Designed	Drawn	Checked
LLD	DJB	RSA

Date: September 2016
Scale: Horiz: NA Vert: NA
Project No: 5124371
Sheet: 10

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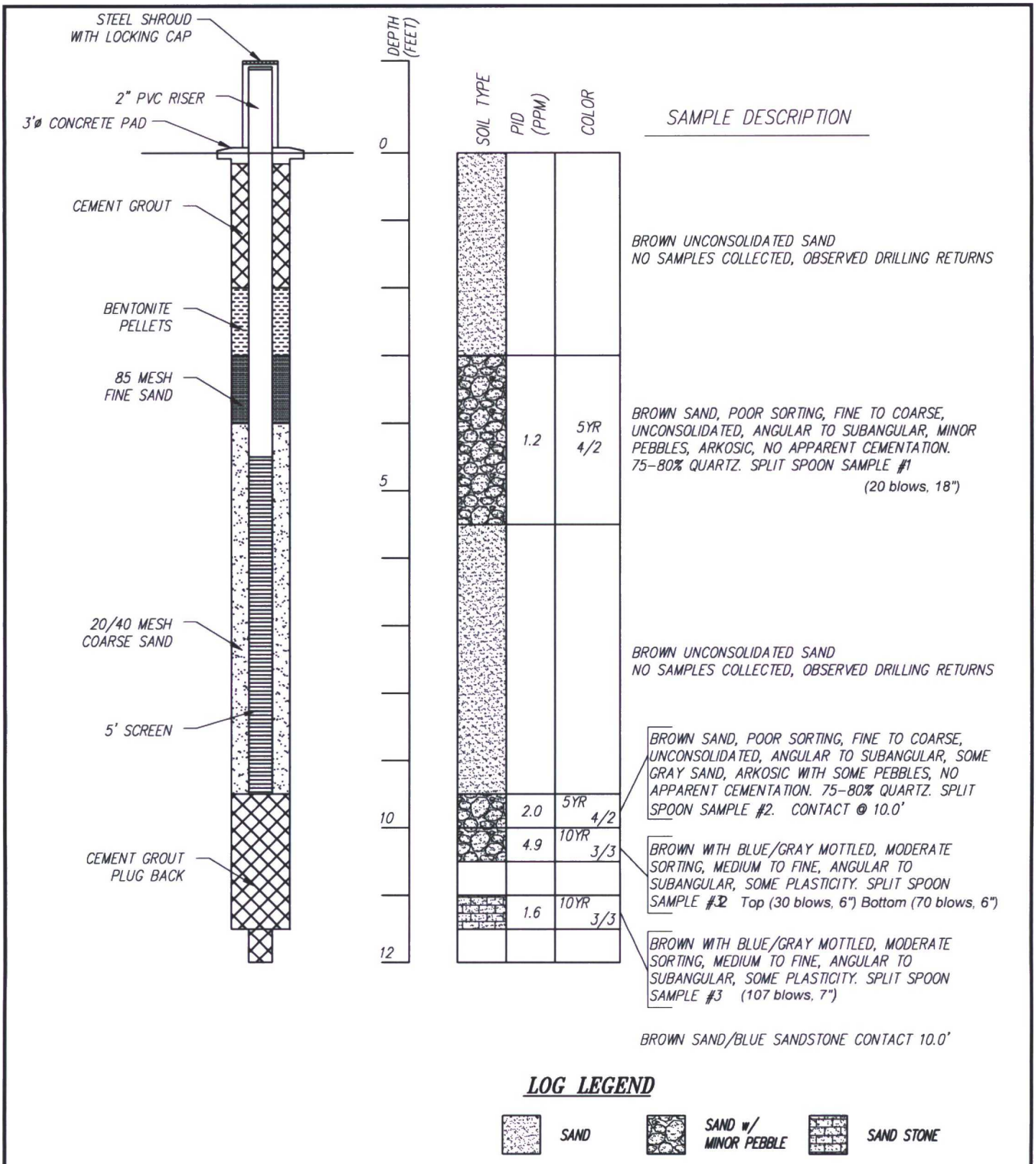
P:\5-BP Mudge LS6 GW Investigation 5124371\CAD\Civil\5123917 BP Mudge LS6-Well Logs.dwg, DJB, 9/2/2016 8:54 AM



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BP FARMINGTON, NEW MEXICO

MW-7 MONITORING WELL LOG
MUDGE LS6
SECTION 11, T31N, R11W
SAN JUAN COUNTY, NEW MEXICO

Designed	Drawn	Checked
LLD	DJB	RSA

Date: September 2016
Scale: Horiz: NA Vert: NA
Project No: 5124371
Sheet: 11

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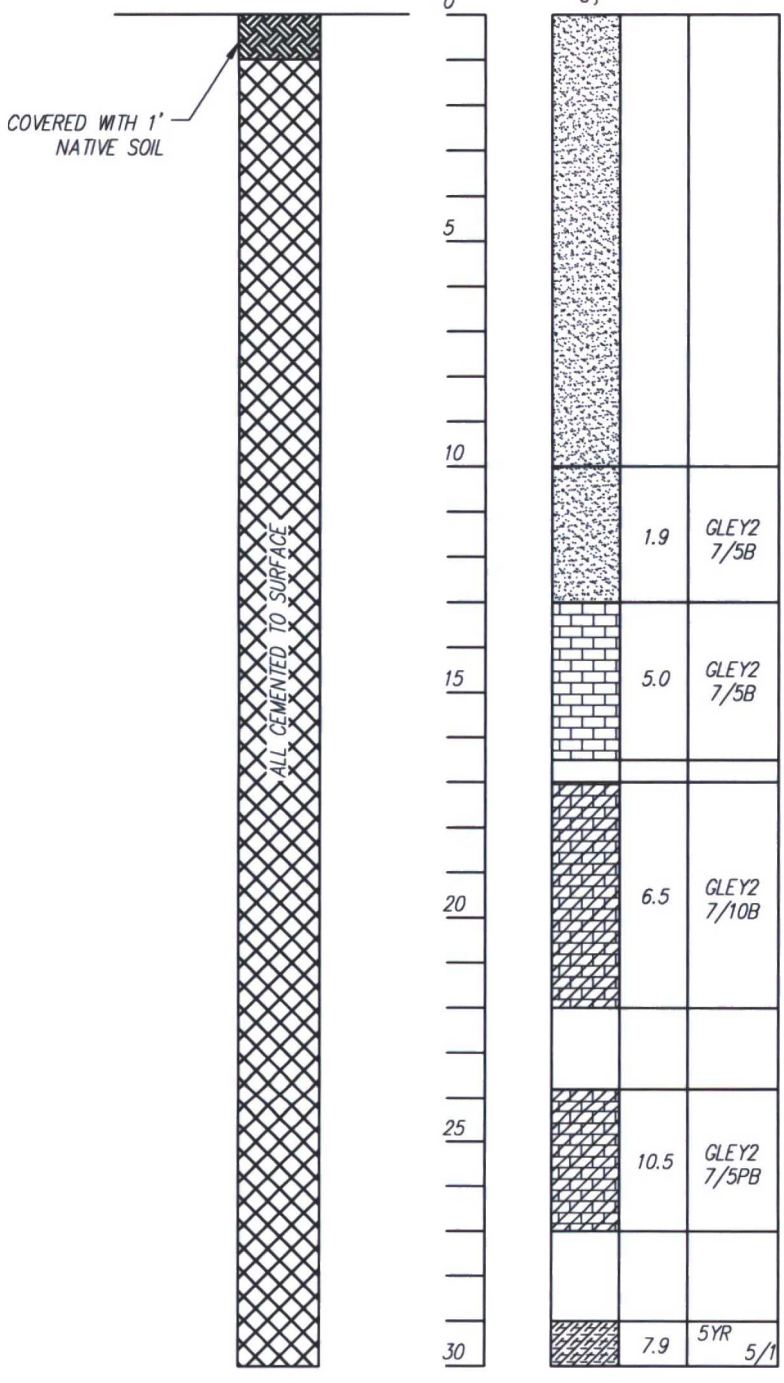

NOTE: ARTESIAN WATER FLOW ENCOUNTERED IN THE DARK GRAY FRACTURED SHALE @ 29' TO 30'. VERBAL APPROVAL FROM NMOSE TO PLUG AND ABANDON THIS BOREHOLE WITH CEMENT GROUT.

LOG LEGEND

SHALE
SAND
CLAY
SAND STONE

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BP FARMINGTON, NEW MEXICO

SB-6D MONITORING WELL LOG
MUDGE LS6
SECTION 11, T31N, R11W
SAN JUAN COUNTY, NEW MEXICO

Designed	Drawn	Checked
LLD	DJB	RSA

Date: September 2016
Scale: Horiz: NA Vert: NA
Project No: 5124371
Sheet: 12

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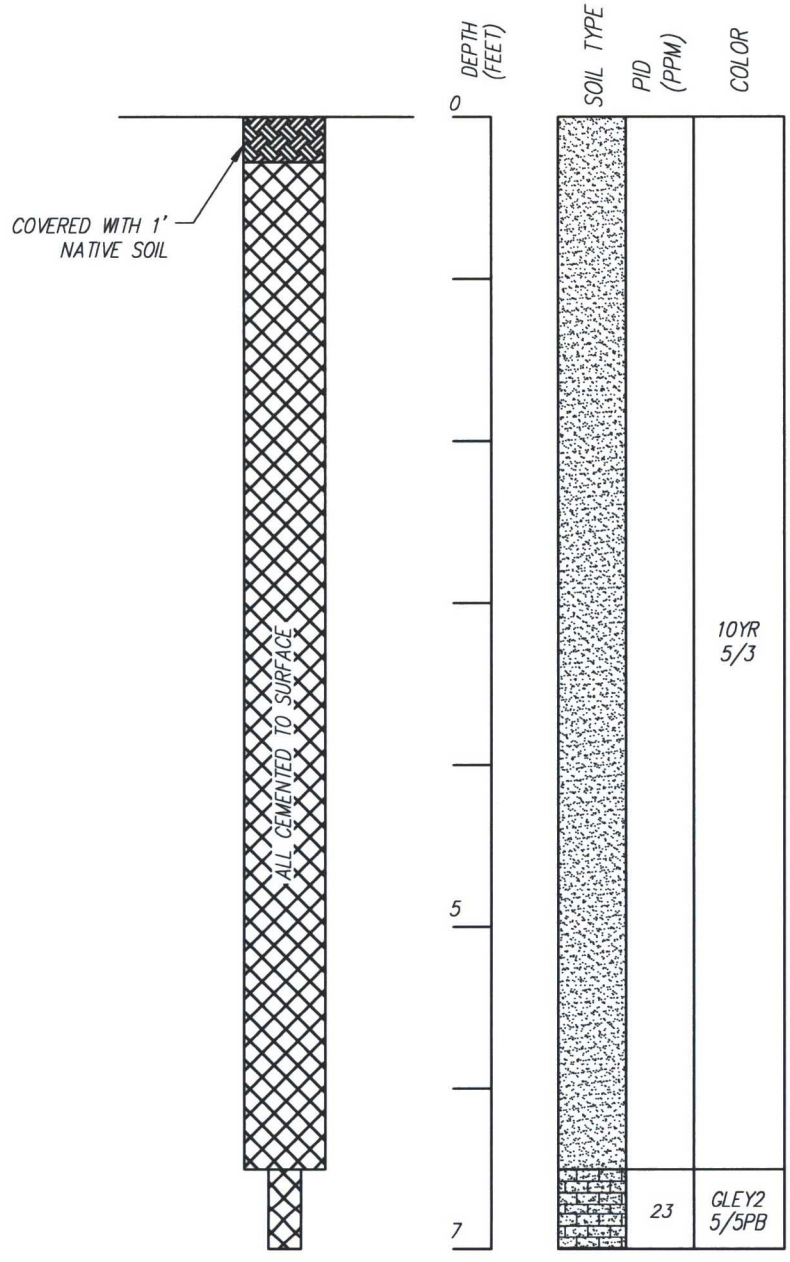

NOTE:
AFTER DISCUSSION WITH BP REPRESENTATIVE, DECISION MADE TO PLUG THIS SOIL BORING WITH CEMENT GROUT. ANOTHER SOIL BORING WILL BE DRILLED FOR THE #7 WELL.

LOG LEGEND

SAND

SAND STONE

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SB-7A MONITORING WELL LOG
MUDGE LS6
SECTION 11, T31N, R11W
SAN JUAN COUNTY, NEW MEXICO

Designed	Drawn	Checked
LLD	DJB	RSA

Date: September 2016
Scale: Horiz: NA Vert: NA
Project No: 5124371
Sheet: 13

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BLAGG ENGINEERING, INC.
P.O. BOX 87, BLOOMFIELD, NM 87413
(505) 632-1199

22' S 21° E

FIELD BORING LOG

BORING ID: MW-1

PROJECT: BP: Mudge LS 6
CLIENT: BP America Production Co.
DRILLING CONTRACTOR: Kyvek
EQUIPMENT USED: CME-95
DATE START: 6/4/2015 DATE FINISH: 6/4/15 DRILLER: KP LOGGED BY: JCB
TOTAL DEPTH: 25' CASING TYPE & SIZE: 2" PVC SLOT SIZE: 0.010
COMMENTS:

DEPTH FEET	SAMPLE TIME	SAMPLE TYPE	SAMPLE DESCRIPTION
1'	0831 START	CUTTINGS	SILTY SAND - TAN - Lite Moisture - BACKFILL
2'			
3'			
4'			
5'			
6'			
7'			
8'			
9'			
10			
11'			
12'			
13'			
14'			
15'			
16'			
17'			
18'			SANDSTONE @ 17½'
19'			
20			Approximate GW Depth 6/16/2015
21'	0855	SS	SANDSTONE, Medium Grained, Lite/Medium Moisture, GRAY COLOR (DRIVE 0"/50 Blows)
22'			
23'			
24'			
25'			
26'	0910	SS	DRIVE 6"/50 Blows SAA
27'			
28'			TD DRILLED = 25'
29'			
30			

CUTTINGS
BENT
10/20 SAND

FIGURE 14

BLAGG ENGINEERING, INC.
P.O. BOX 87, BLOOMFIELD, NM 87413
(505) 632-1199

50' S25°E

FIELD BORING LOG

BORING ID: MW-2

PROJECT: BP: Mudge LS 6
CLIENT: BP America Production Co.
DRILLING CONTRACTOR: Kyvek
EQUIPMENT USED: CME-95
DATE START: 6/4/2015 DATE FINISH: 6/4/2015 DRILLER: KP LOGGED BY: JCB
TOTAL DEPTH: 30' CASING TYPE & SIZE: 2" PVC SLOT SIZE: 0.010
COMMENTS:

DEPTH FEET	SAMPLE TIME	SAMPLE TYPE	SAMPLE DESCRIPTION
1'	1015	CUTTINGS	SILTY SAND - TAN - Lite Moisture - BACKFILL
2'			
3'			
4'			
5'			
6'			
7'			
8'			
9'			
10			
11'			
12'			
13'			
14'			
15'			
16'			
17'			
18'			
19'			
20			V. Moist @ 20'
21'			
22'			
23'			
24'			
25'			
26'			SANDSTONE @ 26'
27'			
28'			
29'			
30			DRILLED TD = 30'

CUTTINGS
GEAT
10/20 SAND

Approximate GW Depth 6/16/2015

1047 SS. DRIVE 6"/50 Blows SANDSTONE, Lite Gray, Medium Grained Lite Moisture

FIGURE 15

BLAGG ENGINEERING, INC.

P.O. BOX 87, BLOOMFIELD, NM 87413

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Page 1 of 1

17' N59W

FIELD BORING LOG

BORING ID: MW-3

PROJECT: BP: Mudge LS 6

CLIENT: BP America Production Co.

DRILLING CONTRACTOR: Kyvek

EQUIPMENT USED: CME-95

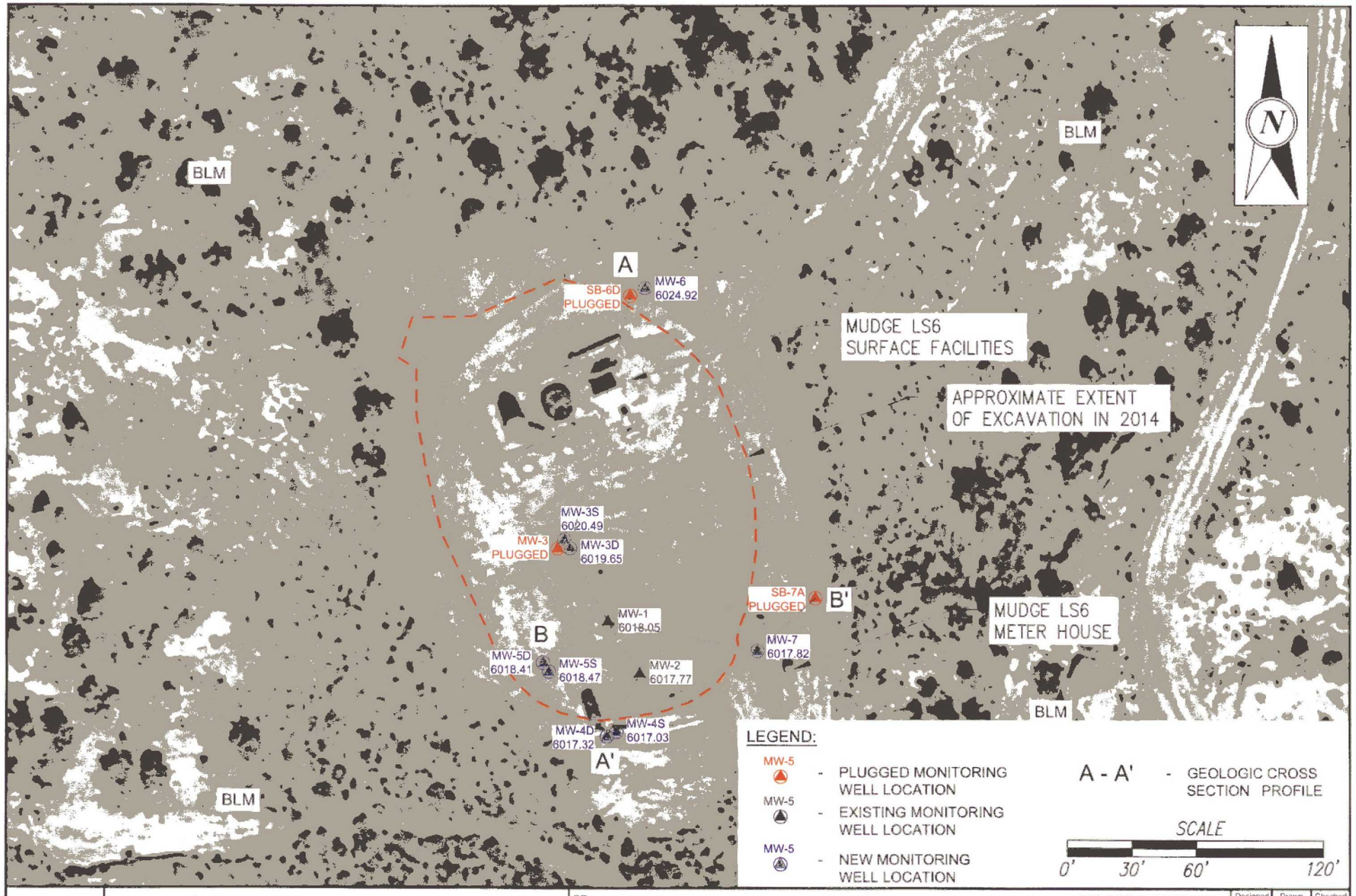
DATE START: 6/4/2015 DATE FINISH: 6/4/15 DRILLER: KP LOGGED BY: JCB

TOTAL DEPTH: 30' CASING TYPE & SIZE: 2" PVC SLOT SIZE: 0.010

COMMENTS:

DEPTH FEET	SAMPLE TIME	SAMPLE TYPE	FLUSH MOUNT	SAMPLE DESCRIPTION
1'	1215 START	cuttings	CUTTINGS	Silty SAND - TAN - Lite Moisture, BACKFILL
2'				
3'				
4'				
5'				
6'				
7'				
8'				
9'				
10				
11'				
12'			BENT	
13'				
14'				
15'				
16'				
17'				SANDSTONE @ 17'
18'			10/20 SAND	
19'				
20				Approximate GW Depth on 6/16/2015
21'				
22'				
23'				
24'				
25'				
26'				
27'				
28'				
29'				
30	1325			TD Drilled = 30'

FIGURE 16



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FARMINGTON, NEW MEXICO

MUDGE LS6
CROSS SECTION MAP
SECTION 11, T31N, R11W

SAN JUAN COUNTY, NEW MEXICO

Designed	Drawn	Checked
SH	DJB	RSA

Date: JULY, 2016

Scale: Horiz. 1"=60'
Vert. N/A

Project No: 5124371

Sheet: 17

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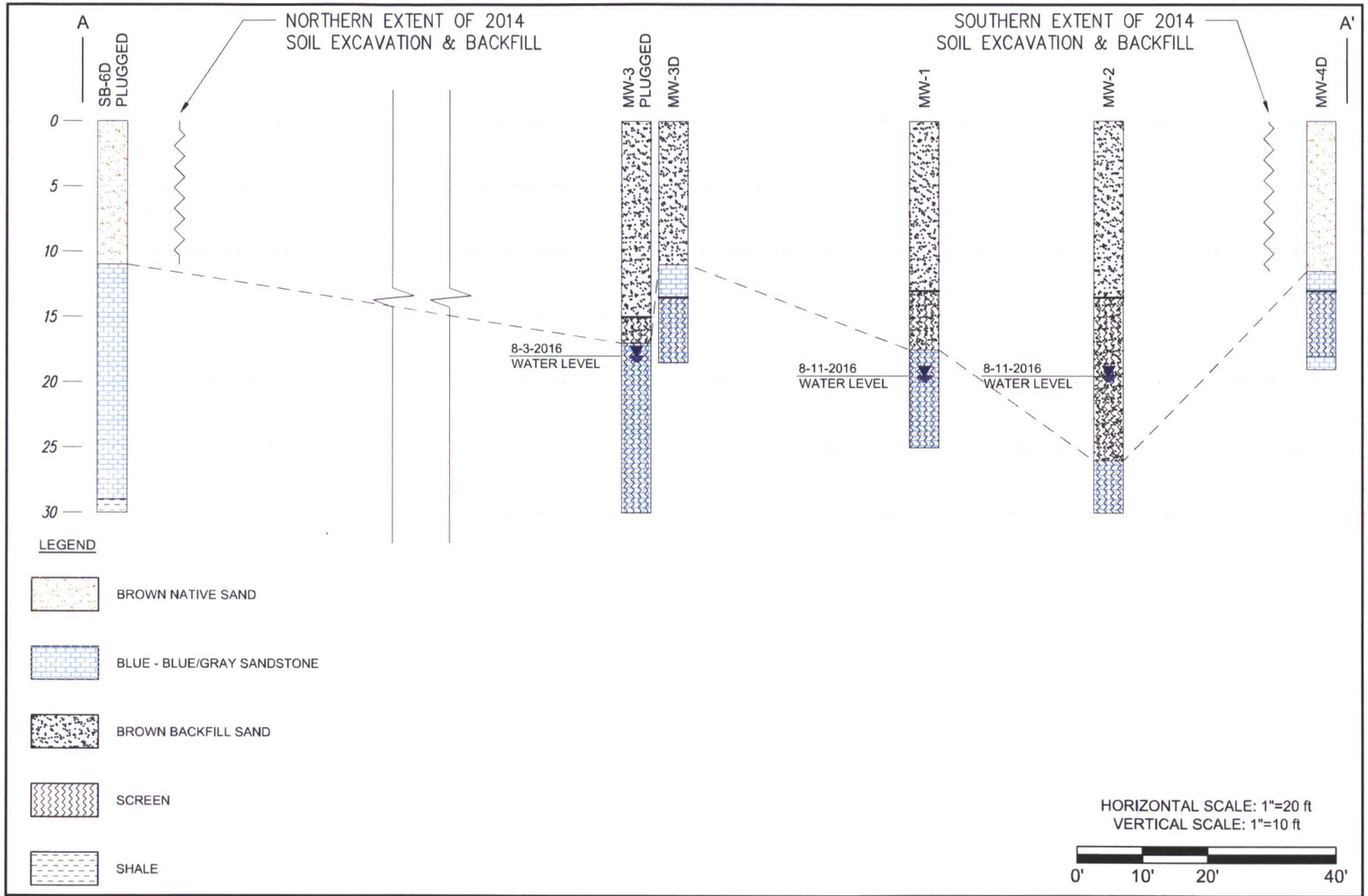

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FARMINGTON, NEW MEXICO

MUDGE LS6
GEOLOGIC CROSS SECTION A-A'
SECTION 11, T31N, R11W

SAN JUAN COUNTY, NEW MEXICO

Designed	Drawn	Checked
LDD	DJB	RSA

Date: SEPTEMBER, 2016

Scale: Horiz: 1" = 20'
Vert: 1" = 10'

Project No: 5124371

Sheet: 18

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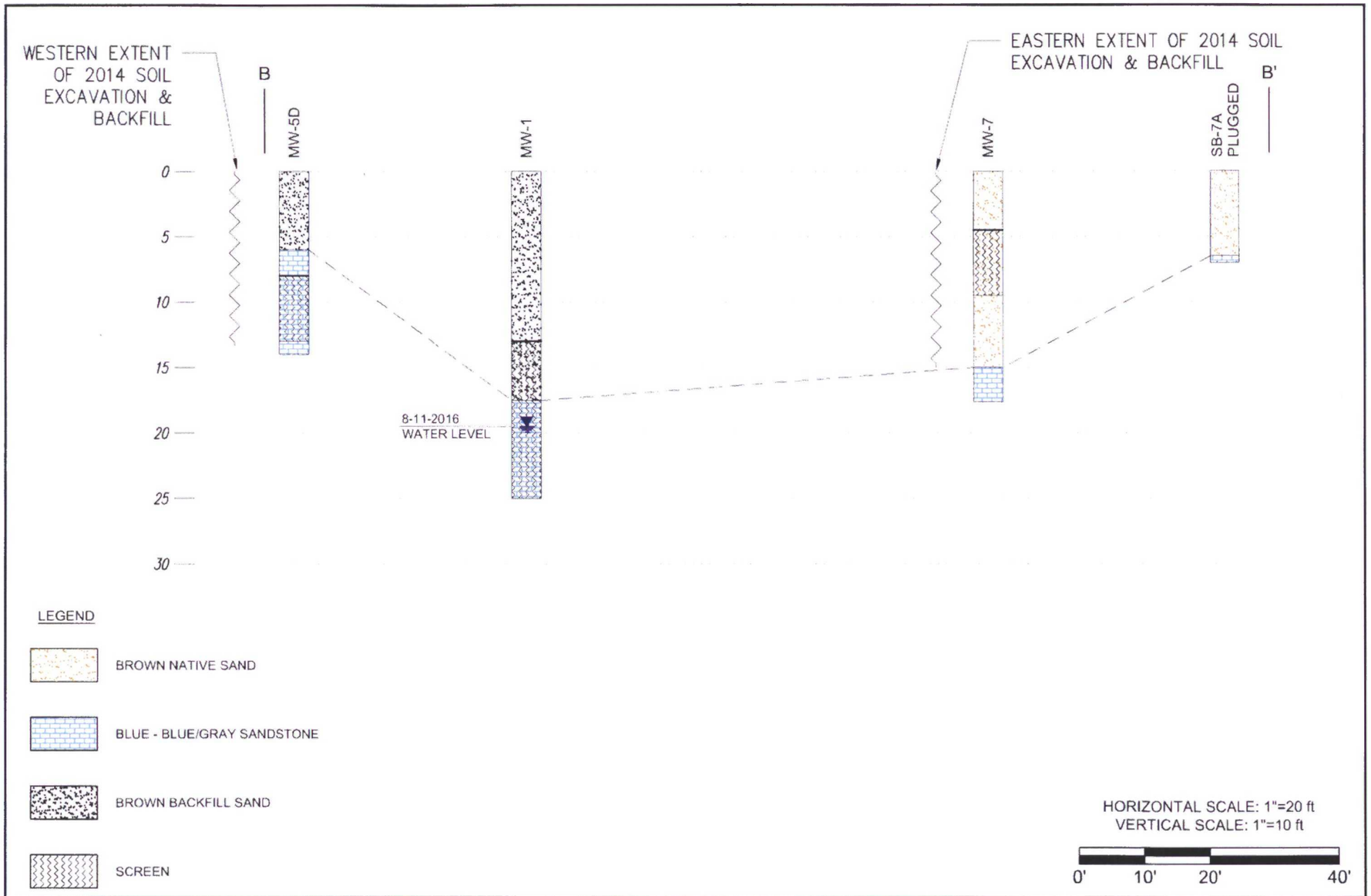

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FARMINGTON, NEW MEXICO

MUDGE LS6
GEOLOGIC CROSS SECTION B-B'
SECTION 11, T31N, R11W

SAN JUAN COUNTY, NEW MEXICO

Designed	Drawn	Checked
LDD	DJB	RSA

Date: SEPTEMBER, 2016
Scale: Horiz: 1" = 20'
Vert: 1" = 10'
Project No: 5124371
Sheet: 19

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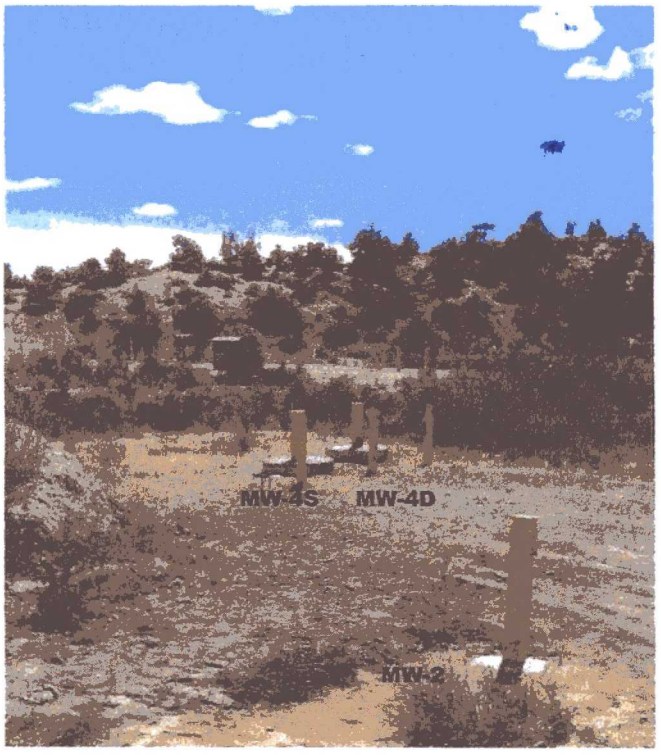
TABLE 1: TOPOGRAPHIC SURVEY			
Well	Casing Elevation	Latitude	Longitude
MW-1	6018.05	36.908768	-107.965588
MW-2	6017.77	36.908702	-107.965537
MW-3	N/A, Plugged	36.908867	-107.965670
MW-3S	6020.49	36.908873	-107.965658
MW-3D	6019.65	36.908862	-107.965649
MW-4S	6017.03	36.908628	-107.965574
MW-4D	6017.32	36.908622	-107.965590
MW-5S	6018.47	36.908705	-107.965682
MW-5D	6018.41	36.908716	-107.965692
MW-6	6024.92	36.909194	-107.965531
SB-6D	N/A, Plugged	36.909183	-107.965554
MW-7	6017.82	36.908732	-107.965351
SB-7A	N/A, Plugged	36.908792	-107.965267

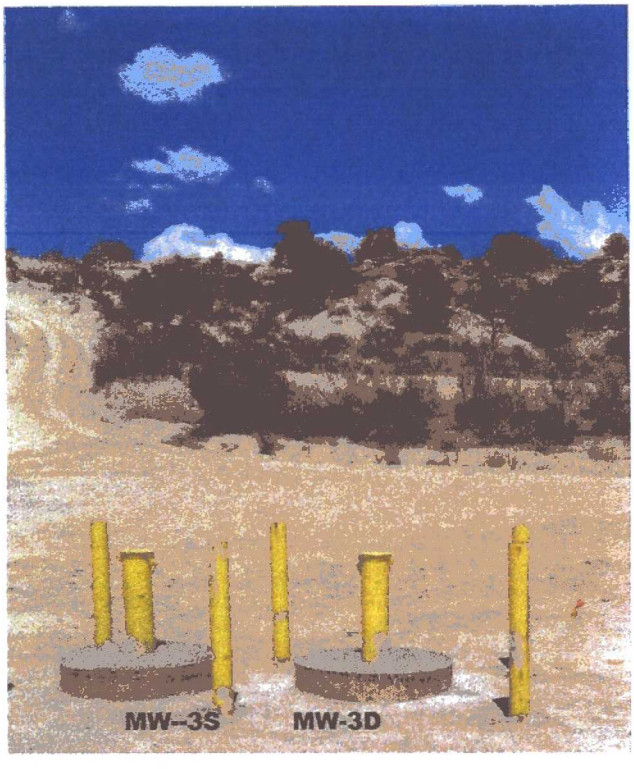
TABLE 2: SUMMARY OF LABORATORY ANALYSIS								
Soil Boring	Depth	Method 8260				Method 8015		
		B	T	E	X	GRO	DRO	MRO
SB-3S	10	ND	ND	ND	ND	ND	11	ND
SB-3S	13	ND	ND	ND	ND	ND	ND	ND
SB-3S	14	ND	ND	ND	ND	ND	ND	ND
SB-3D	17	ND	ND	ND	ND	ND	ND	ND
SB-3D	19	ND	ND	ND	ND	ND	ND	ND
SB-4S	4	ND	ND	ND	ND	ND	ND	ND
SB-4S	8	ND	ND	ND	ND	ND	ND	ND
SB-4D	11.5	ND	ND	ND	ND	ND	ND	ND
SB-4D	18	ND	ND	ND	ND	ND	ND	ND
SB-5S	6.8	ND	ND	ND	ND	ND	ND	ND
SB-5D	6	ND	ND	ND	ND	ND	ND	ND
SB-5D	12	ND	ND	ND	ND	11	17	ND
SB-6S	5	ND	ND	ND	ND	ND	ND	ND
SB-6D	10	ND	ND	ND	ND	ND	ND	ND
SB-6D	10.5	ND	ND	ND	ND	ND	ND	ND
SB-6D	23	ND	ND	ND	ND	ND	ND	ND
SB-7A	5	ND	ND	ND	ND	ND	ND	ND
SB-7A	6.5	0.057	0.32	ND	0.34	ND	ND	ND
SB-7BS	9.0	ND	ND	ND	ND	ND	ND	ND
SB-7BS	11.5	ND	ND	ND	ND	ND	ND	ND

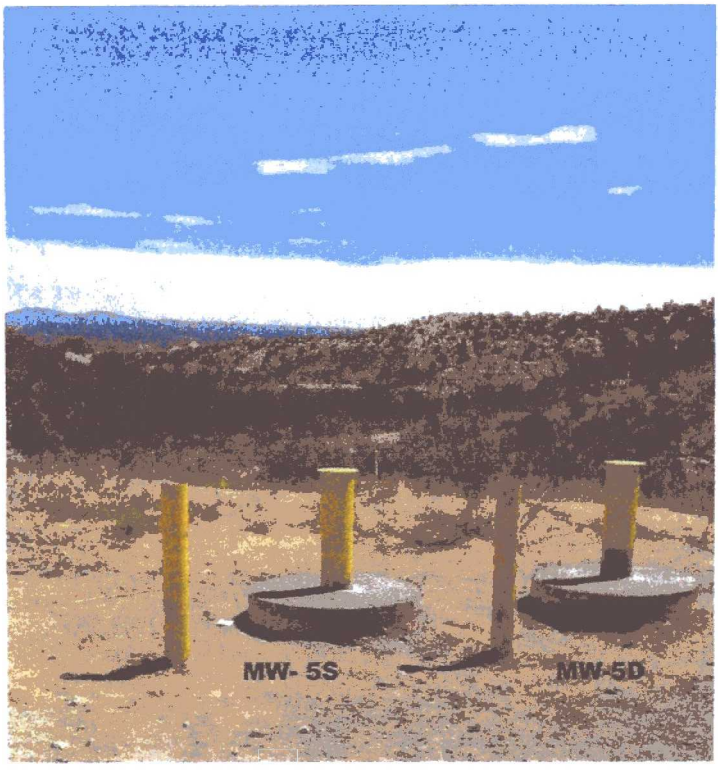
ADDITIONAL ANALYSES		
	MW-4D	MW-5S
TOC	N/D	0.19
EPA 300.0		
Nitrite as N	N/D	N/D
Nitrate as N	1.4	1.7
Phosphorus	N/D	N/D
Sulfate	7100	5000
Ammonia as N	N/D	N/D
EPA 7471		
Mercury	N/D	N/D
EPA 6010B Metals		
Arsenic	N/D	N/D
Barium	17	25
Cadmium	N/D	N/D
Chromium	2.7	4.2
Iron	5200	8100
Lead	2.7	3.4
Manganese	91	96
Selenium	N/D	N/D
Silver	N/D	N/D
EPA 8015M/D		
DRO	N/D	N/D
MRO	N/D	N/D
EPA 8015D		
GRO	N/D	N/D
EPA 8021B		
Benzene	N/D	N/D
Toluene	N/D	N/D
Ethylbenzene	N/D	N/D
Xylenes	N/D	N/D


Yellow Jacket Drilling Rig


MW-1


MW-4S
MW-4D
MW-2


MW--3S
MW-3D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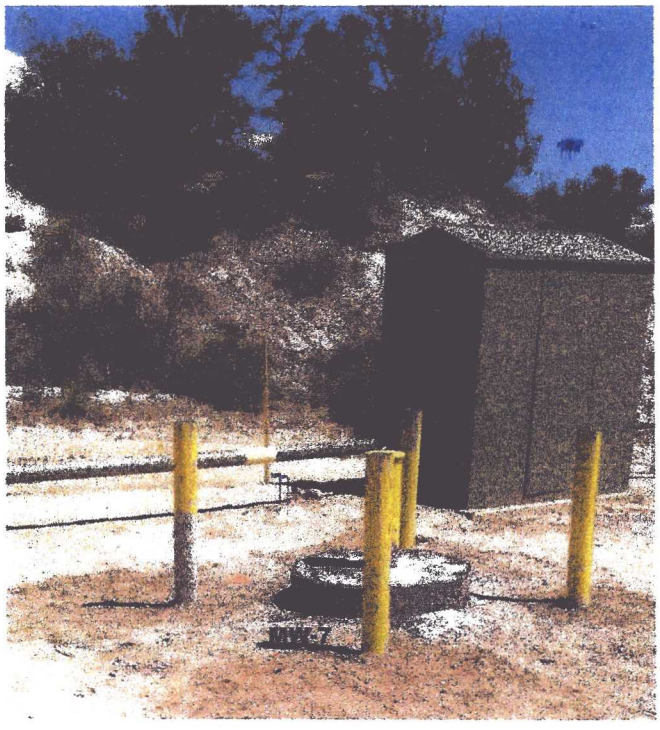
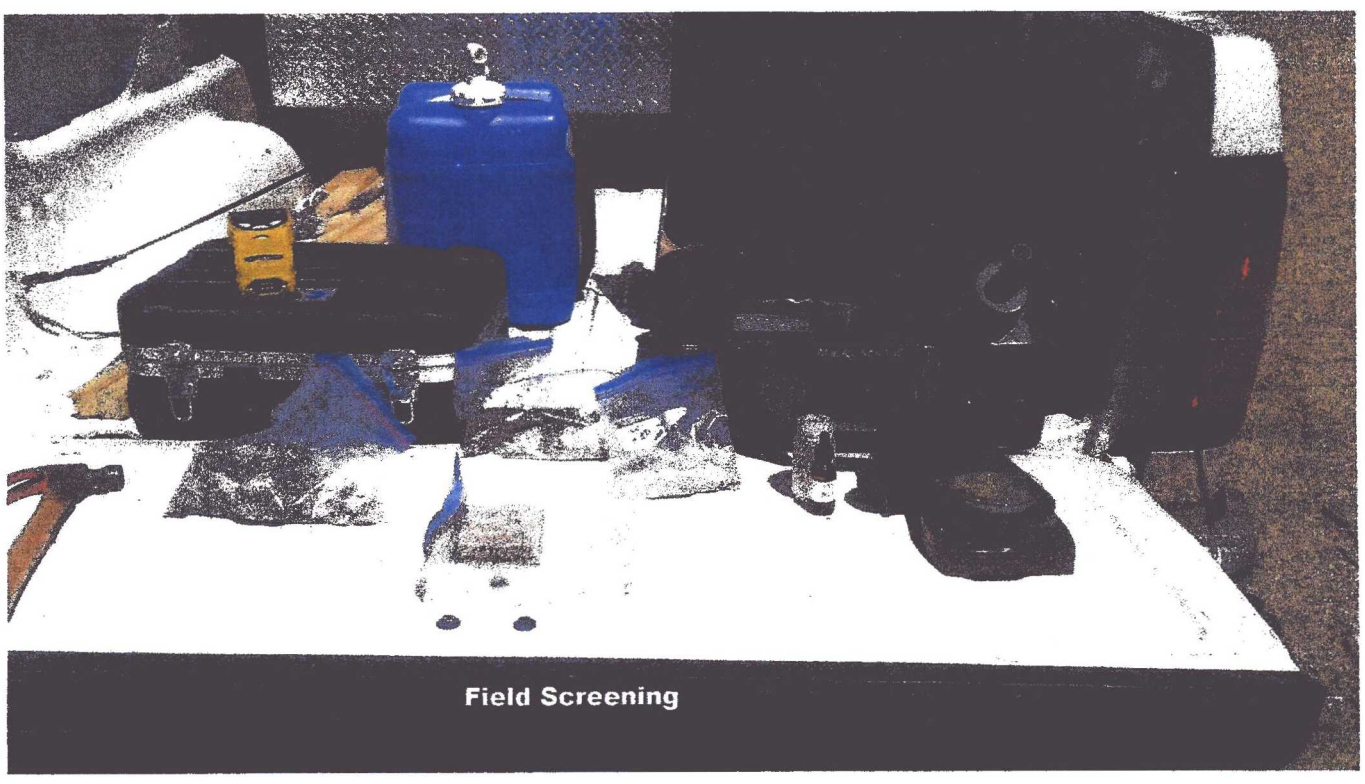
MW-5D





Field Screening

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

October 05, 2016

Reid Allan
SMA-FARM
401 W. Broadway
Farmington, NM 87401
TEL: (505) 325-5667
FAX (505) 327-1496

RE: BP Mudge LS 006 OrderNo.: 1608446

Dear Reid Allan:

Hall Environmental Analysis Laboratory received 5 sample(s) on 8/6/2016 for the analyses presented in the following report.

This report is a revised report and it replaces the original report issued August 10, 2016.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. All samples are reported as received unless otherwise indicated.

Please don't hesitate to contact HEAL for any additional information or clarifications.

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **1608446**
Date Reported: **10/5/2016**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: SMA-FARM
Project: BP Mudge LS 006
Lab ID: 1608446-001 **Matrix:** SOIL

Client Sample ID: SB3-S-10.0-160804
Collection Date: 8/4/2016 7:25:00 AM
Received Date: 8/6/2016 7:45:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	11	10		mg/Kg	1	8/10/2016 11:46:50 AM	26867
Motor Oil Range Organics (MRO)	ND	50		mg/Kg	1	8/10/2016 11:46:50 AM	26867
Surr: DNOP	98.2	70-130		%Rec	1	8/10/2016 11:46:50 AM	26867
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	4.9		mg/Kg	1	8/9/2016 10:28:37 PM	26849
Surr: BFB	109	68.3-144		%Rec	1	8/9/2016 10:28:37 PM	26849
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.025		mg/Kg	1	8/9/2016 10:28:37 PM	26849
Toluene	ND	0.049		mg/Kg	1	8/9/2016 10:28:37 PM	26849
Ethylbenzene	ND	0.049		mg/Kg	1	8/9/2016 10:28:37 PM	26849
Xylenes, Total	ND	0.099		mg/Kg	1	8/9/2016 10:28:37 PM	26849
Surr: 4-Bromofluorobenzene	102	80-120		%Rec	1	8/9/2016 10:28:37 PM	26849

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: SMA-FARM
Project: BP Mudge LS 006
Lab ID: 1608446-002 **Matrix:** SOIL

Client Sample ID: SB3-S-13.0-160804
Collection Date: 8/4/2016 7:40:00 AM
Received Date: 8/6/2016 7:45:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.8		mg/Kg	1	8/10/2016 12:08:42 PM	26867
Motor Oil Range Organics (MRO)	ND	49		mg/Kg	1	8/10/2016 12:08:42 PM	26867
Surr: DNOP	99.2	70-130		%Rec	1	8/10/2016 12:08:42 PM	26867
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	4.7		mg/Kg	1	8/9/2016 10:51:57 PM	26849
Surr: BFB	105	68.3-144		%Rec	1	8/9/2016 10:51:57 PM	26849
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.023		mg/Kg	1	8/9/2016 10:51:57 PM	26849
Toluene	ND	0.047		mg/Kg	1	8/9/2016 10:51:57 PM	26849
Ethylbenzene	ND	0.047		mg/Kg	1	8/9/2016 10:51:57 PM	26849
Xylenes, Total	ND	0.093		mg/Kg	1	8/9/2016 10:51:57 PM	26849
Surr: 4-Bromofluorobenzene	94.7	80-120		%Rec	1	8/9/2016 10:51:57 PM	26849

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Analytical Report
Lab Order **1608446**
Date Reported: **10/5/2016**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: SMA-FARM
Project: BP Mudge LS 006
Lab ID: 1608446-003 **Matrix:** SOIL

Client Sample ID: SB3-S-14.0-160804
Collection Date: 8/4/2016 7:45:00 AM
Received Date: 8/6/2016 7:45:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.7		mg/Kg	1	8/10/2016 12:30:26 PM	26867
Motor Oil Range Organics (MRO)	ND	49		mg/Kg	1	8/10/2016 12:30:26 PM	26867
Surr: DNOP	101	70-130		%Rec	1	8/10/2016 12:30:26 PM	26867
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	4.9		mg/Kg	1	8/10/2016 12:25:41 AM	26849
Surr: BFB	106	68.3-144		%Rec	1	8/10/2016 12:25:41 AM	26849
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.025		mg/Kg	1	8/10/2016 12:25:41 AM	26849
Toluene	ND	0.049		mg/Kg	1	8/10/2016 12:25:41 AM	26849
Ethylbenzene	ND	0.049		mg/Kg	1	8/10/2016 12:25:41 AM	26849
Xylenes, Total	ND	0.098		mg/Kg	1	8/10/2016 12:25:41 AM	26849
Surr: 4-Bromofluorobenzene	98.2	80-120		%Rec	1	8/10/2016 12:25:41 AM	26849

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: SMA-FARM
Project: BP Mudge LS 006
Lab ID: 1608446-004
Matrix: SOIL
Client Sample ID: SB3-D-17.0-160804
Collection Date: 8/4/2016 10:20:00 AM
Received Date: 8/6/2016 7:45:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	10		mg/Kg	1	8/10/2016 12:52:18 PM	26867
Motor Oil Range Organics (MRO)	ND	50		mg/Kg	1	8/10/2016 12:52:18 PM	26867
Surr: DNOP	101	70-130		%Rec	1	8/10/2016 12:52:18 PM	26867
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	4.8		mg/Kg	1	8/10/2016 12:49:11 AM	26849
Surr: BFB	108	68.3-144		%Rec	1	8/10/2016 12:49:11 AM	26849
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.024		mg/Kg	1	8/10/2016 12:49:11 AM	26849
Toluene	ND	0.048		mg/Kg	1	8/10/2016 12:49:11 AM	26849
Ethylbenzene	ND	0.048		mg/Kg	1	8/10/2016 12:49:11 AM	26849
Xylenes, Total	ND	0.096		mg/Kg	1	8/10/2016 12:49:11 AM	26849
Surr: 4-Bromofluorobenzene	100	80-120		%Rec	1	8/10/2016 12:49:11 AM	26849

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: SMA-FARM
Project: BP Mudge LS 006
Lab ID: 1608446-005 **Matrix:** SOIL

Client Sample ID: SB3-D-19.0-160804
Collection Date: 8/4/2016 10:21:00 AM
Received Date: 8/6/2016 7:45:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	10		mg/Kg	1	8/10/2016 1:14:09 PM	26867
Motor Oil Range Organics (MRO)	ND	50		mg/Kg	1	8/10/2016 1:14:09 PM	26867
Surr: DNOP	97.6	70-130		%Rec	1	8/10/2016 1:14:09 PM	26867
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	4.8		mg/Kg	1	8/10/2016 1:12:42 AM	26849
Surr: BFB	109	68.3-144		%Rec	1	8/10/2016 1:12:42 AM	26849
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.024		mg/Kg	1	8/10/2016 1:12:42 AM	26849
Toluene	ND	0.048		mg/Kg	1	8/10/2016 1:12:42 AM	26849
Ethylbenzene	ND	0.048		mg/Kg	1	8/10/2016 1:12:42 AM	26849
Xylenes, Total	ND	0.097		mg/Kg	1	8/10/2016 1:12:42 AM	26849
Surr: 4-Bromofluorobenzene	102	80-120		%Rec	1	8/10/2016 1:12:42 AM	26849

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1608446**

05-Oct-16

Client: SMA-FARM

Project: BP Mudge LS 006

Sample ID **LCS-26867**	SampType: **LCS**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **LCSS**	Batch ID: **26867**	RunNo: **36347**
Prep Date: **8/9/2016**	Analysis Date: **8/10/2016**	SeqNo: **1126001** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	43	10	50.00	0	86.2	62.6	124			
Surr: DNOP	4.7		5.000		93.9	70	130			

Sample ID **MB-26867**	SampType: **MBLK**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **PBS**	Batch ID: **26867**	RunNo: **36347**
Prep Date: **8/9/2016**	Analysis Date: **8/10/2016**	SeqNo: **1126002** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	ND	10								
Motor Oil Range Organics (MRO)	ND	50								
Surr: DNOP	9.6		10.00		95.6	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1608446**

05-Oct-16

Client: SMA-FARM

Project: BP Mudge LS 006

Sample ID **MB-26849**	SampType: **MBLK**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **PBS**	Batch ID: **26849**	RunNo: **36339**
Prep Date: **8/8/2016**	Analysis Date: **8/9/2016**	SeqNo: **1125631** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	ND	5.0								
Surr: BFB	1100		1000		107	68.3	144			

Sample ID **LCS-26849**	SampType: **LCS**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **LCSS**	Batch ID: **26849**	RunNo: **36339**
Prep Date: **8/8/2016**	Analysis Date: **8/9/2016**	SeqNo: **1125632** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	27	5.0	25.00	0	109	80	120			
Surr: BFB	1200		1000		121	68.3	144			

Sample ID **1608446-002AMS**	SampType: **MS**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **SB3-S-13.0-160804**	Batch ID: **26849**	RunNo: **36339**
Prep Date: **8/8/2016**	Analysis Date: **8/9/2016**	SeqNo: **1125642** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	29	4.7	23.52	0	124	59.3	143			
Surr: BFB	1100		940.7		122	68.3	144			

Sample ID **1608446-002AMSD**	SampType: **MSD**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **SB3-S-13.0-160804**	Batch ID: **26849**	RunNo: **36339**
Prep Date: **8/8/2016**	Analysis Date: **8/9/2016**	SeqNo: **1125650** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	30	4.8	23.99	0	127	59.3	143	3.72	20	
Surr: BFB	1200		959.7		123	68.3	144	0	0	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1608446**

05-Oct-16

Client: SMA-FARM

Project: BP Mudge LS 006

Sample ID **MB-26849**	SampType: **MBLK**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **PBS**	Batch ID: **26849**	RunNo: **36339**
Prep Date: **8/8/2016**	Analysis Date: **8/9/2016**	SeqNo: **1125674** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	0.025								
Toluene	ND	0.050								
Ethylbenzene	ND	0.050								
Xylenes, Total	ND	0.10								
Surr: 4-Bromofluorobenzene	1.0		1.000		103	80	120			

Sample ID **LCS-26849**	SampType: **LCS**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **LCSS**	Batch ID: **26849**	RunNo: **36339**
Prep Date: **8/8/2016**	Analysis Date: **8/9/2016**	SeqNo: **1125675** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	1.0	0.025	1.000	0	102	75.3	123			
Toluene	1.1	0.050	1.000	0	107	80	124			
Ethylbenzene	1.2	0.050	1.000	0	115	82.8	121			
Xylenes, Total	3.4	0.10	3.000	0	112	83.9	122			
Surr: 4-Bromofluorobenzene	1.1		1.000		111	80	120			

Sample ID **1608446-001AMS**	SampType: **MS**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **SB3-S-10.0-160804**	Batch ID: **26849**	RunNo: **36339**
Prep Date: **8/8/2016**	Analysis Date: **8/9/2016**	SeqNo: **1125677** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	1.0	0.025	0.9872	0	102	71.5	122			
Toluene	1.1	0.049	0.9872	0	109	71.2	123			
Ethylbenzene	1.2	0.049	0.9872	0	118	75.2	130			
Xylenes, Total	3.4	0.099	2.962	0	114	72.4	131			
Surr: 4-Bromofluorobenzene	1.1		0.9872		108	80	120			

Sample ID **1608446-001AMSD**	SampType: **MSD**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **SB3-S-10.0-160804**	Batch ID: **26849**	RunNo: **36339**
Prep Date: **8/8/2016**	Analysis Date: **8/9/2016**	SeqNo: **1125678** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	1.0	0.025	1.000	0	101	71.5	122	0.636	20	
Toluene	1.0	0.050	1.000	0	105	71.2	123	2.38	20	
Ethylbenzene	1.1	0.050	1.000	0	114	75.2	130	1.87	20	
Xylenes, Total	3.3	0.10	3.000	0	109	72.4	131	2.88	20	
Surr: 4-Bromofluorobenzene	1.1		1.000		106	80	120	0	0	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: SMA-FARM Work Order Number: 1608446 RcptNo: 1

Received by/date: LM 08/06/16

Logged By: Anne Thorne 8/6/2016 7:45:00 AM Anne Thorne

Completed By: Anne Thorne 8/8/2016 Anne Thorne

Reviewed By: MG 08/08/16

Chain of Custody

1. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
2. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
3. How was the sample delivered?	Courier		

Log In

4. Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
5. Were all samples received at a temperature of >0° C to 6.0°C	Yes ☑	No ☐	NA ☐
6. Sample(s) in proper container(s)?	Yes ☑	No ☐	
7. Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8. Are samples (except VOA and ONG) properly preserved?	Yes ☑	No ☐	
9. Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10. VOA vials have zero headspace?	Yes ☐	No ☐	No VOA Vials ☑
11. Were any sample containers received broken?	Yes ☐	No ☑	
12. Does paperwork match bottle labels? (Note discrepancies on chain of custody)	Yes ☑	No ☐	
13. Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
14. Is it clear what analyses were requested?	Yes ☑	No ☐	
15. Were all holding times able to be met? (If no, notify customer for authorization.)	Yes ☑	No ☐	

# of preserved bottles checked for pH: _____ (<2 or >12 unless noted)

Adjusted? _____

Checked by: _____

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: _____ Date _____

By Whom: _____ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding: _____

Client Instructions: _____

17. Additional remarks:

18. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	2.0	Good	Yes			

Chain-of-Custody Record

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Client: Souder Miller & Assoc

Mailing Address: 401 W Broadway
Farmington, NM 87401

Phone #: 505 325 7535

Email or Fax#: loren.diede@soudermiller.com

QA/QC Package:
☒ Standard ☐ Level 4 (Full Validation)

Accreditation
☐ NELAP ☐ Other _____

EDD (Type) _____

Turn-Around Time:
☒ Standard ☐ Rush _____

Project Name: BP mudge LS006

Project #: See remarks

Project Manager: Reid Allen

Sampler: LLD/JES

On Ice: ☒ Yes ☐ No

Sample Temperature: 2.0

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1608446	BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH 8015B (GRO / DRO / MRO)	TPH (Method 418.1)	EDB (Method 504.1)	PAH's (8310 or 8270 SIMS)	RCRA 8 Metals	Anions (F,Cl,NO_3,NO_2,PO_4,SO_4)	8081 Pesticides / 8082 PCB's	8260B (VOA)	8270 (Semi-VOA)					Air Bubbles (Y or N)
04-16	0725	soil	SB3-S-10.0-160804	4oz jar	Cool	001	X		X													
04-16	0740	soil	SB3-S-13.0-160804	"	"	002	X		X													
04-16	0745	soil	SB3-S-14.0-160804	"	"	003	X		X													
04-16	1020	soil	SB3-D-17.0-160804	"	"	004	X		X													
04-16	1021	soil	SB3-D-19.0-160804	"	"	005	X		X													

Date	Time	Relinquished by:	Received by:	Date	Time
5/16	1300		Christa Waltz	8/5/16	1300
5/16	1840	Christa Waltz		08/06/16	0745

Remarks: BP INVOICE:
VID: VDRINKWJA1
WBS: L1-0016C-EMUDGLELS6

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

October 05, 2016

Reid Allan
Souder, Miller and Associates
401 W. Broadway
Farmington, NM 87401
TEL: (505) 325-5667
FAX (505) 327-1496

RE: BP Mudge LS 006 OrderNo.: 1608572

Dear Reid Allan:

Hall Environmental Analysis Laboratory received 2 sample(s) on 8/9/2016 for the analyses presented in the following report.

This report is a revised report and it replaces the original report issued August 15, 2016.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. All samples are reported as received unless otherwise indicated.

Please don't hesitate to contact HEAL for any additional information or clarifications.

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **1608572**
Date Reported: **10/5/2016**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller and Associates
Project: BP Mudge LS 006
Lab ID: 1608572-001 **Matrix:** SOIL

Client Sample ID: SB7B-S-9.0-160805
Collection Date: 8/5/2016 6:45:00 AM
Received Date: 8/9/2016 8:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.8		mg/Kg	1	8/12/2016 5:33:19 PM	26914
Motor Oil Range Organics (MRO)	ND	49		mg/Kg	1	8/12/2016 5:33:19 PM	26914
Surr: DNOP	82.3	70-130		%Rec	1	8/12/2016 5:33:19 PM	26914
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **RAA**	
Gasoline Range Organics (GRO)	ND	4.6		mg/Kg	1	8/11/2016 7:52:50 PM	26889
Surr: BFB	79.0	68.3-144		%Rec	1	8/11/2016 7:52:50 PM	26889
EPA METHOD 8021B: VOLATILES						Analyst: **RAA**	
Benzene	ND	0.023		mg/Kg	1	8/11/2016 7:52:50 PM	26889
Toluene	ND	0.046		mg/Kg	1	8/11/2016 7:52:50 PM	26889
Ethylbenzene	ND	0.046		mg/Kg	1	8/11/2016 7:52:50 PM	26889
Xylenes, Total	ND	0.093		mg/Kg	1	8/11/2016 7:52:50 PM	26889
Surr: 4-Bromofluorobenzene	101	80-120		%Rec	1	8/11/2016 7:52:50 PM	26889

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller and Associates
Client Sample ID: SB7B-S-11.5-160805
Project: BP Mudge LS 006
Collection Date: 8/5/2016 7:30:00 AM
Lab ID: 1608572-002 **Matrix:** SOIL **Received Date:** 8/9/2016 8:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.8		mg/Kg	1	8/12/2016 5:55:24 PM	26914
Motor Oil Range Organics (MRO)	ND	49		mg/Kg	1	8/12/2016 5:55:24 PM	26914
Surr: DNOP	84.4	70-130		%Rec	1	8/12/2016 5:55:24 PM	26914
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **RAA**	
Gasoline Range Organics (GRO)	ND	4.8		mg/Kg	1	8/11/2016 8:17:16 PM	26889
Surr: BFB	82.8	68.3-144		%Rec	1	8/11/2016 8:17:16 PM	26889
EPA METHOD 8021B: VOLATILES						Analyst: **RAA**	
Benzene	ND	0.024		mg/Kg	1	8/11/2016 8:17:16 PM	26889
Toluene	ND	0.048		mg/Kg	1	8/11/2016 8:17:16 PM	26889
Ethylbenzene	ND	0.048		mg/Kg	1	8/11/2016 8:17:16 PM	26889
Xylenes, Total	ND	0.096		mg/Kg	1	8/11/2016 8:17:16 PM	26889
Surr: 4-Bromofluorobenzene	104	80-120		%Rec	1	8/11/2016 8:17:16 PM	26889

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1608572**

05-Oct-16

Client: Souder, Miller and Associates

Project: BP Mudge LS 006

Sample ID **LCS-26914**	SampType: **LCS**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **LCSS**	Batch ID: **26914**	RunNo: **36459**
Prep Date: **8/11/2016**	Analysis Date: **8/12/2016**	SeqNo: **1129466** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	42	10	50.00	0	83.1	62.6	124			
Surr: DNOP	4.0		5.000		80.9	70	130			

Sample ID **MB-26914**	SampType: **MBLK**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **PBS**	Batch ID: **26914**	RunNo: **36459**
Prep Date: **8/11/2016**	Analysis Date: **8/12/2016**	SeqNo: **1129467** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	ND	10								
Motor Oil Range Organics (MRO)	ND	50								
Surr: DNOP	8.6		10.00		85.8	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1608572**

05-Oct-16

Client: Souder, Miller and Associates

Project: BP Mudge LS 006

Sample ID **1608572-002AMS**	SampType: **MS**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **SB7B-S-11.5-160805**	Batch ID: **26889**	RunNo: **36413**
Prep Date: **8/10/2016**	Analysis Date: **8/11/2016**	SeqNo: **1128245** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	26	4.7	23.70	0	109	59.3	143			
Surr: BFB	890		947.9		94.0	68.3	144			

Sample ID **1608572-002AMSD**	SampType: **MSD**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **SB7B-S-11.5-160805**	Batch ID: **26889**	RunNo: **36413**
Prep Date: **8/10/2016**	Analysis Date: **8/11/2016**	SeqNo: **1128246** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	27	4.8	24.15	0	110	59.3	143	2.46	20	
Surr: BFB	890		966.2		92.1	68.3	144	0	0	

Sample ID **LCS-26889**	SampType: **LCS**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **LCSS**	Batch ID: **26889**	RunNo: **36413**
Prep Date: **8/10/2016**	Analysis Date: **8/11/2016**	SeqNo: **1128262** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	23	5.0	25.00	0	91.5	80	120			
Surr: BFB	890		1000		89.0	68.3	144			

Sample ID **MB-26889**	SampType: **MBLK**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **PBS**	Batch ID: **26889**	RunNo: **36413**
Prep Date: **8/10/2016**	Analysis Date: **8/11/2016**	SeqNo: **1128263** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	ND	5.0								
Surr: BFB	860		1000		86.4	68.3	144			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1608572**

05-Oct-16

Client: Souder, Miller and Associates

Project: BP Mudge LS 006

Sample ID **1608572-001AMS**	SampType: **MS**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **SB7B-S-9.0-160805**	Batch ID: **26889**	RunNo: **36413**
Prep Date: **8/10/2016**	Analysis Date: **8/11/2016**	SeqNo: **1128271** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	1.0	0.024	0.9515	0	109	71.5	122			
Toluene	1.0	0.048	0.9515	0	107	71.2	123			
Ethylbenzene	1.0	0.048	0.9515	0	108	75.2	130			
Xylenes, Total	3.1	0.095	2.854	0	107	72.4	131			
Surr: 4-Bromofluorobenzene	1.1		0.9515		111	80	120			

Sample ID **1608572-001AMSD**	SampType: **MSD**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **SB7B-S-9.0-160805**	Batch ID: **26889**	RunNo: **36413**
Prep Date: **8/10/2016**	Analysis Date: **8/11/2016**	SeqNo: **1128272** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	1.1	0.024	0.9737	0	111	71.5	122	4.22	20	
Toluene	1.1	0.049	0.9737	0	113	71.2	123	7.81	20	
Ethylbenzene	1.1	0.049	0.9737	0	112	75.2	130	6.53	20	
Xylenes, Total	3.2	0.097	2.921	0	110	72.4	131	4.81	20	
Surr: 4-Bromofluorobenzene	1.1		0.9737		113	80	120	0	0	

Sample ID **LCS-26889**	SampType: **LCS**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **LCSS**	Batch ID: **26889**	RunNo: **36413**
Prep Date: **8/10/2016**	Analysis Date: **8/11/2016**	SeqNo: **1128289** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	0.89	0.025	1.000	0	89.4	75.3	123			
Toluene	0.90	0.050	1.000	0	90.4	80	124			
Ethylbenzene	0.88	0.050	1.000	0	87.6	82.8	121			
Xylenes, Total	2.6	0.10	3.000	0	87.4	83.9	122			
Surr: 4-Bromofluorobenzene	1.1		1.000		108	80	120			

Sample ID **MB-26889**	SampType: **MBLK**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **PBS**	Batch ID: **26889**	RunNo: **36413**
Prep Date: **8/10/2016**	Analysis Date: **8/11/2016**	SeqNo: **1128290** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	0.025								
Toluene	ND	0.050								
Ethylbenzene	ND	0.050								
Xylenes, Total	ND	0.10								
Surr: 4-Bromofluorobenzene	1.1		1.000		115	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: **SMA-FARM** Work Order Number: **1608572** RcptNo: 1

Received by/date: AJ 08/09/16

Logged By: **Ashley Gallegos** 8/9/2016 8:00:00 AM

Completed By: **Ashley Gallegos** 8/9/2016 5:29:50 PM

Reviewed By: 08/10/16

Chain of Custody

1. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
2. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
3. How was the sample delivered?	Courier		

Log In

4. Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
5. Were all samples received at a temperature of >0° C to 6.0°C	Yes ☑	No ☐	NA ☐
6. Sample(s) in proper container(s)?	Yes ☑	No ☐	
7. Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8. Are samples (except VOA and ONG) properly preserved?	Yes ☑	No ☐	
9. Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10. VOA vials have zero headspace?	Yes ☑	No ☐	No VOA Vials ☐
11. Were any sample containers received broken?	Yes ☐	No ☑	# of preserved bottles checked for pH:
12. Does paperwork match bottle labels? (Note discrepancies on chain of custody)	Yes ☑	No ☐	(<2 or >12 unless noted)
13. Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	Adjusted?
14. Is it clear what analyses were requested?	Yes ☑	No ☐	
15. Were all holding times able to be met? (If no, notify customer for authorization.)	Yes ☑	No ☐	Checked by:

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: _____ Date _____

By Whom: _____ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding: _____

Client Instructions: _____

17. Additional remarks:

18. **Cooler Information**

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.8	Good	Yes			

Chain-of-Custody Record

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Client: Souder Miller & Assoc	Turn-Around Time: ☒ Standard ☐ Rush
	Project Name: BP Mudge LS #006
Mailing Address: 401 W Broadway, Farmington, NM 87401	Project #: See remarks
Phone #: 505 325 7535	
email or Fax#: lauren.diede@soudermiller.com	Project Manager: Reid Allen
QA/QC Package: Standard ☐ Level 4 (Full Validation)	
Accreditation: NELAP ☐ Other	Sampler: LLD/JES
EDD (Type)	On Ice: ☒ Yes ☐ No
	Sample Temperature: 1.8°C

Analysis Request

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1608572	BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH 8015B (GRO/DRO/MRO)	TPH (Method 418.1)	EDB (Method 504.1)	PAH's (8310 or 8270 SIMS)	RCRA 8 Metals	Anions ($F, Cl, NO_3, NO_2, PO_4, SO_4$)	8081 Pesticides / 8082 PCB's	8260B (VOA)	8270 (Semi-VOA)					Air Bubbles (Y or N)
8/5/16	0645	Soil	SB 7B-S-20-160805	4oz jar	cool	-001	X		X													
8/5/16	0730	Soil	SB 7B-S-11.5-160805	4oz jar	"	-002	X		X													

Date:	Time:	Relinquished by:	Received by:	Date	Time
8/8/16	604			8/8/16	604
8/8/16	1828			08/09/16	0800

Remarks: BP Invoice:
VID: VDRINKWJA1
WBS: LT-0016 C-EMUDGLEL56

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

October 05, 2016

Reid Allan
Souder, Miller and Associates
401 W. Broadway
Farmington, NM 87401
TEL: (505) 325-5667
FAX (505) 327-1496

RE: BP Mudge LS006 OrderNo.: 1608309

Dear Reid Allan:

Hall Environmental Analysis Laboratory received 6 sample(s) on 8/4/2016 for the analyses presented in the following report.

This report is a revised report and it replaces the original report issued August 15, 2016.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. All samples are reported as received unless otherwise indicated.

Please don't hesitate to contact HEAL for any additional information or clarifications.

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **1608309**
Date Reported: **10/5/2016**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller and Associates
Client Sample ID: SB6-S-5.0-160801
Project: BP Mudge LS006
Collection Date: 8/1/2016 10:51:00 AM
Lab ID: 1608309-001 **Matrix:** SOIL **Received Date:** 8/4/2016 6:30:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.6		mg/Kg	1	8/9/2016 10:36:38 AM	26826
Motor Oil Range Organics (MRO)	ND	48		mg/Kg	1	8/9/2016 10:36:38 AM	26826
Surr: DNOP	98.0	70-130		%Rec	1	8/9/2016 10:36:38 AM	26826
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	4.7		mg/Kg	1	8/9/2016 12:18:20 PM	26838
Surr: BFB	106	68.3-144		%Rec	1	8/9/2016 12:18:20 PM	26838
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.024		mg/Kg	1	8/9/2016 12:18:20 PM	26838
Toluene	ND	0.047		mg/Kg	1	8/9/2016 12:18:20 PM	26838
Ethylbenzene	ND	0.047		mg/Kg	1	8/9/2016 12:18:20 PM	26838
Xylenes, Total	ND	0.094		mg/Kg	1	8/9/2016 12:18:20 PM	26838
Surr: 4-Bromofluorobenzene	101	80-120		%Rec	1	8/9/2016 12:18:20 PM	26838

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller and Associates
Project: BP Mudge LS006
Lab ID: 1608309-002 **Matrix:** SOIL

Client Sample ID: SB6-D-10.5-160801
Collection Date: 8/1/2016 12:15:00 PM
Received Date: 8/4/2016 6:30:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.7		mg/Kg	1	8/9/2016 10:58:23 AM	26826
Motor Oil Range Organics (MRO)	ND	49		mg/Kg	1	8/9/2016 10:58:23 AM	26826
Surr: DNOP	106	70-130		%Rec	1	8/9/2016 10:58:23 AM	26826
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	4.8		mg/Kg	1	8/9/2016 12:41:50 PM	26838
Surr: BFB	109	68.3-144		%Rec	1	8/9/2016 12:41:50 PM	26838
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.024		mg/Kg	1	8/9/2016 12:41:50 PM	26838
Toluene	ND	0.048		mg/Kg	1	8/9/2016 12:41:50 PM	26838
Ethylbenzene	ND	0.048		mg/Kg	1	8/9/2016 12:41:50 PM	26838
Xylenes, Total	ND	0.096		mg/Kg	1	8/9/2016 12:41:50 PM	26838
Surr: 4-Bromofluorobenzene	102	80-120		%Rec	1	8/9/2016 12:41:50 PM	26838

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller and Associates
Client Sample ID: SB6-D-10.0-160801
Project: BP Mudge LS006
Collection Date: 8/1/2016 11:04:00 AM
Lab ID: 1608309-003 **Matrix:** SOIL **Received Date:** 8/4/2016 6:30:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.6		mg/Kg	1	8/9/2016 11:20:20 AM	26826
Motor Oil Range Organics (MRO)	ND	48		mg/Kg	1	8/9/2016 11:20:20 AM	26826
Surr: DNOP	106	70-130		%Rec	1	8/9/2016 11:20:20 AM	26826
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	4.8		mg/Kg	1	8/9/2016 1:05:16 PM	26838
Surr: BFB	107	68.3-144		%Rec	1	8/9/2016 1:05:16 PM	26838
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.024		mg/Kg	1	8/9/2016 1:05:16 PM	26838
Toluene	ND	0.048		mg/Kg	1	8/9/2016 1:05:16 PM	26838
Ethylbenzene	ND	0.048		mg/Kg	1	8/9/2016 1:05:16 PM	26838
Xylenes, Total	ND	0.097		mg/Kg	1	8/9/2016 1:05:16 PM	26838
Surr: 4-Bromofluorobenzene	101	80-120		%Rec	1	8/9/2016 1:05:16 PM	26838

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller and Associates
Client Sample ID: SB6-D-23.0-160802
Project: BP Mudge LS006
Collection Date: 8/2/2016 1:15:00 PM
Lab ID: 1608309-004 **Matrix:** SOIL **Received Date:** 8/4/2016 6:30:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.8		mg/Kg	1	8/9/2016 11:42:15 AM	26826
Motor Oil Range Organics (MRO)	ND	49		mg/Kg	1	8/9/2016 11:42:15 AM	26826
Surr: DNOP	136	70-130	S	%Rec	1	8/9/2016 11:42:15 AM	26826
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	5.0		mg/Kg	1	8/9/2016 1:28:44 PM	26838
Surr: BFB	107	68.3-144		%Rec	1	8/9/2016 1:28:44 PM	26838
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.025		mg/Kg	1	8/9/2016 1:28:44 PM	26838
Toluene	ND	0.050		mg/Kg	1	8/9/2016 1:28:44 PM	26838
Ethylbenzene	ND	0.050		mg/Kg	1	8/9/2016 1:28:44 PM	26838
Xylenes, Total	ND	0.099		mg/Kg	1	8/9/2016 1:28:44 PM	26838
Surr: 4-Bromofluorobenzene	98.5	80-120		%Rec	1	8/9/2016 1:28:44 PM	26838

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller and Associates
Client Sample ID: SB7-A-5.0-160803
Project: BP Mudge LS006
Collection Date: 8/3/2016 9:15:00 AM
Lab ID: 1608309-005 **Matrix:** SOIL **Received Date:** 8/4/2016 6:30:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.8		mg/Kg	1	8/12/2016 6:17:23 PM	26826
Motor Oil Range Organics (MRO)	ND	49		mg/Kg	1	8/12/2016 6:17:23 PM	26826
Surr: DNOP	79.5	70-130		%Rec	1	8/12/2016 6:17:23 PM	26826
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	4.8		mg/Kg	1	8/9/2016 1:52:13 PM	26838
Surr: BFB	108	68.3-144		%Rec	1	8/9/2016 1:52:13 PM	26838
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.024		mg/Kg	1	8/9/2016 1:52:13 PM	26838
Toluene	ND	0.048		mg/Kg	1	8/9/2016 1:52:13 PM	26838
Ethylbenzene	ND	0.048		mg/Kg	1	8/9/2016 1:52:13 PM	26838
Xylenes, Total	ND	0.097		mg/Kg	1	8/9/2016 1:52:13 PM	26838
Surr: 4-Bromofluorobenzene	100	80-120		%Rec	1	8/9/2016 1:52:13 PM	26838

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller and Associates
Client Sample ID: SB7-A-6.5-160803
Project: BP Mudge LS006
Collection Date: 8/3/2016 9:35:00 AM
Lab ID: 1608309-006 **Matrix:** SOIL **Received Date:** 8/4/2016 6:30:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.8		mg/Kg	1	8/9/2016 12:26:16 PM	26826
Motor Oil Range Organics (MRO)	ND	49		mg/Kg	1	8/9/2016 12:26:16 PM	26826
Surr: DNOP	118	70-130		%Rec	1	8/9/2016 12:26:16 PM	26826
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	4.8		mg/Kg	1	8/9/2016 2:15:45 PM	26838
Surr: BFB	107	68.3-144		%Rec	1	8/9/2016 2:15:45 PM	26838
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	0.057	0.024		mg/Kg	1	8/9/2016 2:15:45 PM	26838
Toluene	0.32	0.048		mg/Kg	1	8/9/2016 2:15:45 PM	26838
Ethylbenzene	ND	0.048		mg/Kg	1	8/9/2016 2:15:45 PM	26838
Xylenes, Total	0.34	0.095		mg/Kg	1	8/9/2016 2:15:45 PM	26838
Surr: 4-Bromofluorobenzene	97.3	80-120		%Rec	1	8/9/2016 2:15:45 PM	26838

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1608309**

05-Oct-16

Client: Souder, Miller and Associates

Project: BP Mudge LS006

Sample ID **LCS-26826**	SampType: **LCS**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **LCSS**	Batch ID: **26826**	RunNo: **36316**
Prep Date: **8/8/2016**	Analysis Date: **8/9/2016**	SeqNo: **1124902** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	42	10	50.00	0	84.0	62.6	124			
Surr: DNOP	4.4		5.000		87.8	70	130			

Sample ID **MB-26826**	SampType: **MBLK**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **PBS**	Batch ID: **26826**	RunNo: **36316**
Prep Date: **8/8/2016**	Analysis Date: **8/9/2016**	SeqNo: **1124903** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	ND	10								
Motor Oil Range Organics (MRO)	ND	50								
Surr: DNOP	9.1		10.00		91.0	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1608309**

05-Oct-16

Client: Souder, Miller and Associates

Project: BP Mudge LS006

Sample ID **MB-26838**	SampType: **MBLK**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **PBS**	Batch ID: **26838**	RunNo: **36339**
Prep Date: **8/8/2016**	Analysis Date: **8/9/2016**	SeqNo: **1125609** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	ND	5.0								
Surr: BFB	1100		1000		110	68.3	144			

Sample ID **LCS-26838**	SampType: **LCS**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **LCSS**	Batch ID: **26838**	RunNo: **36339**
Prep Date: **8/8/2016**	Analysis Date: **8/9/2016**	SeqNo: **1125610** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	28	5.0	25.00	0	112	80	120			
Surr: BFB	1200		1000		121	68.3	144			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1608309**

05-Oct-16

Client: Souder, Miller and Associates

Project: BP Mudge LS006

Sample ID **MB-26838**	SampType: **MBLK**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **PBS**	Batch ID: **26838**	RunNo: **36339**
Prep Date: **8/8/2016**	Analysis Date: **8/9/2016**	SeqNo: **1125662** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	0.025								
Toluene	ND	0.050								
Ethylbenzene	ND	0.050								
Xylenes, Total	ND	0.10								
Surr: 4-Bromofluorobenzene	1.0		1.000		104	80	120			

Sample ID **LCS-26838**	SampType: **LCS**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **LCSS**	Batch ID: **26838**	RunNo: **36339**
Prep Date: **8/8/2016**	Analysis Date: **8/9/2016**	SeqNo: **1125663** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	0.92	0.025	1.000	0	91.5	75.3	123			
Toluene	1.0	0.050	1.000	0	102	80	124			
Ethylbenzene	1.1	0.050	1.000	0	113	82.8	121			
Xylenes, Total	3.3	0.10	3.000	0	111	83.9	122			
Surr: 4-Bromofluorobenzene	1.1		1.000		110	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

HALL ENVIRONMENTAL ANALYSIS LABORATORY
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: SMA-FARM Work Order Number: 1608309 RcptNo: 1

Received by/date: AG 08/04/16

Logged By: Ashley Gallegos 8/4/2016 6:30:00 AM AG

Completed By: Ashley Gallegos 8/5/2016 11:44:13 AM AG

Reviewed By: JO 8/08/16

Chain of Custody

1. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
2. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
3. How was the sample delivered?	Courier		

Log In

4. Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
5. Were all samples received at a temperature of >0° C to 6.0°C	Yes ☑	No ☐	NA ☐
6. Sample(s) in proper container(s)?	Yes ☑	No ☐	
7. Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8. Are samples (except VOA and ONG) properly preserved?	Yes ☑	No ☐	
9. Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10. VOA vials have zero headspace?	Yes ☐	No ☐	No VOA Vials ☑
11. Were any sample containers received broken?	Yes ☐	No ☑	
12. Does paperwork match bottle labels? (Note discrepancies on chain of custody)	Yes ☑	No ☐	
13. Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
14. Is it clear what analyses were requested?	Yes ☑	No ☐	
15. Were all holding times able to be met? (If no, notify customer for authorization.)	Yes ☑	No ☐	

# of preserved bottles checked for pH: _____ (<2 or >12 unless noted)

Adjusted? _____

Checked by: _____

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: _____ Date: _____

By Whom: _____ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding: _____

Client Instructions: _____

17. Additional remarks:

18. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	2.5	Good	Yes			

Chain-of-Custody Record

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Client: Souder Miller & Assoc	Turn-Around Time: ☒ Standard ☐ Rush
Mailing Address: 401 W. Broadway, Farmington, NM 87401	Project Name: BP Mudge LS 006
Phone #: 505 325-7535	Project #: See remarks
Email or Fax#: lorea.diede@soudermiller.com	Project Manager: Reid Allen
QA/QC Package: ☒ Standard ☐ Level 4 (Full Validation)	Sampler: LLD/JES
Accreditation: ☐ NELAP ☐ Other	On Ice: ☐ Yes ☐ No
EDD (Type)	Sample Temperature: 2.5

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1608309	BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH 8015B (GRO / DRO / MRO)	TPH (Method 418.1)	EDB (Method 504.1)	PAH's (8310 or 8270 SIMS)	RCRA 8 Metals	Anions ($F, Cl, NO_3, NO_2, PO_4, SO_4$)	8081 Pesticides / 8082 PCB's	8260B (VOA)	8270 (Semi-VOA)				Air Bubbles (Y or N)
1-16	1051	Soil	SB6-S-5.0-160801	4 oz jar	Cool	-001	X		X												
1-16	1215	Soil	SB6-D-10.5-160801	"	"	-002	X		X												
1-16	1104	Soil	SB6-D-10.0-160801	"	"	-003	X		X												
2-16	1315	Soil	SB6-D-23.0-160802	"	"	-004	X		X												
3-16	0915	Soil	SB7-A-5.0-160803	"	"	-005	X		X												
3-16	0935	Soil	SB7-A-6.5-160803	"	"	-006	X		X												

Date	Time	Relinquished by:	Received by:	Date	Time
8/4	1555			8/2/16	1555
8/3/16	1904			08/04/16	0430

Remarks: Please invoice BP
VID: UDRINWJA1
WBS: L1-0016C-E: MUDGELS6

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

October 05, 2016

Reid Allan
SMA-FARM
401 W. Broadway
Farmington, NM 87401
TEL: (505) 325-5667
FAX (505) 327-1496

RE: BP Mudge LS 006 OrderNo.: 1608706

Dear Reid Allan:

Hall Environmental Analysis Laboratory received 5 sample(s) on 8/10/2016 for the analyses presented in the following report.

This report is a revised report and it replaces the original report issued August 18, 2016.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. All samples are reported as received unless otherwise indicated.

Please don't hesitate to contact HEAL for any additional information or clarifications.

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **1608706**
Date Reported: **10/5/2016**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: SMA-FARM
Project: BP Mudge LS 006
Lab ID: 1608706-001 **Matrix:** SOIL

Client Sample ID: SB4-S-4.0-160808
Collection Date: 8/8/2016 4:04:00 PM
Received Date: 8/10/2016 8:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.5		mg/Kg	1	8/16/2016 12:57:43 AM	26952
Motor Oil Range Organics (MRO)	ND	47		mg/Kg	1	8/16/2016 12:57:43 AM	26952
Surr: DNOP	101	70-130		%Rec	1	8/16/2016 12:57:43 AM	26952
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	4.7		mg/Kg	1	8/16/2016 1:50:48 PM	26959
Surr: BFB	79.5	68.3-144		%Rec	1	8/16/2016 1:50:48 PM	26959
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.024		mg/Kg	1	8/16/2016 1:50:48 PM	26959
Toluene	ND	0.047		mg/Kg	1	8/16/2016 1:50:48 PM	26959
Ethylbenzene	ND	0.047		mg/Kg	1	8/16/2016 1:50:48 PM	26959
Xylenes, Total	ND	0.094		mg/Kg	1	8/16/2016 1:50:48 PM	26959
Surr: 4-Bromofluorobenzene	92.2	80-120		%Rec	1	8/16/2016 1:50:48 PM	26959

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: SMA-FARM
Project: BP Mudge LS 006
Lab ID: 1608706-002 **Matrix:** SOIL

Client Sample ID: SB4-S-8.0-160808
Collection Date: 8/8/2016 4:16:00 PM
Received Date: 8/10/2016 8:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.5		mg/Kg	1	8/16/2016 1:19:32 AM	26952
Motor Oil Range Organics (MRO)	ND	47		mg/Kg	1	8/16/2016 1:19:32 AM	26952
Surr: DNOP	103	70-130		%Rec	1	8/16/2016 1:19:32 AM	26952
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	4.6		mg/Kg	1	8/16/2016 3:01:27 PM	26959
Surr: BFB	80.4	68.3-144		%Rec	1	8/16/2016 3:01:27 PM	26959
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.023		mg/Kg	1	8/16/2016 3:01:27 PM	26959
Toluene	ND	0.046		mg/Kg	1	8/16/2016 3:01:27 PM	26959
Ethylbenzene	ND	0.046		mg/Kg	1	8/16/2016 3:01:27 PM	26959
Xylenes, Total	ND	0.091		mg/Kg	1	8/16/2016 3:01:27 PM	26959
Surr: 4-Bromofluorobenzene	93.3	80-120		%Rec	1	8/16/2016 3:01:27 PM	26959

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: SMA-FARM
Project: BP Mudge LS 006
Lab ID: 1608706-003 **Matrix:** SOIL

Client Sample ID: SB4-D-18.0-160808
Collection Date: 8/8/2016 2:50:00 PM
Received Date: 8/10/2016 8:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	10		mg/Kg	1	8/16/2016 1:41:12 AM	26952
Motor Oil Range Organics (MRO)	ND	50		mg/Kg	1	8/16/2016 1:41:12 AM	26952
Surr: DNOP	92.4	70-130		%Rec	1	8/16/2016 1:41:12 AM	26952
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	4.8		mg/Kg	1	8/16/2016 4:12:01 PM	26959
Surr: BFB	80.6	68.3-144		%Rec	1	8/16/2016 4:12:01 PM	26959
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.024		mg/Kg	1	8/16/2016 4:12:01 PM	26959
Toluene	ND	0.048		mg/Kg	1	8/16/2016 4:12:01 PM	26959
Ethylbenzene	ND	0.048		mg/Kg	1	8/16/2016 4:12:01 PM	26959
Xylenes, Total	ND	0.097		mg/Kg	1	8/16/2016 4:12:01 PM	26959
Surr: 4-Bromofluorobenzene	93.0	80-120		%Rec	1	8/16/2016 4:12:01 PM	26959

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: SMA-FARM
Project: BP Mudge LS 006
Lab ID: 1608706-004 **Matrix:** SOIL

Client Sample ID: SB5-D-6.0-160808
Collection Date: 8/8/2016 7:10:00 AM
Received Date: 8/10/2016 8:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.5		mg/Kg	1	8/16/2016 2:02:55 AM	26952
Motor Oil Range Organics (MRO)	ND	47		mg/Kg	1	8/16/2016 2:02:55 AM	26952
Surr: DNOP	91.4	70-130		%Rec	1	8/16/2016 2:02:55 AM	26952
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	4.7		mg/Kg	1	8/16/2016 4:35:29 PM	26959
Surr: BFB	80.8	68.3-144		%Rec	1	8/16/2016 4:35:29 PM	26959
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.024		mg/Kg	1	8/16/2016 4:35:29 PM	26959
Toluene	ND	0.047		mg/Kg	1	8/16/2016 4:35:29 PM	26959
Ethylbenzene	ND	0.047		mg/Kg	1	8/16/2016 4:35:29 PM	26959
Xylenes, Total	ND	0.095		mg/Kg	1	8/16/2016 4:35:29 PM	26959
Surr: 4-Bromofluorobenzene	92.6	80-120		%Rec	1	8/16/2016 4:35:29 PM	26959

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: SMA-FARM
Project: BP Mudge LS 006
Lab ID: 1608706-005 **Matrix:** SOIL

Client Sample ID: SB5-D-12.0-160808
Collection Date: 8/8/2016 8:30:00 AM
Received Date: 8/10/2016 8:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	17	9.3		mg/Kg	1	8/16/2016 2:24:44 AM	26952
Motor Oil Range Organics (MRO)	ND	47		mg/Kg	1	8/16/2016 2:24:44 AM	26952
Surr: DNOP	92.1	70-130		%Rec	1	8/16/2016 2:24:44 AM	26952
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	11	4.8		mg/Kg	1	8/16/2016 4:58:54 PM	26959
Surr: BFB	129	68.3-144		%Rec	1	8/16/2016 4:58:54 PM	26959
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.024		mg/Kg	1	8/16/2016 4:58:54 PM	26959
Toluene	ND	0.048		mg/Kg	1	8/16/2016 4:58:54 PM	26959
Ethylbenzene	ND	0.048		mg/Kg	1	8/16/2016 4:58:54 PM	26959
Xylenes, Total	ND	0.096		mg/Kg	1	8/16/2016 4:58:54 PM	26959
Surr: 4-Bromofluorobenzene	96.5	80-120		%Rec	1	8/16/2016 4:58:54 PM	26959

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1608706**

05-Oct-16

Client: SMA-FARM

Project: BP Mudge LS 006

Sample ID **LCS-26952**	SampType: **LCS**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **LCSS**	Batch ID: **26952**	RunNo: **36499**
Prep Date: **8/12/2016**	Analysis Date: **8/16/2016**	SeqNo: **1131127** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	51	10	50.00	0	103	62.6	124			
Surr: DNOP	4.7		5.000		94.7	70	130			

Sample ID **MB-26952**	SampType: **MBLK**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **PBS**	Batch ID: **26952**	RunNo: **36499**
Prep Date: **8/12/2016**	Analysis Date: **8/16/2016**	SeqNo: **1131128** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	ND	10								
Motor Oil Range Organics (MRO)	ND	50								
Surr: DNOP	8.5		10.00		85.3	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1608706**

05-Oct-16

Client: SMA-FARM

Project: BP Mudge LS 006

Sample ID **MB-26959**	SampType: **MBLK**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **PBS**	Batch ID: **26959**	RunNo: **36549**
Prep Date: **8/12/2016**	Analysis Date: **8/16/2016**	SeqNo: **1131799** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	ND	5.0								
Surr: BFB	790		1000		79.2	68.3	144			

Sample ID **LCS-26959**	SampType: **LCS**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **LCSS**	Batch ID: **26959**	RunNo: **36549**
Prep Date: **8/12/2016**	Analysis Date: **8/16/2016**	SeqNo: **1131800** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	20	5.0	25.00	0	80.1	80	120			
Surr: BFB	870		1000		86.6	68.3	144			

Sample ID **1608706-002AMS**	SampType: **MS**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **SB4-S-8.0-160808**	Batch ID: **26959**	RunNo: **36549**
Prep Date: **8/12/2016**	Analysis Date: **8/16/2016**	SeqNo: **1131807** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	19	4.9	24.53	0	77.7	59.3	143			
Surr: BFB	860		981.4		87.5	68.3	144			

Sample ID **1608706-002AMSD**	SampType: **MSD**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **SB4-S-8.0-160808**	Batch ID: **26959**	RunNo: **36549**
Prep Date: **8/12/2016**	Analysis Date: **8/16/2016**	SeqNo: **1131808** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	18	4.9	24.73	0	72.2	59.3	143	6.47	20	
Surr: BFB	860		989.1		86.7	68.3	144	0	0	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1608706**

05-Oct-16

Client: SMA-FARM

Project: BP Mudge LS 006

Sample ID **MB-26959**	SampType: **MBLK**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **PBS**	Batch ID: **26959**	RunNo: **36549**
Prep Date: **8/12/2016**	Analysis Date: **8/16/2016**	SeqNo: **1131828** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	0.025								
Toluene	ND	0.050								
Ethylbenzene	ND	0.050								
Xylenes, Total	ND	0.10								
Surr: 4-Bromofluorobenzene	0.94		1.000		94.4	80	120			

Sample ID **LCS-26959**	SampType: **LCS**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **LCSS**	Batch ID: **26959**	RunNo: **36549**
Prep Date: **8/12/2016**	Analysis Date: **8/16/2016**	SeqNo: **1131829** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	0.88	0.025	1.000	0	87.7	75.3	123			
Toluene	0.94	0.050	1.000	0	94.4	80	124			
Ethylbenzene	0.97	0.050	1.000	0	97.2	82.8	121			
Xylenes, Total	2.9	0.10	3.000	0	97.2	83.9	122			
Surr: 4-Bromofluorobenzene	0.98		1.000		97.9	80	120			

Sample ID **1608706-001AMS**	SampType: **MS**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **SB4-S-4.0-160808**	Batch ID: **26959**	RunNo: **36549**
Prep Date: **8/12/2016**	Analysis Date: **8/16/2016**	SeqNo: **1131835** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	0.80	0.024	0.9643	0	82.6	71.5	122			
Toluene	0.88	0.048	0.9643	0	91.6	71.2	123			
Ethylbenzene	0.92	0.048	0.9643	0	95.5	75.2	130			
Xylenes, Total	2.8	0.096	2.893	0	96.7	72.4	131			
Surr: 4-Bromofluorobenzene	0.94		0.9643		97.5	80	120			

Sample ID **1608706-001AMSD**	SampType: **MSD**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **SB4-S-4.0-160808**	Batch ID: **26959**	RunNo: **36549**
Prep Date: **8/12/2016**	Analysis Date: **8/16/2016**	SeqNo: **1131836** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	0.78	0.024	0.9533	0	82.1	71.5	122	1.68	20	
Toluene	0.86	0.048	0.9533	0	89.9	71.2	123	3.03	20	
Ethylbenzene	0.88	0.048	0.9533	0	92.2	75.2	130	4.66	20	
Xylenes, Total	2.7	0.095	2.860	0	92.9	72.4	131	5.23	20	
Surr: 4-Bromofluorobenzene	0.94		0.9533		98.8	80	120	0	0	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: SMA-FARM | Work Order Number: 1608706 | RcptNo: 1

Received by/date: LM 08/10/16

Logged By: **Michelle Garcia** 8/10/2016 8:00:00 AM Michelle Garcia

Completed By: **Michelle Garcia** 8/11/2016 3:47:49 PM Michelle Garcia

Reviewed By: IO 8/12/16

Chain of Custody

1. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
2. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
3. How was the sample delivered?	Courier		

Log In

4. Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
5. Were all samples received at a temperature of >0° C to 6.0°C	Yes ☑	No ☐	NA ☐
6. Sample(s) in proper container(s)?	Yes ☑	No ☐	
7. Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8. Are samples (except VOA and ONG) properly preserved?	Yes ☑	No ☐	
9. Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10. VOA vials have zero headspace?	Yes ☐	No ☐	No VOA Vials ☑
11. Were any sample containers received broken?	Yes ☐	No ☑	
12. Does paperwork match bottle labels? (Note discrepancies on chain of custody)	Yes ☑	No ☐	
13. Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
14. Is it clear what analyses were requested?	Yes ☑	No ☐	
15. Were all holding times able to be met? (If no, notify customer for authorization.)	Yes ☑	No ☐	

# of preserved bottles checked for pH: _____ (<2 or >12 unless noted)

Adjusted? _____

Checked by: _____

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: _____ Date: _____

By Whom: _____ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding: _____

Client Instructions: _____

17. Additional remarks:

18. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.6	Good	Yes			

Chain-of-Custody Record

ent: Souder Miller & Assoc

iling Address: 401 W. Broadway

Farmington, NM 87401

one #: 505 325 7535

ail or Fax#: loren.diede@soudermiller.com

/QC Package:

Standard ☐ Level 4 (Full Validation)

creditation

NELAP ☐ Other _____

EDD (Type) _____

Turn-Around Time:

☒ Standard ☐ Rush _____

Project Name:

BP Mudge LS #66

Project #:

seevemarks

Project Manager:

Reid Allen

Sampler: LLD / JES

On Ice: ☑ Yes ☐ No

Sample Temperature: 1.6

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1608706	BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH 8015B (GRO / DRO / MRO)	TPH (Method 418.1)	EDB (Method 504.1)	PAH's (8310 or 8270 SIMS)	RCRA 8 Metals	Anions (F,Cl,NO_3,NO_2,PO_4,SO_4)	8081 Pesticides / 8082 PCB's	8260B (VOA)	8270 (Semi-VOA)					Air Bubbles (Y or N)
8-16	1604	Soil	SB4-S-4.0-160808	4oz jar	cool	-001	X		X													
8-16	1616	Soil	SB4-S-8.0-160808	4oz jar	cool	-002	X		X													
8-16	1450	Soil	SB4-D-18.0-160808	4oz jar	cool	-003	X		X													
8-16	0710	Soil	SB5-D-6.0-160808	4oz jar	cool	-004	X		X													
8-16	0830	Soil	SB5-D-12.0-160808	4oz jar	cool	-005	X		X													

Date:	Time:	Relinquished by:	Received by:	Date	Time
8/8/16	1810			8/8/16	1810
8/8/16	1851	Christine Walker		08/10/16	0800

Remarks: BP INVOICE:

VID: VDRINKWJA1

WBS: L1-0016C-EMUDGLEL56

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

August 24, 2016

Reid Allan
Souder, Miller and Associates
401 W. Broadway
Farmington, NM 87401
TEL: (505) 325-5667
FAX (505) 327-1496

RE: BP Mudge LS 006 OrderNo.: 1608898

Dear Reid Allan:

Hall Environmental Analysis Laboratory received 2 sample(s) on 8/10/2016 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0190

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **1608898**
Date Reported: **8/24/2016**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller and Associates
Project: BP Mudge LS 006
Lab ID: 1608898-001 **Matrix:** SOIL

Client Sample ID: SB4-D-11.5-160808
Collection Date: 8/8/2016 2:02:00 PM
Received Date: 8/10/2016 8:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
WALKLEY BLACK TOC/FOC/OM						Analyst: **JRR**	
TOC	ND	0.13		% C	1	8/18/2016 3:23:00 PM	27064
EPA METHOD 300.0: ANIONS						Analyst: **LGT**	
Nitrogen, Nitrite (As N)	ND	0.30		mg/Kg	1	8/18/2016 11:11:31 AM	27070
Nitrogen, Nitrate (As N)	1.4	0.30		mg/Kg	1	8/18/2016 11:11:31 AM	27070
Phosphorus, Orthophosphate (As P)	ND	30		mg/Kg	20	8/18/2016 11:48:45 AM	27070
Sulfate	7100	300		mg/Kg	200	8/23/2016 12:32:46 AM	27070
AMMONIA AS N						Analyst: **CJS**	
Nitrogen, Ammonia	ND	25		mg/Kg	1	8/22/2016 2:25:00 PM	R36667
EPA METHOD 7471: MERCURY						Analyst: **pmf**	
Mercury	ND	0.032		mg/Kg	1	8/17/2016 12:37:20 PM	27011
EPA METHOD 6010B: SOIL METALS						Analyst: **MED**	
Arsenic	ND	2.5		mg/Kg	1	8/17/2016 6:31:01 PM	26997
Barium	17	0.099		mg/Kg	1	8/17/2016 6:31:01 PM	26997
Cadmium	ND	0.099		mg/Kg	1	8/17/2016 6:31:01 PM	26997
Chromium	2.7	0.30		mg/Kg	1	8/17/2016 6:31:01 PM	26997
Iron	5200	490		mg/Kg	200	8/18/2016 11:32:08 AM	26997
Lead	2.7	0.25		mg/Kg	1	8/18/2016 11:34:20 AM	26997
Manganese	91	0.099		mg/Kg	1	8/17/2016 6:31:01 PM	26997
Selenium	ND	2.5		mg/Kg	1	8/17/2016 6:31:01 PM	26997
Silver	ND	0.25		mg/Kg	1	8/17/2016 6:31:01 PM	26997
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.5		mg/Kg	1	8/17/2016 1:44:50 PM	27019
Motor Oil Range Organics (MRO)	ND	47		mg/Kg	1	8/17/2016 1:44:50 PM	27019
Surr: DNOP	82.6	70-130		%Rec	1	8/17/2016 1:44:50 PM	27019
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	4.6		mg/Kg	1	8/17/2016 1:44:13 PM	27006
Surr: BFB	84.6	68.3-144		%Rec	1	8/17/2016 1:44:13 PM	27006
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.023		mg/Kg	1	8/17/2016 1:44:13 PM	27006
Toluene	ND	0.046		mg/Kg	1	8/17/2016 1:44:13 PM	27006
Ethylbenzene	ND	0.046		mg/Kg	1	8/17/2016 1:44:13 PM	27006
Xylenes, Total	ND	0.093		mg/Kg	1	8/17/2016 1:44:13 PM	27006
Surr: 4-Bromofluorobenzene	99.4	80-120		%Rec	1	8/17/2016 1:44:13 PM	27006

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Souder, Miller and Associates
Project: BP Mudge LS 006
Lab ID: 1608898-002 **Matrix:** SOIL

Client Sample ID: SB5-S-6.8-160808
Collection Date: 8/8/2016 10:00:00 AM
Received Date: 8/10/2016 8:00:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
WALKLEY BLACK TOC/FOC/OM						Analyst: **JRR**	
TOC	0.19	0.13		% C	1	8/18/2016 3:23:00 PM	27064
EPA METHOD 300.0: ANIONS						Analyst: **LGT**	
Nitrogen, Nitrite (As N)	ND	0.30		mg/Kg	1	8/18/2016 12:01:10 PM	27070
Nitrogen, Nitrate (As N)	1.7	0.30		mg/Kg	1	8/18/2016 12:01:10 PM	27070
Phosphorus, Orthophosphate (As P)	ND	30		mg/Kg	20	8/18/2016 12:13:35 PM	27070
Sulfate	5000	300		mg/Kg	200	8/23/2016 12:45:11 AM	27070
AMMONIA AS N						Analyst: **CJS**	
Nitrogen, Ammonia	ND	25		mg/Kg	1	8/22/2016 2:25:00 PM	R36667
EPA METHOD 7471: MERCURY						Analyst: **pmf**	
Mercury	ND	0.032		mg/Kg	1	8/17/2016 12:39:09 PM	27011
EPA METHOD 6010B: SOIL METALS						Analyst: **MED**	
Arsenic	ND	2.5		mg/Kg	1	8/17/2016 6:34:10 PM	26997
Barium	25	0.099		mg/Kg	1	8/17/2016 6:34:10 PM	26997
Cadmium	ND	0.099		mg/Kg	1	8/17/2016 6:34:10 PM	26997
Chromium	4.2	0.30		mg/Kg	1	8/17/2016 6:34:10 PM	26997
Iron	8100	490		mg/Kg	200	8/18/2016 11:36:18 AM	26997
Lead	3.4	0.25		mg/Kg	1	8/18/2016 11:38:28 AM	26997
Manganese	96	0.099		mg/Kg	1	8/17/2016 6:34:10 PM	26997
Selenium	ND	2.5		mg/Kg	1	8/17/2016 6:34:10 PM	26997
Silver	ND	0.25		mg/Kg	1	8/17/2016 6:34:10 PM	26997
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **TOM**	
Diesel Range Organics (DRO)	ND	9.7		mg/Kg	1	8/17/2016 2:12:39 PM	27019
Motor Oil Range Organics (MRO)	ND	49		mg/Kg	1	8/17/2016 2:12:39 PM	27019
Surr: DNOP	81.7	70-130		%Rec	1	8/17/2016 2:12:39 PM	27019
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	5.0		mg/Kg	1	8/17/2016 2:54:54 PM	27006
Surr: BFB	84.4	68.3-144		%Rec	1	8/17/2016 2:54:54 PM	27006
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.025		mg/Kg	1	8/17/2016 2:54:54 PM	27006
Toluene	ND	0.050		mg/Kg	1	8/17/2016 2:54:54 PM	27006
Ethylbenzene	ND	0.050		mg/Kg	1	8/17/2016 2:54:54 PM	27006
Xylenes, Total	ND	0.10		mg/Kg	1	8/17/2016 2:54:54 PM	27006
Surr: 4-Bromofluorobenzene	100	80-120		%Rec	1	8/17/2016 2:54:54 PM	27006

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

Laboratory Report for
Hall Environmental Analysis
Laboratory

Samples: 1608898-001B & 002B

August 19, 2016

Daniel B. Stephens & Associates, Inc.

4400 Alameda Blvd. NE, Suite C • Albuquerque, New Mexico 87113

August 19, 2016

Andy Freeman
Hall Environmental Analysis Laboratory
4901 Hawkins NE, Suite D
Albuquerque, NM 87109
(505) 345-3975

Re: DBS&A Laboratory Report for the Hall Environmental Analysis Laboratory 1608898 Samples

Dear Mr. Freeman:

Enclosed is the report for the Hall Environmental Analysis Laboratory 1608898 samples. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Hall Environmental Analysis Laboratory and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.
SOIL TESTING & RESEARCH LABORATORY

Joleen Hines
Laboratory Supervising Manager

Enclosure

Daniel B. Stephens & Associates, Inc.
Soil Testing & Research Laboratory
4400 Alameda Blvd. NE, Suite C 505-889-7752
Albuquerque, NM 87113 FAX 505-889-0258

Summaries

Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]								Particle Size[4]			Specific Gravity[5]		Air Perm-eability	Atterberg Limits	Proctor Compaction
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K_{unsat}	DS	WS	H	F	C			
1608898-001B																X	X					
1608898-002B																X	X					

[1] G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

[2] CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

[3] HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity

[4] DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

[5] F = Fine (<4.75mm), C = Coarse (>4.75mm)

Notes

Sample Receipt:
Two samples were hand delivered each in a full 8 oz. jar sealed with a lid on August 16, 2016.

Sample Preparation and Testing Notes:
The samples were subjected to particle size analysis testing. Particle diameter calculations in the hydrometer portion of the particle size analysis testing are based on the use of an assumed specific gravity value of 2.65.

Summary of Particle Size Characteristics

Sample Number	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification	USDA Classification	
1608898-001B	7.1E-139	0.23	0.28	3.9E+137	6.1E+136	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
1608898-002B	0.00081	0.11	0.14	173	28	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

[1] Greater than 10% of sample is coarse material

Percent Gravel, Sand, Silt and Clay*

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
1608898-001B	0.0	73.0	10.7	16.2
1608898-002B	0.0	66.6	17.7	15.6

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Particle Size Analysis

Summary of Particle Size Characteristics

Sample Number	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	ASTM Classification	USDA Classification	
1608898-001B	7.1E-139	0.23	0.28	3.9E+137	6.1E+136	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)
1608898-002B	0.00081	0.11	0.14	173	28	WS/H	Classification by ASTM 2487 requires Atterberg test	Sandy Loam	(Est)

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material

Percent Gravel, Sand, Silt and Clay*

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
1608898-001B	0.0	73.0	10.7	16.2
1608898-002B	0.0	66.6	17.7	15.6

*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Hall Environmental Analysis Laboratory
Job Number: NM16.0136.00
Sample Number: 1608898-001B
Client ID: SB4-D-11.5-160808
Depth: NA
Test Date: 19-Aug-16

Initial Dry Weight of Sample (g): 314.07
Weight Passing #10 (g): 314.07
Weight Retained #10 (g): 0.00
Weight of Hydrometer Sample (g): 88.27
Calculated Weight of Sieve Sample (g): 88.27

Shape: Rounded
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	314.07	100.00
	2"	50	0.00	0.00	314.07	100.00
	1.5"	38.1	0.00	0.00	314.07	100.00
	1"	25	0.00	0.00	314.07	100.00
	3/4"	19.0	0.00	0.00	314.07	100.00
	3/8"	9.5	0.00	0.00	314.07	100.00
	4	4.75	0.00	0.00	314.07	100.00
	10	2.00	0.00	0.00	314.07	100.00
-10			(Based on calculated sieve wt.)			
	20	0.85	0.62	0.62	87.65	99.30
	40	0.425	11.36	11.98	76.29	86.43
	60	0.250	30.46	42.44	45.83	51.92
	140	0.106	19.64	62.08	26.19	29.67
	200	0.075	2.38	64.46	23.81	26.97
	dry pan		0.39	64.85	23.42	
	wet pan			23.42	0.00	

d_{10} (mm): 7.1E-139
d_{16} (mm): 1.0E-08
d_{30} (mm): 0.11
d_{50} (mm): 0.23
d_{60} (mm): 0.28
d_{84} (mm): 0.41

Median Particle Diameter--d_{50} (mm): 0.23
Uniformity Coefficient, Cu--$[d_{60}/d_{10}]$ (mm): 3.9E+137
Coefficient of Curvature, Cc--$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 6.1E+136
Mean Particle Diameter--$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 0.21

Note: Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test
USDA Soil Classification: Sandy Loam

Laboratory analysis by: C. Krous
Data entered by: C. Krous
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Hall Environmental Analysis Laboratory
Job Number: NM16.0136.00
Sample Number: 1608898-001B
Client ID: SB4-D-11.5-160808
Depth: NA

Test Date: 18-Aug-16
Start Time: 8:39

Type of Water Used: DISTILLED
Reaction with H_2O_2: NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

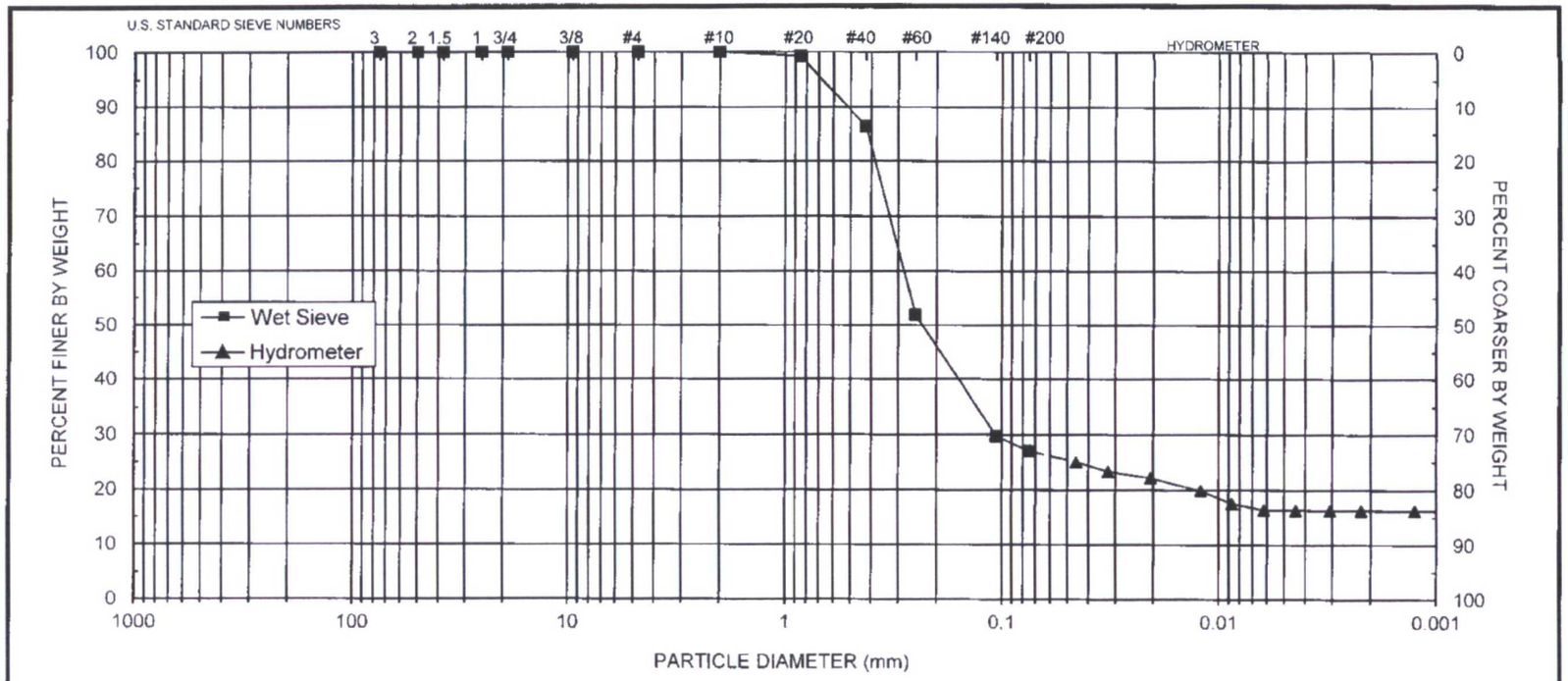
Initial Wt. (g): 88.27
Total Sample Wt. (g): 314.07
Wt. Passing #10 (g): 314.07

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
18-Aug-16	1	22.5	27.5	5.5	22.0	11.8	0.04540	25.0	25.0
	2	22.5	26.0	5.5	20.5	12.0	0.03243	23.3	23.3
	5	22.5	25.0	5.5	19.5	12.2	0.02065	22.1	22.1
	15	22.4	23.0	5.5	17.5	12.5	0.01210	19.8	19.8
	30	22.2	21.0	5.5	15.5	12.9	0.00868	17.5	17.5
	60	22.0	20.0	5.6	14.5	13.0	0.00620	16.4	16.4
	120	21.5	20.0	5.6	14.4	13.0	0.00441	16.3	16.3
	250	21.2	20.0	5.7	14.3	13.0	0.00306	16.2	16.2
	480	21.6	20.0	5.7	14.3	13.0	0.00220	16.2	16.2
19-Aug-16	1478	21.9	20.0	5.7	14.3	13.0	0.00125	16.2	16.2

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: C. Krous
Data entered by: C. Krous
Checked by: J. Hines



d_{10} = 7.1E-139	d_{30} = 0.11	d_{50} = 0.23	d_{60} = 0.28	C_u = 3.9E+137	C_c = 6.1E+136

SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION	USDA CLASSIFICATION
1608898-001B	**NA**	**Classification by ASTM 2487 requires Atterberg test**	**Sandy Loam**

Note: Reported values for d_{10}, C_u, C_c, and ASTM classification are estimates, since extrapolation was required to obtain the d_{10} diameter

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: Hall Environmental Analysis Laboratory
Job Number: NM16.0136.00
Sample Number: 1608898-002B
Client ID: SB5-S-6.8-160808
Depth: NA
Test Date: 19-Aug-16

Initial Dry Weight of Sample (g): 355.17
Weight Passing #10 (g): 355.17
Weight Retained #10 (g): 0.00
Weight of Hydrometer Sample (g): 57.45
Calculated Weight of Sieve Sample (g): 57.45

Shape: Rounded
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	355.17	100.00
	2"	50	0.00	0.00	355.17	100.00
	1.5"	38.1	0.00	0.00	355.17	100.00
	1"	25	0.00	0.00	355.17	100.00
	3/4"	19.0	0.00	0.00	355.17	100.00
	3/8"	9.5	0.00	0.00	355.17	100.00
	4	4.75	0.00	0.00	355.17	100.00
	10	2.00	0.00	0.00	355.17	100.00
-10			(Based on calculated sieve wt.)			
	20	0.85	0.04	0.04	57.41	99.93
	40	0.425	0.06	0.10	57.35	99.83
	60	0.250	1.81	1.91	55.54	96.68
	140	0.106	29.40	31.31	26.14	45.50
	200	0.075	6.98	38.29	19.16	33.35
	dry pan		0.81	39.10	18.35	
	wet pan			18.35	0.00	

d_{10} (mm): 0.00081
d_{16} (mm): 0.0021
d_{30} (mm): 0.056
d_{50} (mm): 0.11
d_{60} (mm): 0.14
d_{84} (mm): 0.20

Median Particle Diameter --d_{50} (mm): 0.11
Uniformity Coefficient, Cu --$[d_{60}/d_{10}]$ (mm): 173
Coefficient of Curvature, Cc --$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 28
Mean Particle Diameter --$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 0.10

Note: Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test
USDA Soil Classification: Sandy Loam

Laboratory analysis by: C. Krous
Data entered by: C. Krous
Checked by: J. Hines

Particle Size Analysis
Hydrometer Data

Job Name: Hall Environmental Analysis Laboratory
Job Number: NM16.0136.00
Sample Number: 1608898-002B
Client ID: SB5-S-6.8-160808
Depth: NA

Test Date: 18-Aug-16
Start Time: 8:33

Type of Water Used: DISTILLED
Reaction with H_2O_2: NA
Dispersant:* $(NaPO_3)_6$
Assumed particle density: 2.65

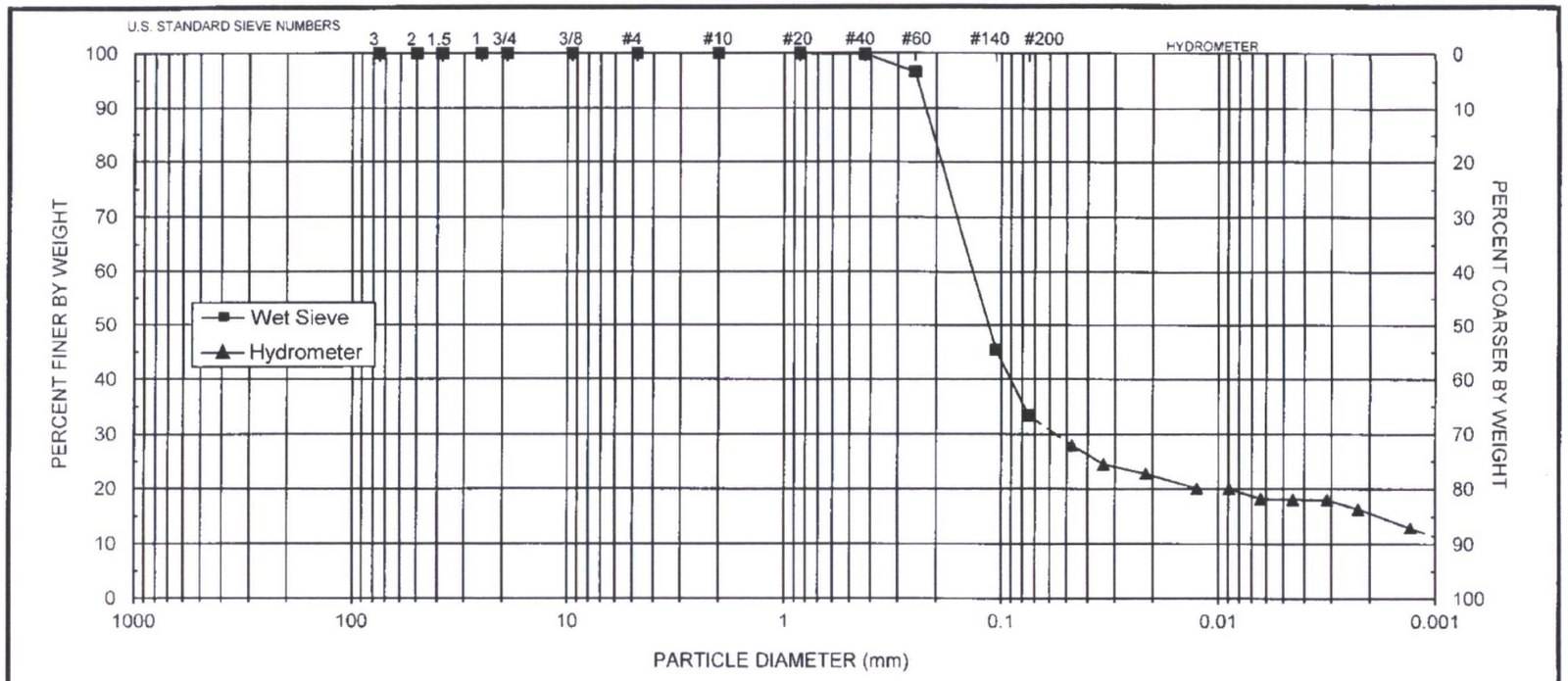
Initial Wt. (g): 57.45
Total Sample Wt. (g): 355.17
Wt. Passing #10 (g): 355.17

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
18-Aug-16	1	22.6	21.5	5.5	16.0	12.8	0.04720	27.9	27.9
	2	22.6	19.5	5.5	14.0	13.1	0.03380	24.4	24.4
	5	22.6	18.5	5.5	13.0	13.3	0.02151	22.7	22.7
	15	22.5	17.0	5.5	11.5	13.5	0.01255	20.1	20.1
	30	22.2	17.0	5.5	11.5	13.5	0.00890	20.0	20.0
	60	22.0	16.0	5.6	10.5	13.7	0.00635	18.2	18.2
	120	21.5	16.0	5.6	10.4	13.7	0.00452	18.1	18.1
	250	21.2	16.0	5.7	10.3	13.7	0.00314	18.0	18.0
	485	21.6	15.0	5.6	9.4	13.8	0.00226	16.4	16.4
19-Aug-16	1483	21.9	13.0	5.6	7.4	14.2	0.00130	13.0	13.0

Comments:

* Dispersion device: mechanically operated stirring device

Laboratory analysis by: C. Krous
Data entered by: C. Krous
Checked by: J. Hines



d_{10} = 0.00081	d_{30} = 0.056	d_{50} = 0.11	d_{60} = 0.14	C_u = 173	C_c = 28

SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION	USDA CLASSIFICATION
1608898-002B	**NA**	**Classification by ASTM 2487 requires Atterberg test**	**Sandy Loam**

Note: Reported values for d_{10}, C_u, C_c, and ASTM classification are estimates, since extrapolation was required to obtain the d_{10} diameter

Laboratory Tests and Methods

Tests and Methods

Particle Size Analysis:	ASTM D422
USDA Classification:	ASTM D422, USDA Soil Textural Triangle

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1608898**

24-Aug-16

Client: Souder, Miller and Associates
Project: BP Mudge LS 006

Sample ID **MB-27070** SampType: **MBLK** TestCode: **EPA Method 300.0: Anions**
Client ID: **PBS** Batch ID: **27070** RunNo: **36631**
Prep Date: **8/18/2016** Analysis Date: **8/18/2016** SeqNo: **1134648** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Nitrite (As N)	ND	0.30								
Nitrogen, Nitrate (As N)	ND	0.30								
Phosphorus, Orthophosphate (As P	ND	1.5								
Sulfate	ND	1.5								

Sample ID **LCS-27070** SampType: **LCS** TestCode: **EPA Method 300.0: Anions**
Client ID: **LCSS** Batch ID: **27070** RunNo: **36631**
Prep Date: **8/18/2016** Analysis Date: **8/18/2016** SeqNo: **1134649** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Nitrite (As N)	2.9	0.30	3.000	0	95.9	90	110			
Nitrogen, Nitrate (As N)	7.4	0.30	7.500	0	98.6	90	110			
Phosphorus, Orthophosphate (As P	15	1.5	15.00	0	97.5	90	110			
Sulfate	29	1.5	30.00	0	97.4	90	110			

Sample ID **1608898-001AMS** SampType: **MS** TestCode: **EPA Method 300.0: Anions**
Client ID: **SB4-D-11.5-160808** Batch ID: **27070** RunNo: **36631**
Prep Date: **8/18/2016** Analysis Date: **8/18/2016** SeqNo: **1134652** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Nitrite (As N)	2.6	0.30	3.000	0	87.2	71.5	113			
Nitrogen, Nitrate (As N)	8.5	0.30	7.500	1.356	95.4	83.8	113			

Sample ID **1608898-001AMSD** SampType: **MSD** TestCode: **EPA Method 300.0: Anions**
Client ID: **SB4-D-11.5-160808** Batch ID: **27070** RunNo: **36631**
Prep Date: **8/18/2016** Analysis Date: **8/18/2016** SeqNo: **1134653** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Nitrite (As N)	2.7	0.30	3.000	0	88.4	71.5	113	1.42	20	
Nitrogen, Nitrate (As N)	8.8	0.30	7.500	1.356	99.2	83.8	113	3.30	20	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1608898**

24-Aug-16

Client: Souder, Miller and Associates

Project: BP Mudge LS 006

Sample ID **LCS-27019**	SampType: **LCS**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **LCSS**	Batch ID: **27019**	RunNo: **36556**
Prep Date: **8/16/2016**	Analysis Date: **8/17/2016**	SeqNo: **1132223** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	44	10	50.00	0	88.4	62.6	124			
Surr: DNOP	4.5		5.000		90.6	70	130			

Sample ID **MB-27019**	SampType: **MBLK**	TestCode: **EPA Method 8015M/D: Diesel Range Organics**
Client ID: **PBS**	Batch ID: **27019**	RunNo: **36556**
Prep Date: **8/16/2016**	Analysis Date: **8/17/2016**	SeqNo: **1132224** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	ND	10								
Motor Oil Range Organics (MRO)	ND	50								
Surr: DNOP	8.9		10.00		89.4	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1608898**

24-Aug-16

Client: Souder, Miller and Associates
Project: BP Mudge LS 006

Sample ID **MB-27006**	SampType: **MBLK**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **PBS**	Batch ID: **27006**	RunNo: **36570**
Prep Date: **8/16/2016**	Analysis Date: **8/17/2016**	SeqNo: **1132895** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	ND	5.0								
Surr: BFB	850		1000		84.7	68.3	144			

Sample ID **LCS-27006**	SampType: **LCS**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **LCSS**	Batch ID: **27006**	RunNo: **36570**
Prep Date: **8/16/2016**	Analysis Date: **8/17/2016**	SeqNo: **1132896** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	26	5.0	25.00	0	104	80	120			
Surr: BFB	900		1000		90.3	68.3	144			

Sample ID **1608898-001AMS**	SampType: **MS**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **SB4-D-11.5-160808**	Batch ID: **27006**	RunNo: **36570**
Prep Date: **8/16/2016**	Analysis Date: **8/17/2016**	SeqNo: **1132899** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	22	4.7	23.65	0	94.1	59.3	143			
Surr: BFB	890		946.1		93.9	68.3	144			

Sample ID **1608898-001AMSD**	SampType: **MSD**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **SB4-D-11.5-160808**	Batch ID: **27006**	RunNo: **36570**
Prep Date: **8/16/2016**	Analysis Date: **8/17/2016**	SeqNo: **1132900** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	22	4.8	23.88	0	92.6	59.3	143	0.678	20	
Surr: BFB	900		955.1		94.4	68.3	144	0	0	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1608898**

24-Aug-16

Client: Souder, Miller and Associates

Project: BP Mudge LS 006

Sample ID **MB-27006**	SampType: **MBLK**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **PBS**	Batch ID: **27006**	RunNo: **36570**
Prep Date: **8/16/2016**	Analysis Date: **8/17/2016**	SeqNo: **1132930** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	0.025								
Toluene	ND	0.050								
Ethylbenzene	ND	0.050								
Xylenes, Total	ND	0.10								
Surr: 4-Bromofluorobenzene	0.99		1.000		99.4	80	120			

Sample ID **LCS-27006**	SampType: **LCS**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **LCSS**	Batch ID: **27006**	RunNo: **36570**
Prep Date: **8/16/2016**	Analysis Date: **8/17/2016**	SeqNo: **1132931** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	0.83	0.025	1.000	0	83.2	75.3	123			
Toluene	0.92	0.050	1.000	0	92.1	80	124			
Ethylbenzene	0.99	0.050	1.000	0	98.5	82.8	121			
Xylenes, Total	3.0	0.10	3.000	0	100	83.9	122			
Surr: 4-Bromofluorobenzene	1.1		1.000		105	80	120			

Qualifiers:

- * Value exceeds Maximum Contaminant Level.
- B Analyte detected in the associated Method Blank
- D Sample Diluted Due to Matrix
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- J Analyte detected below quantitation limits
- ND Not Detected at the Reporting Limit
- P Sample pH Not In Range
- R RPD outside accepted recovery limits
- RL Reporting Detection Limit
- S % Recovery outside of range due to dilution or matrix
- W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1608898**

24-Aug-16

Client: Souder, Miller and Associates

Project: BP Mudge LS 006

Sample ID **MB-27011**	SampType: **MBLK**	TestCode: **EPA Method 7471: Mercury**							
Client ID: **PBS**	Batch ID: **27011**	RunNo: **36567**							
Prep Date: **8/16/2016**	Analysis Date: **8/17/2016**	SeqNo: **1132352**	Units: **mg/Kg**						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	ND	0.033								

Sample ID **LCS-27011**	SampType: **LCS**	TestCode: **EPA Method 7471: Mercury**							
Client ID: **LCSS**	Batch ID: **27011**	RunNo: **36567**							
Prep Date: **8/16/2016**	Analysis Date: **8/17/2016**	SeqNo: **1132353**	Units: **mg/Kg**						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.17	0.033	0.1667	0	104	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1608898**

24-Aug-16

Client: Souder, Miller and Associates

Project: BP Mudge LS 006

Sample ID **MB-26997**	SampType: **MBLK**	TestCode: **EPA Method 6010B: Soil Metals**
Client ID: **PBS**	Batch ID: **26997**	RunNo: **36584**
Prep Date: **8/15/2016**	Analysis Date: **8/17/2016**	SeqNo: **1132795** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	ND	2.5								
Barium	ND	0.10								
Cadmium	ND	0.10								
Chromium	ND	0.30								
Iron	ND	2.5								
Manganese	ND	0.10								
Selenium	ND	2.5								
Silver	ND	0.25								

Sample ID **LCS-26997**	SampType: **LCS**	TestCode: **EPA Method 6010B: Soil Metals**
Client ID: **LCSS**	Batch ID: **26997**	RunNo: **36584**
Prep Date: **8/15/2016**	Analysis Date: **8/17/2016**	SeqNo: **1132796** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	23	2.5	25.00	0	92.6	80	120			
Barium	22	0.10	25.00	0	88.1	80	120			
Cadmium	23	0.10	25.00	0	91.1	80	120			
Chromium	22	0.30	25.00	0	88.7	80	120			
Iron	24	2.5	25.00	0	96.9	80	120			
Manganese	22	0.10	25.00	0	87.7	80	120			
Selenium	23	2.5	25.00	0	93.5	80	120			
Silver	4.5	0.25	5.000	0	90.9	80	120			

Sample ID **MB-26997**	SampType: **MBLK**	TestCode: **EPA Method 6010B: Soil Metals**
Client ID: **PBS**	Batch ID: **26997**	RunNo: **36591**
Prep Date: **8/15/2016**	Analysis Date: **8/18/2016**	SeqNo: **1133464** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Lead	ND	0.25								

Sample ID **LCS-26997**	SampType: **LCS**	TestCode: **EPA Method 6010B: Soil Metals**
Client ID: **LCSS**	Batch ID: **26997**	RunNo: **36591**
Prep Date: **8/15/2016**	Analysis Date: **8/18/2016**	SeqNo: **1133465** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Lead	22	0.25	25.00	0	87.6	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1608898**

24-Aug-16

Client: Souder, Miller and Associates

Project: BP Mudge LS 006

Sample ID **MB**	SampType: **MBLK**	TestCode: **Ammonia as N**							
Client ID: **PBS**	Batch ID: **R36667**	RunNo: **36667**							
Prep Date:	Analysis Date: **8/22/2016**	SeqNo: **1135826**	Units: **mg/Kg**						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Ammonia	ND	25								

Sample ID **LCS**	SampType: **LCS**	TestCode: **Ammonia as N**							
Client ID: **LCSS**	Batch ID: **R36667**	RunNo: **36667**							
Prep Date:	Analysis Date: **8/22/2016**	SeqNo: **1135827**	Units: **mg/Kg**						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Ammonia	500	25	500.0	0	99.4	80	120			

Sample ID **1608898-001AMS**	SampType: **MS**	TestCode: **Ammonia as N**							
Client ID: **SB4-D-11.5-160808**	Batch ID: **R36667**	RunNo: **36667**							
Prep Date:	Analysis Date: **8/22/2016**	SeqNo: **1135829**	Units: **mg/Kg**						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Ammonia	500	25	500.0	0	101	75	125			

Sample ID **1608898-001AMSD**	SampType: **MSD**	TestCode: **Ammonia as N**							
Client ID: **SB4-D-11.5-160808**	Batch ID: **R36667**	RunNo: **36667**							
Prep Date:	Analysis Date: **8/22/2016**	SeqNo: **1135830**	Units: **mg/Kg**						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Ammonia	510	25	500.0	0	102	75	125	1.38	20	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1608898**

24-Aug-16

Client: Souder, Miller and Associates

Project: BP Mudge LS 006

Sample ID **MB-27064**	SampType: **MBLK**	TestCode: **Walkley Black TOC/FOC/OM**
Client ID: **PBS**	Batch ID: **27064**	RunNo: **36612**
Prep Date: **8/18/2016**	Analysis Date: **8/18/2016**	SeqNo: **1134133** Units: **% C**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
TOC	ND	0.13								

Sample ID **LCS-27064**	SampType: **LCS**	TestCode: **Walkley Black TOC/FOC/OM**
Client ID: **LCSS**	Batch ID: **27064**	RunNo: **36612**
Prep Date: **8/18/2016**	Analysis Date: **8/18/2016**	SeqNo: **1134134** Units: **% C**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
TOC	2.8	0.13	2.740	0	103	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: SMA-FARM Work Order Number: 1608898 RcptNo: 1

Received by/date: AT/LM 08/10/16

Logged By: Anne Thorne 8/10/2016 8:00:00 AM Anne Thorne

Completed By: Anne Thorne 8/16/2016 Anne Thorne

Reviewed By: JC 8/16/16

Chain of Custody

1. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
2. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
3. How was the sample delivered?	Courier		

Log In

4. Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
5. Were all samples received at a temperature of >0° C to 6.0°C	Yes ☑	No ☐	NA ☐
6. Sample(s) in proper container(s)?	Yes ☑	No ☐	
7. Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8. Are samples (except VOA and ONG) properly preserved?	Yes ☑	No ☐	
9. Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10. VOA vials have zero headspace?	Yes ☐	No ☐	No VOA Vials ☑
11. Were any sample containers received broken?	Yes ☐	No ☑	
12. Does paperwork match bottle labels? (Note discrepancies on chain of custody)	Yes ☑	No ☐	
13. Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
14. Is it clear what analyses were requested?	Yes ☑	No ☐	
15. Were all holding times able to be met? (If no, notify customer for authorization.)	Yes ☑	No ☐	

# of preserved bottles checked for pH: _____ (<2 or >12 unless noted)

Adjusted? _____

Checked by: _____

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: _____ Date _____

By Whom: _____ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding: _____

Client Instructions: _____

17. Additional remarks:

18. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.6	Good	Yes			

Chain-of-Custody Record

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Client: Souder Miller & Assoc	Turn-Around Time: ☒ Standard ☐ Rush
Mailing Address: 401 W. Broadway, Farmington, NM 87401	Project Name: BP Mudge LS 006
Phone #: 505 325 7535	Project #: see below
email or Fax#: lorendiede@soudermiller.com	Project Manager: Reid Allen
QA/QC Package: ☒ Standard ☐ Level 4 (Full Validation)	Sampler:
Accreditation ☐ NELAP ☐ Other	On Ice: ☒ Yes ☐ No
☐ EDD (Type)	Sample Temperature: 1.6

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1608898	BTEX + ~~MTBE~~ + ~~TMB~~'s (8021)	BTEX + MTBE + TPH (Gas only)	TPH 8015B (GRO / DRO / ~~MRO~~)	TPH (Method 418.1)	EDB (Method 504.1)	PAH's (8310 or 8270 SIMS)	RCRA 8 Metals	Anions (F, Cl, NO_3, NO_2, PO_4, SO_4)	8081 Pesticides / 8082 PCB's	8260B (VOA)	8270 (Semi-VOA)	TOC / NH_4	Grain Size Distribution	Total Fe, Mn	Heavy Metals / Natural Oxygen Demand	Air Bubbles (Y or N)
8-08-16	1402	Soil	SB4-D-11.5-160808	8oz jar	cool	001	X		X					X				X	X	X	X	
8-08-16	1402	Soil	SB4-D-11.5-160808	8oz jar	cool	001	X		X					X				X	X	X	X	
8-08-16	1000	Soil	SB5-S-6.8-160808	8oz jar	cool	002	X		X					X				X	X	X	X	
8-08-16	1000	Soil	SB5-S-6.8-160808	8oz jar	cool	002	X		X					X				X	X	X	X	
NOTES																						
Also Analyze all for:			TPH fractions: C10-C12, C12-C16, C16-C21, C21-C30, C30-C35	C5-C6, C6-C8, C8-C10,																		

Date	Time	Relinquished by:	Received by:	Date	Time
8/8/16	1810			8/8/16	1810
8/9/16	1851			08/10/16	0800

Remarks: BP INVOICE:
VID: VDRINKWJA1
WBS: L1-0016C-EMUDGLELS6

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

October 14, 2016

Andy Freeman
Hall Environmental, Inc.
4901 Hawkins St NE
Albuquerque, NM 87109

RE: Soil Oxidant Demand Test Results (Irena Moreno, BP)

Dear Mr. Freeman:

This letter report describes the procedures and results persulfate soil oxidant demand (SOD) tests conducted by PRIMA Environmental, Inc. Per request of Dr. Irene Moreno, Technical Specialist BP Remediation Management, the oxidant used was hydrogen peroxide activated persulfate (AP-HP).

Sample Receipt and Preparation

One soil sample was received on September 30, 2016. The soil was homogenized and large rocks were removed by hand.

Procedures

Soil, sodium persulfate solution (SP), and hydrogen peroxide (HP) were combined to give initial SP concentrations of 5.0 g/L, 15 g/L, or 30 g/L and HP concentrations of 3600 mg/L, 11,000 mg/L and 21,000 mg/L (5:1 HP:SP mole ratio). All bottles were shaken by hand periodically. After 48 hours, the bottles were destructively sampled and the aqueous phase analyzed for SP and HP.

Results

The 48hr SOD data are given in **Table 1**. SOD ranged from 0.3 to 2.0 g SP/kg soil, depending upon the initial concentration of SP. Increased SOD with increasing initial concentration of oxidant is a common phenomenon. HP was not detected in any sample.

Table 1. 48hr SOD Peroxide Activated Persulfate.

Test	Sodium Persulfate			Hydrogen Peroxide		
	Initial	Final	Consumed (SOD)	Initial	Final	Consumed (SOD)
	g/L	g/L	g/kg soil	mg/L	mg/L	mg/kg soil
AP-HP						
Low - A	5.0	4.6	0.4	3,600	< 10	3,600
Low - B	5.0	4.8	0.2	3,600	< 20	3,600
Average	*5.0*	*4.7*	*0.3*	*3,600*		*3,600*
Medium - A	15	15.0	0.0	11,000	< 100	11,000
Medium - B	15	14.0	1.0	11,000	< 100	11,000
Average	*15*	*14.5*	*0.5*	*11,000*	*< 100*	*11,000*
High - A	30	29	1	21,000	< 200	21,000
High - B	30	28	2	21,000	< 200	21,000
Average	*30*	*29*	*2*	*21,000*	*< 200*	*21,000*

If you have any questions regarding these results, please give me a call at 916-939-7300. Thank you for the opportunity to be of service.

Sincerely,
PRIMA Environmental, Inc.

Cindy G. Schreier, Ph.D.
President

PLUGGING RECORD

NOTE: A Well Plugging Plan of Operations shall be approved by the State Engineer prior to plugging - 19.27.4 NMAC

I. GENERAL / WELL OWNERSHIP:

State Engineer Well Number: Well not permitted, Located on the Mudge LS 6 wellsite; Unit M, Sec.11, T 31N, R 11W

Well owner: BP America Production Company Phone No.: 505-326-0653

Mailing address: 200 Energy Court

City: Farmington State: NM Zip code: 87401

II. WELL PLUGGING INFORMATION:

1) Name of well drilling company that plugged well: Yellow Jacket Drilling Services, LLC

2) New Mexico Well Driller License No.: WD-1458 Expiration Date: 10-31-2016

3) Well plugging activities were supervised by the following well driller(s)/rig supervisor(s): Richard LeBlanc

4) Date well plugging began: 8-3-2016 Date well plugging concluded: 8-3-2016

5) GPS Well Location: Latitude: N 36 deg, 54 min, 31.92250 sec
Longitude: W 107 deg, 57 min, 56.41115 sec, WGS 84

6) Depth of well confirmed at initiation of plugging as: 29.5' ft below ground level (bgl), by the following manner: Measuring Line

7) Static water level measured at initiation of plugging: 18' ft bgl

8) Date well plugging plan of operations was approved by the State Engineer: N/A

9) Were all plugging activities consistent with an approved plugging plan? N/A If not, please describe differences between the approved plugging plan and the well as it was plugged (attach additional pages as needed):

This monitoring well (MW-3) had not previously been permitted, it was drilled and constructed in June 2015.

During subsequent monitoring well drilling and construction (SJ 4205 POD 1-9) in August 2016 the MW-3 well was plugged and replacement wells MW-3S and MW-3D were drilled and constructed.

The well was plugged with cement grout, 1' fallback, then backfilled with native soil.

10) Log of Plugging Activities - Label vertical scale with depths, and indicate separate plugging intervals with horizontal lines as necessary to illustrate material or methodology changes. Attach additional pages if necessary.

For each interval plugged, describe within the following columns:

Depth (ft bgl)	Plugging Material Used (include any additives used)	Volume of Material Placed (gallons)	Theoretical Volume of Borehole/ Casing (gallons)	Placement Method (tremie pipe, other)	Comments ("casing perforated first", "open annular space also plugged", etc.)
0'					
6'	Type I/II Portland Cement + 3 % Quick Gel bentonite	28 gallons	29 gallons	Tremie	Drill from surface to 20' with 6" bit, observe PVC, sand returns.
12'					
20' BGS	5 gallons	1.56 Inside 2", But was pumped inside slotted screen	Tremie Pipe	29.5' to 20' plugged inside of 2" screen and sand pack with 5 gallons cement grout	
18'	Type I/II cement + 3% bentonite				
24'					
29.5' BGS					

MULTIPLY		BY		AND OBTAIN
cubic feet	x	7.4805	=	gallons
cubic yards	x	201.97	=	gallons

III. SIGNATURE:

I, Richard LeBlanc, say that I am familiar with the rules of the Office of the State Engineer pertaining to the plugging of wells and that each and all of the statements in this Plugging Record and attachments are true to the best of my knowledge and belief.

R. LeBlanc

Signature of Well Driller

9/7/16

Date

PLUGGING RECORD

NOTE: **A Well Plugging Plan of Operations shall be approved by the State Engineer prior to plugging - 19.27.4 NMAC**

I. GENERAL / WELL OWNERSHIP:

State Engineer Well Number: SJ-4205 POD 6

Well owner: BP America Production Company Phone No.: 505-326-0653

Mailing address: 200 Energy Court

City: Farmington State: NM Zip code: 87401

II. WELL PLUGGING INFORMATION:

1) Name of well drilling company that plugged well: Yellow Jacket Drilling Services, LLC

2) New Mexico Well Driller License No.: WD-1458 Expiration Date: 10-31-2016

3) Well plugging activities were supervised by the following well driller(s)/rig supervisor(s): Richard LeBlanc

4) Date well plugging began: 8-2-2016 Date well plugging concluded: 8-2-2016

5) GPS Well Location: Latitude: 36 deg, 54 min, 33.06039 sec
Longitude: 107 deg, 57 min, 55.99499 sec, WGS 84

6) Depth of well confirmed at initiation of plugging as: 30.0' ft below ground level (bgl), by the following manner: Measuring Line

7) Static water level measured at initiation of plugging: 5' ft bgl

8) Date well plugging plan of operations was approved by the State Engineer: Verbal 8-2-16

9) Were all plugging activities consistent with an approved plugging plan? Yes If not, please describe differences between the approved plugging plan and the well as it was plugged (attach additional pages as needed):

This borehole encountered artesian flow at 29' bgs. NMOSE Aztec office was notified and verbal approval obtained to plug and abandon this borehole.

Borehole was cemented from TD to surface with cement grout, fallback of 1', backfilled with native soil.

10) Log of Plugging Activities - Label vertical scale with depths, and indicate separate plugging intervals with horizontal lines as necessary to illustrate material or methodology changes. Attach additional pages if necessary.

For each interval plugged, describe within the following columns:

Depth (ft bgl)	Plugging Material Used (include any additives used)	Volume of Material Placed (gallons)	Theoretical Volume of Borehole/ Casing (gallons)	Placement Method (tremie pipe, other)	Comments ("casing perforated first", "open annular space also plugged", etc.)
0'					
6'	Type I/II Portland Cement + 3 % Quick Gel bentonite	33	30	Tremie	Tremie pipe to 30', pumped cement grout to surface. Fall back 1'. SD and backfilled with native soil
12'					
18'					
24'					
30'					

MULTIPLY		BY		AND OBTAIN
cubic feet	x	7.4805	=	gallons
cubic yards	x	201.97	=	gallons

III. SIGNATURE:

I, Richard LeBlanc, say that I am familiar with the rules of the Office of the State Engineer pertaining to the plugging of wells and that each and all of the statements in this Plugging Record and attachments are true to the best of my knowledge and belief.

R. LeBlanc

Signature of Well Driller

9/7/16

Date

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER
AZTEC

Tom Blaine, P.E.
State Engineer

100 Gossett Drive, Suite A
Aztec, New Mexico 87410

July 20, 2016

Stephanie Hinds, Staff EIT II
Souder, Miller & Associates
401 W. Broadway
Farmington, NM 87401

RE: Permit Approval for Non-Consumptive Wells, SJ-4205 POD1-POD9, BP America Production Co., BP Mudge LS6 Release Investigation

Dear Ms. Hinds:

On July 19, 2016, the New Mexico Office of the State Engineer (NMOSE) received an application to permit nine new groundwater monitoring wells associated with the above referenced location. The application was submitted by Souder, Miller & Assoc. on behalf of BP America Production Co. Enclosed is a copy of the above numbered permit, which has been approved subject to the conditions set forth on the approval page and in the attached Conditions of Approval.

A standardized plugging method for the future abandonment of the nine newly permitted wells has also been included in the Conditions of Approval. This eliminates the need to submit a separate Well Plugging Plan of Operations for approval by the NMOSE prior to plugging, unless an alternate plugging method is proposed, required by a separate oversight agency, necessary due to incompatibility with actual conditions, or artesian conditions are encountered. Please be aware that there are deadlines to submit well records for the newly installed monitoring wells and plugging records for any abandoned wells. These deadlines can be found in the attached Conditions of Approval. The well and plugging records should be sent to the NMOSE District V, 100 Gossett Drive, Suite A, Aztec, NM, 87410.

Also, additional existing non-permitted wells are identified with this site investigation on the site map provided with the application. NMOSE is requesting that these existing wells be brought into compliance by obtaining permit coverage. Please work with the BP America Production Co. to obtain the necessary permit coverage for these wells and submit an application to NMOSE as soon as practicable.

If you have any questions regarding this permitting action, please feel free to contact me at (505) 334-4751.

Sincerely,

Kimberly Kirby
Water Resource Specialist
Water Rights Division District V

Enclosures

cc: Aztec Reading (w/o enclosures)
SJ-4205 File
WATERS
Steve Moskal, BP America Production Co., via email: Steven.Moskal@bp.com
Reid Allan, Souder, Miller & Assoc., via email: reid.allan@soudermiller.com

File No. SJ-4205 POD1-POD9

NEW MEXICO OFFICE OF THE STATE ENGINEER

APPLICATION FOR PERMIT TO DRILL A WELL WITH NO CONSUMPTIVE USE OF WATER

(check applicable box):

For fees, see State Engineer website: http://www.ose.state.nm.us/

Purpose:

- ☐ Pollution Control And / Or Recovery
- ☐ Geo-Thermal
- ☐ Exploratory
- ☐ Construction Site De-Watering
- ☐ Other (Describe):
- ■ Monitoring
- ☐ Mineral De-Watering

A separate permit will be required to apply water to beneficial use.

■ Temporary Request - Requested Start Date: July 25, 2016 Requested End Date: Unknown

Plugging Plan of Operations Submitted? ☐ Yes ■ No

STATE ENGINEER OFFICE
AZTEC, NEW MEXICO
2016 JUL 19 PM 3 58

OSE Notation: A standardized plugging method has been included in the Conditions of Approval for abandonment of the wells covered by this permit.

1. APPLICANT(S)

Name: BP America Production Co.; represented by Souder, Miller & Associates	Name: BP America Production Co., represented by Souder, Miller & Associates
Contact or Agent: Stephanie Hinds check here if Agent ■	Contact or Agent: Reid Allan check here if Agent ■
Mailing Address: 401 W. Broadway	Mailing Address: 401 W. Broadway
City: Farmington	City: Farmington
State: NM Zip Code: 87401	State: NM Zip Code: 87401
Phone: 505-793-7079 ☐ Home ■ Cell Phone (Work): 505-325-7535	Phone: ☐ Home ■ Cell Phone (Work): 505-325-7535
E-mail (optional): stephanie.hinds@soudermiller.com	E-mail (optional): reid.allan@soudermiller.com

FOR OSE INTERNAL USE Application for Permit Form wr-07, Rev 6/14/12

File No.: SJ-4205 POD1-POD9	Trn No.	Receipt No:
Trans Description (optional):		
Sub-Basin:	PCW/LOG Due Date: July 20, 2017	

2. WELL(S) Describe the well(s) applicable to this application.

Location Required: Coordinate location must be reported in NM State Plane (NAD 83), UTM (NAD 83), or Latitude/Longitude (Lat/Long - WGS84).
District II (Roswell) and District VII (Cimarron) customers, provide a PLSS location in addition to above.

☐ NM State Plane (NAD83) (Feet) ☐ NM West Zone ☐ NM East Zone ☐ NM Central Zone
☐ UTM (NAD83) (Meters) ☐ Zone 12N ☐ Zone 13N
■ Lat/Long (WGS84) (to the nearest 1/10th of second)

Well Number (if known):	X or Easting or Longitude:	Y or Northing or Latitude:	Provide if known: -Public Land Survey System (PLSS) (*Quarters or Halves , Section, Township, Range*) OR - Hydrographic Survey Map & Tract; OR - Lot, Block & Subdivision; OR - Land Grant Name
(SJ-4205 POD1) MW-3D	-107.96564	36.90883	SW 1/4 of SW 1/4; Sec. 11, T31N, R11W
(SJ-4205 POD2) MW-3S	-107.96564	36.90883	SW 1/4 of SW 1/4; Sec. 11, T31N, R11W
(SJ-4205 POD3) MW-4	-107.96551	36.90850	SW 1/4 of SW 1/4; Sec. 11, T31N, R11W
(SJ-4205 POD4) MW-5D	-107.96569	36.90866	SW 1/4 of SW 1/4; Sec. 11, T31N, R11W
(SJ-4205 POD5) MW-5S	-107.96569	36.90866	SW 1/4 of SW 1/4; Sec. 11, T31N, R11W

NOTE: If more well locations need to be described, complete form WR-08 (Attachment 1 – POD Descriptions)
Additional well descriptions are attached: ■ Yes ☐ No If yes, how many 4 wells

Other description relating well to common landmarks, streets, or other:
See attached maps.

Well is on land owned by: BLM

Well Information: NOTE: If more than one (1) well needs to be described, provide attachment. **Attached?** ■ Yes ☐ No
If yes, how many 2

Approximate depth of well (feet): 17 - 30 ft	Outside diameter of well casing (inches): 2.00
Driller Name: Yellow Jacket Drilling Services	Driller License Number: 1458

3. ADDITIONAL STATEMENTS OR EXPLANATIONS

A total of nine monitoring wells are to be installed at the Mudge LS6 well site for purposes of continued site investigation as a result of a spill that occurred in August 2014. The shallow ground water monitoring wells (MW-3S, MW-5S, MW-6S, MW-7, and MW-8) will be installed at 17-20 feet below ground surface (bgs) and will target saturated soils in the brown sand layer. The deep groundwater monitoring wells (MW-3D, MW-4, MW-5D, and MW-6D) will be installed at 30 feet bgs and will target the sand lens in the blue sandstone layer.

2016 JUL 19 PM 3:58

STATE ENGINEER OFFICE
AZTEC, NEW MEXICO

FOR OSE INTERNAL USE — Application for Permit, Form wr-07

File No.: SJ-4205 POD1-POD9	Trn No.:

4. SPECIFIC REQUIREMENTS: The applicant must include the following, as applicable to each well type. Please check the appropriate boxes, to indicate the information has been included and/or attached to this application.

Exploratory: ☐ Include a description of any proposed pump test, if applicable.	**Pollution Control and/or Recovery:** ☐ Include a plan for pollution control/recovery, that includes the following: ☐ A description of the need for the pollution control or recovery operation. ☐ The estimated maximum period of time for completion of the operation. ☐ The annual diversion amount. ☐ The annual consumptive use amount. ☐ The maximum amount of water to be diverted and injected for the duration of the operation. ☐ The method and place of discharge.	**Construction De-Watering:** ☐ Include a description of the proposed dewatering operation, ☐ The estimated duration of the operation, ☐ The maximum amount of water to be diverted, ☐ A description of the need for the dewatering operation, and, ☐ A description of how the diverted water will be disposed of.	**Mine De-Watering:** ☐ Include a plan for pollution control/recovery, that includes the following: ☐ A description of the need for mine dewatering. ☐ The estimated maximum period of time for completion of the operation. ☐ The source(s) of the water to be diverted. ☐ The geohydrologic characteristics of the aquifer(s). ☐ The maximum amount of water to be diverted per annum. ☐ The maximum amount of water to be diverted for the duration of the operation. ☐ The quality of the water. ☐ The method of measurement of water diverted. ☐ The recharge of water to the aquifer. ☐ Description of the estimated area of hydrologic effect of the project. ☐ The method and place of discharge. ☐ An estimation of the effects on surface water rights and underground water rights from the mine dewatering project. ☐ A description of the methods employed to estimate effects on surface water rights and underground water rights. ☐ Information on existing wells, rivers, springs, and wetlands within the area of hydrologic effect.
Monitoring: ■ Include the reason for the monitoring well, and, ■ The duration of the planned monitoring.	☐ The method of measurement of water produced and discharged. ☐ The source of water to be injected. ☐ The method of measurement of water injected. ☐ The characteristics of the aquifer. ☐ The method of determining the resulting annual consumptive use of water and depletion from any related stream system. ☐ Proof of any permit required from the New Mexico Environment Department. ■ An access agreement if the applicant is not the owner of the land on which the pollution plume control or recovery well is to be located.	**Geo-Thermal:** ☐ Include a description of the geothermal heat exchange project, ☐ The amount of water to be diverted and re-injected for the project, ☐ The time frame for constructing the geothermal heat exchange project, and, ☐ The duration of the project. ☐ Preliminary surveys, design data, and additional information shall be included to provide all essential facts relating to the request.	

ACKNOWLEDGEMENT

I, We (name of applicant(s)), Souder, Miller & Associates - Stephanie Hinds and Reid Allan
Print Name(s)

affirm that the foregoing statements are true to the best of (my, our) knowledge and belief.

Stephanie Hinds
Applicant Signature

Applicant Signature

ACTION OF THE STATE ENGINEER

This application is:

☒ approved ☐ partially approved ☐ denied

provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare and further subject to the attached conditions of approval.

Witness my hand and seal this 20th day of July 20 16, for the State Engineer,

Tom Blaine, PE, State Engineer

By: Kimberly Kirby
Signature Print

Title: Water Resource Specialist, Water Rights Division District V
Print

2016 JUL 19 PM 3:58

STATE ENGINEER OFFICE
AZTEC, NEW MEXICO

FOR OSE INTERNAL USE — Application for Permit, Form wr-07

File No.: SJ_4205 POD1-POD9 | Trn No.

NEW MEXICO OFFICE OF THE STATE ENGINEER

ATTACHMENT 1
POINT OF DIVERSION DESCRIPTIONS

This Attachment is to be completed if more than one (1) point of diversion is described on an Application or Declaration.

a. Is this a: ☐ Move-From Point of Diversion(s) ☐ Move-To Point of Diversion(s)	**b. Information on Attachment(s):** Number of points of diversion involved in the application: ~~8~~ 9 Total number of pages attached to the application: 1

☐ **Surface Point of Diversion** **OR** ☒ **Well**

Name of ditch, acequia, or spring:	
Stream or water course:	
Tributary of:	

c. Location (Required):
Required Move to POD location coordinate must be either New Mexico State Plane (NAD 83), UTM (NAD 83), or Lat/Long (WGS84)

NM State Plane (NAD83) (feet) ☐ NM West Zone ☐ NM Central Zone ☐ NM East Zone	UTM (NAD83) (meters) Zone 13N ☐ Zone 12N ☐	☒ Lat/Long–(WGS84) 1/10th of second	OTHER (allowable only for move-from descriptions - see application form for format) ☒ PLSS (quarters, section, township, range) ☐ Hydrographic Survey, Map & Tract ☐ Lot, Block & Subdivision ☐ Grant
POD Number: MW-6D (SJ-4205 POD6)	X or Longitude: -107.96559	Y or Latitude: 36.90926	Other Location Description: SW 1/4 of SW 1/4; Sec. 11, T31N, R11W
POD Number: MW-6S (SJ-4205 POD7)	X or Longitude: -107.96559	Y or Latitude: 36.90926	Other Location Description: SW 1/4 of SW 1/4; Sec. 11, T31N, R11W
POD Number: MW-7 (SJ-4205 POD8)	X or Longitude: -107.96591	Y or Latitude: 36.90924	Other Location Description: SW 1/4 of SW 1/4; Sec. 11, T31N, R11W
POD Number: MW-8 (SJ-4205 POD9)	X or Longitude: -107.96535	Y or Latitude: 36.90875	Other Location Description: SW 1/4 of SW 1/4; Sec. 11, T31N, R11W
POD Number:	X or Longitude:	Y or Latitude:	Other Location Description:
POD Number:	X or Longitude:	Y or Latitude:	Other Location Description:
POD Number:	X or Longitude:	Y or Latitude:	Other Location Description:
POD Number:	X or Longitude:	Y or Latitude:	Other Location Description
POD Number:	X or Longitude:	Y or Latitude:	Other Location Description:

2016 JUL 19 PM 3:58

STATE ENGINEER OFFICE
AZTEC, NEW MEXICO

FOR OSE INTERNAL USE

Form wr-08
POD DESCRIPTIONS - ATTACHMENT 1

File Number: SJ-4205 POD1-POD9	Trn Number:
Trans Description (optional):	

NMOSE Permit to Drill a Non-Consumptive Well(s) - Conditions of Approval
SJ-4205 POD1 – POD9

The New Mexico Office of the State Engineer (NMOSE) has determined that existing water rights will not be impaired by this activity. This application is approved without publication provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare of the state. This application approval (i.e., permit) is further subject to the following conditions of approval.

1. This permit is approved as follows:

Permittee(s): BP America Production Co.
via Souder, Miller & Associates, as Agent
401 W. Broadway
Farmington, NM 87401

Permit Number: SJ-4205

Application File Date: July 19, 2016

Priority: N/A

Source: Groundwater

Point(s) of Diversion: SJ-4205 POD1 through POD9 includes nine newly proposed groundwater monitoring wells associated with a site investigation at the BP Mudge LS6 release site, located on federal land managed by the Bureau of Land Management in San Juan County, New Mexico. The wells (aka, point of diversion; POD) will be located within the SW¼ SW¼ of Section 11, Township 31 North, Range 11 West, NMPM, at the following approximate point locations (Lat/Long, WGS84).

POD Name and Owner's Well Identification	Proposed Longitude (decimal deg.)	Proposed Latitude (decimal deg.)
SJ-4205 POD1 (MW-3D)	-107.96564	36.90883
SJ-4205 POD2 (MW-3S)	-107.96564	36.90883
SJ-4205 POD3 (MW-4)	-107.96551	36.90850
SJ-4205 POD4 (MW-5D)	-107.96569	36.90866
SJ-4205 POD5 (MW-5S)	-107.96569	36.90866
SJ-4205 POD6 (MW-6D)	-107.96559	36.90926
SJ-4205 POD7 (MW-6S)	-107.96559	36.90926
SJ-4205 POD8 (MW-7)	-107.96591	36.90924
SJ-4205 POD9 (MW-8)	-107.96535	36.90875

Purpose of Use: Groundwater monitoring

Place of Use: N/A

Amount of Water: N/A

2. No water shall be appropriated and beneficially used from any wells or borings approved under this permit.

3. No water shall be diverted from the well(s) except for initial well development and periodic sampling purposes. Upon completion of monitoring activities the well(s) shall be plugged in accordance with Subsection C of 19.27.4.30 NMAC, unless a permit to use water is acquired from the NMOSE.

4. The well(s) may continue to be used indefinitely for groundwater sampling or monitoring required for the current site investigation and any associated remediation, so long as they remain in good repair. **A new permit shall be obtained from the NMOSE prior to replacing a well(s) or for any change in use as approved herein.**

5. Water well drilling and well drilling activities, including well plugging, are regulated under NMOSE Regulations 19.27.4 NMAC. These regulations apply, and provide both general and specific direction regarding the drilling of wells in New Mexico. Note that the construction of any well that allows groundwater to flow uncontrolled to the land surface or to move appreciably between geologic units is prohibited. Based on the proposed well construction information provided regarding the subject well(s), the following variances have been provided from 19.27.4.29 and 19.27.4.30 NMAC.

    a. Subsection C of 19.27.4.29 NMAC requires that drilling equipment be disinfected with a chlorine bleach solution. Due to the environmental investigative purpose of these wells, chlorine may bias or degrade contaminates under investigation in the soil and groundwater samples to be collected. Therefore, NMOSE is granting a variance to allow for steam and the use of a suitable cleaning solution for the cleaning of drilling equipment between the drilling of each borehole/well.

    b. Paragraph (2) of Subsection A of 19.27.4.30 NMAC requires that for wells completed less than 20 feet below land surface, the seal be placed from land surface to the bottom of the blank casing. However, due to the need for collection of groundwater samples at particular and discrete intervals, and a screened interval that accounts for fluctuations in the water levels, the seal may be placed above the filter pack which may be extended up to two feet above the top of the screened interval.

6. In accordance with Subsection A of 19.27.4.29 NMAC, on-site supervision of well drilling/plugging is required by the holder of a New Mexico Well Driller License or a NMOSE-registered Drill Rig Supervisor. The New Mexico licensed Well Driller shall ensure that well drilling activities are completed in accordance with 19.27.4.29, 19.27.4.30 and 19.27.4.31 NMAC. However, pursuant to 72-12-12 NMSA 1978 and 19.27.4.8 NMAC, a driller's license is not required for the construction of a driven well with an outside casing diameter of 2⅞ inches or less and that does not require the use of a drill rig (e.g., auger) for installation. This exemption is not applicable to well plugging.

7. The permittee has not indicated whether artesian conditions may be encountered at the proposed well location(s). If artesian conditions are encountered during drilling, all rules and regulations pertaining to the drilling and casing and plugging of artesian wells shall be followed.

8. A Well Record documenting the as-built well construction and materials used shall be filed for each of the new wells in accordance with Subsection K of 19.27.4.29 NMAC. **Well Records shall be filed with the State Engineer (NMOSE District V, 100 Gossett Drive, Suite A, Aztec, NM, 87410) within 20 days after completion of the well(s).** Well installation(s) shall be

complete and the well record(s) filed no later than one year from the date of approval of this permit.

9. If the required Well Record documentation is not received within one year of the date of permit approval, this permit will automatically expire.

10. When the permittee receives approval or direction to permanently abandon the well(s)/borehole(s), plugging shall be performed by a New Mexico licensed well driller. The well(s)/borehole(s) shall be plugged pursuant to Subsection C of 19.27.4.30 NMAC using the following method, unless an alternate plugging method has been proposed by or on behalf of the well owner and approved by the NMOSE. If a well/borehole has encountered artesian conditions, a Well Plugging Plan of Operations shall be submitted and NMOSE approval obtained *prior* to the initiation of *any* well plugging activities concerning artesian wells. Additionally, if the following standardized plugging sealant is not appropriate for use due to incompatibility with the water quality or any soil and water contaminates encountered, a Well Plugging Plan of Operations shall be submitted and NMOSE approval obtained *prior* to the initiation of *any* well plugging activities.

    a. Obstructions in a well/borehole shall be identified and removed if possible. If an obstruction cannot be removed, the method used to grout below and around the obstruction shall be described in detail in the plugging record.

    b. Prior to plugging, calculate the theoretical volume of sealant needed for abandonment of the well/borehole based on the actual measured pluggable depth of the well/borehole and the volume factor for the casing/borehole diameter. Compare the actual volume of sealant placed in the well/borehole with the theoretical volume to verify the actual volume of sealant is equal to or exceeds the theoretical volume.

    c. Portland Type I/II cement shall be used for the plugging sealant. The water mixed with the cement to create the plugging sealant shall be potable water or of similar quality. Portland cement has a fundamental water demand of 5.2 gallons of water per 94-lb sack of cement. Up to a maximum of 6.0 gallons per 94-lb sack is acceptable to allow for greater pumpability.

        Pure bentonite powder ("90 barrel yield") is allowed as a cement additive by NMOSE and American Water Works Association (AWWA) guidelines. If a bentonite additive is used, the following rates and mixing guidelines shall be followed. For a rate or a mixing procedure other than that provided below, the NMOSE District V office must be contacted for pre-approval. Neither granular bentonite nor extended-yield bentonite shall be mixed with cement for the purpose of this plugging activity. When supplementing a cement slurry with bentonite powder, water demand for the mix increases at a rate of approximately 0.65 gallon of water for each 1% increment of bentonite bdwc (by dry weight cement) above the stated base water demand of 5.2 gallons water per 94-lb sack of cement for neat cement. Bentonite powder must be hydrated separately with its required increment of water before being mixed into the wet neat cement. If water is otherwise added to the combination of dry ingredients or the dry bentonite is blended into wet cement, the alkalinity of the cement will restrict the yield of the bentonite powder, resulting in excess free water in the slurry and excessive cement shrinkage upon curing.

    d. Placement of the sealant within the well/borehole shall be by pumping through a tremie pipe extended to near the bottom of the well/borehole and kept below the top of the slurry

column (i.e., immersed in the slurry) as the well/borehole is plugged from bottom upwards in a manner that displaces the standing water column.

e. Prior to, or upon completion of plugging, the well casing may be cut-off below grade as necessary to allow for approved construction onsite, provided a minimum six-inch thickness of reinforced abandonment plugging sealant or concrete completely covers the top of the cut-off casing. Any remaining void to the surface may be filled with native soil, concrete, or asphalt as needed to match the surrounding surface material and blended with the surface topography to prevent ponding.

f. **Within 20 days after completion of well/borehole plugging, a complete Plugging Record shall be filed with the State Engineer** in accordance with Paragraph (3) of Subsection C of 19.27.4.30 NMAC for each well/boring plugged. The Well Plugging Record(s) shall be filed with the State Engineer at the NMOSE District V Office, 100 Gossett Drive, Suite A, Aztec, NM 87410. The required well plugging record form is available at http://www.ose.state.nm.us/PDF/WellDrillers/WD-11.pdf.

11. In accordance with Subsection C of 19.27.4.30 NMAC, a well/borehole that does not encounter groundwater shall be immediately plugged by filling with drill cutting or clean native fill to within 10 feet of land surface and by plugging the remaining 10 feet to the land surface with a neat cement slurry or cement-bentonite sealant as described above. A Plugging Record shall be filed with the State Engineer as described above.

12. Should another regulatory agency sharing jurisdiction of the project authorize, or by regulation require, more stringent requirements than stated herein, the more stringent procedure should be followed. These, among others, may include provisions regarding pre-authorization to proceed, type of methods and materials used, inspection, or prohibition of free discharge of any fluid or other material to or from the well that is related to the drilling and/or monitoring process.

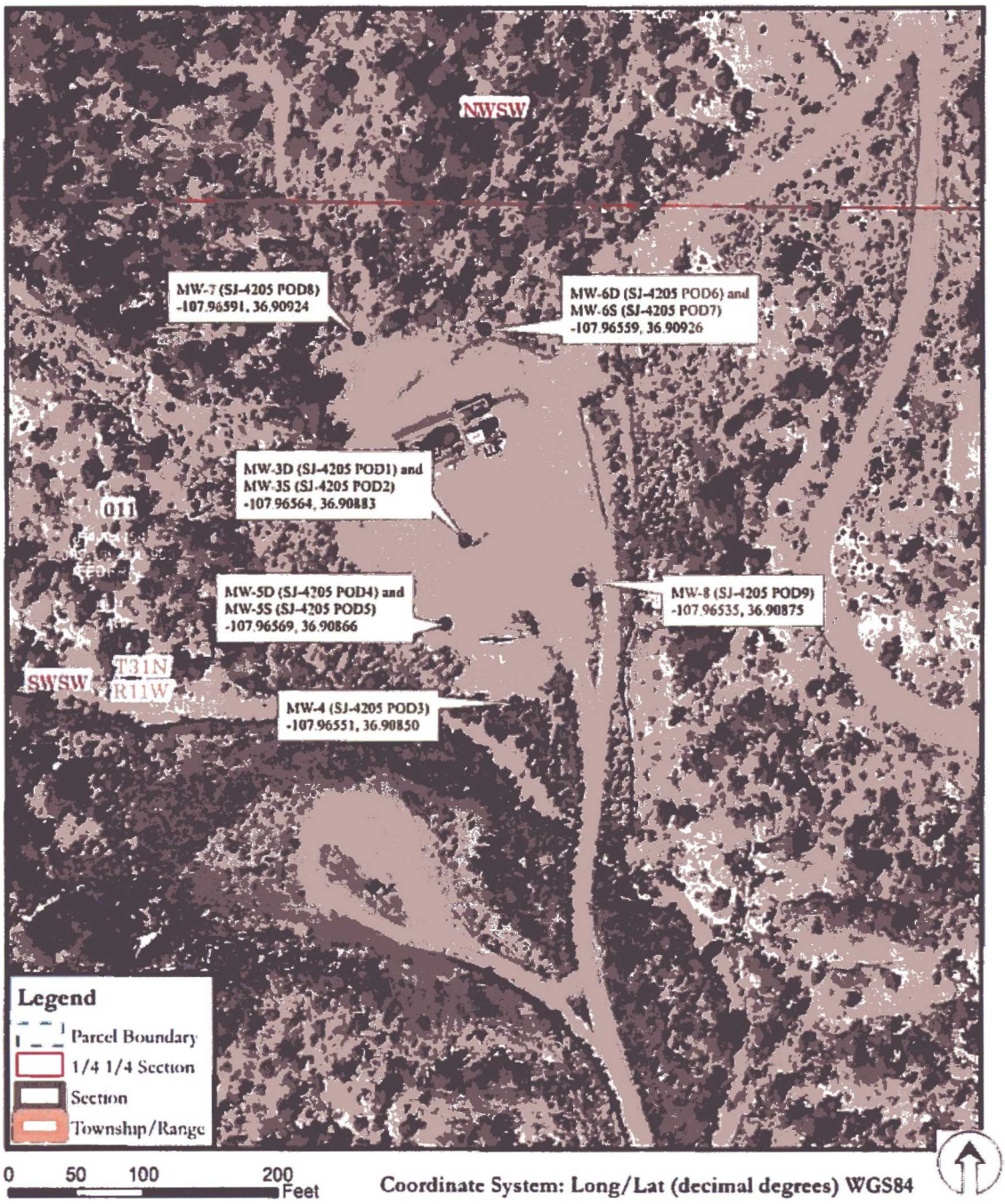
13. Pursuant to 72-12-3 NMSA 1978, the applicant has provided written documentation with the application, which the applicant claims as confirmation that access has been granted for the aforementioned well(s) to be located on property owned by someone other than the well owner/applicant. NMOSE approval of this permit in no way infers the right of access to land not owned by the well owner/applicant.

14. The State Engineer retains jurisdiction of this permit.

The application for non-consumptive use for well(s) SJ-4205 POD1-POD9, submitted on July 19, 2016, is hereby approved with the aforesaid conditions applied, when signed by an authorized designee of the State Engineer:

Witness my hand and seal this 20th day of July, A.D. 2016.
Tom Blaine, P.E., State Engineer

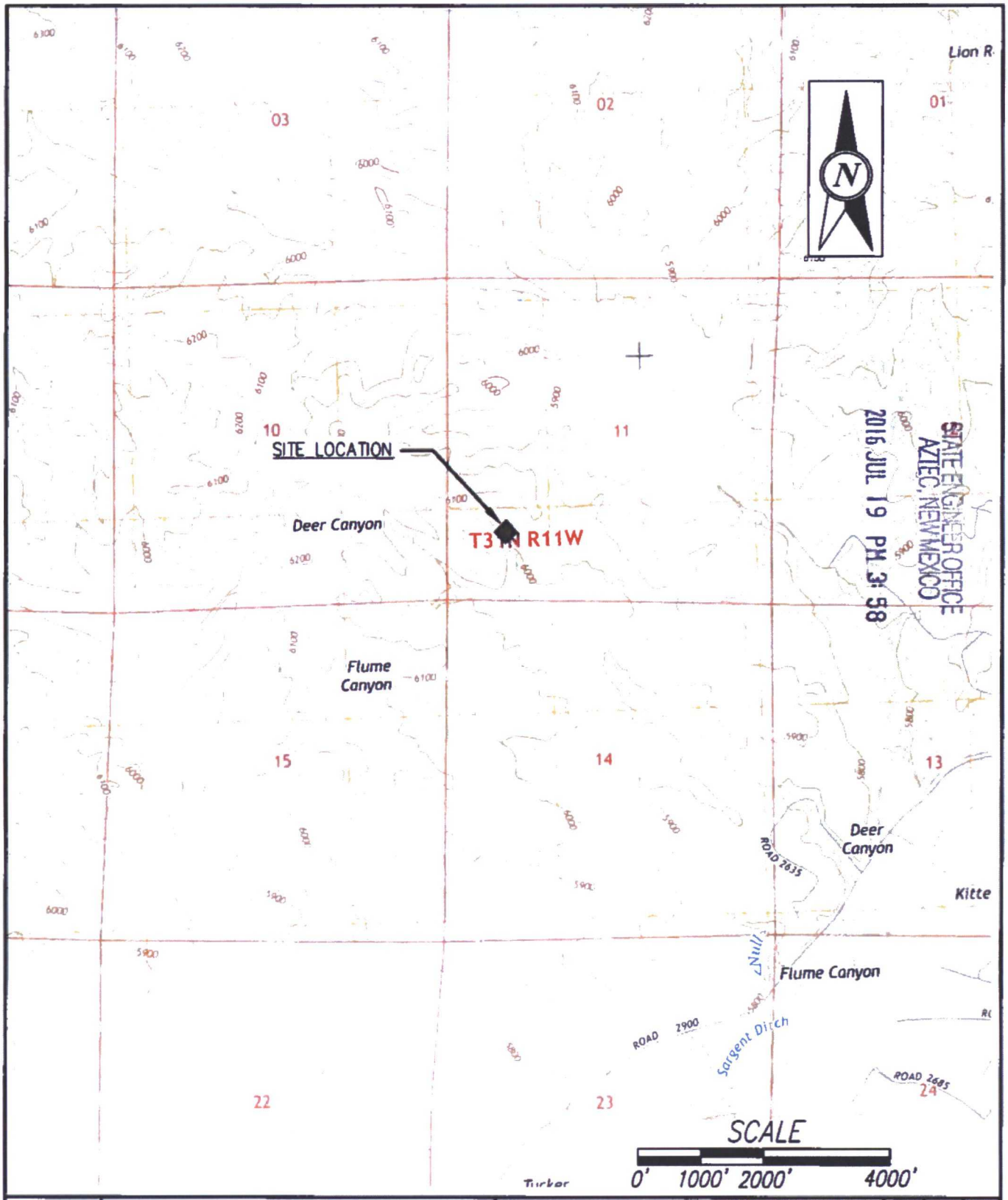
By: _____
Kimberly Kirby, Water Resource Specialist
Water Rights Division District V



Map Description: BP America Production Co.
Groundwater Investigation, BP Mudge LS6
Data sources: Application
File number: SJ-4205
Aerial Photography: 2015

STATE OF NEW MEXICO
Office of the State Engineer
Tom Blaine, P.E.
State Engineer

District V Office, Aztec
Well Location Map



SOUDER, MILLER & ASSOCIATES
401 West Broadway Avenue
Farmington, NM 87401-5907
Serving the Southwest & Rocky Mountains

BP FARMINGTON, NEW MEXICO

VICINITY MAP
MUDGE LS6
SECTION 11, T31N, R11W
SAN JUAN COUNTY, NEW MEXICO

Designed	Drawn	Checked
SH	DJB	RSA

Date JULY 2016
Scale Horiz 1" = 2000' Vert NA
Project No 5124371
Sheet 1

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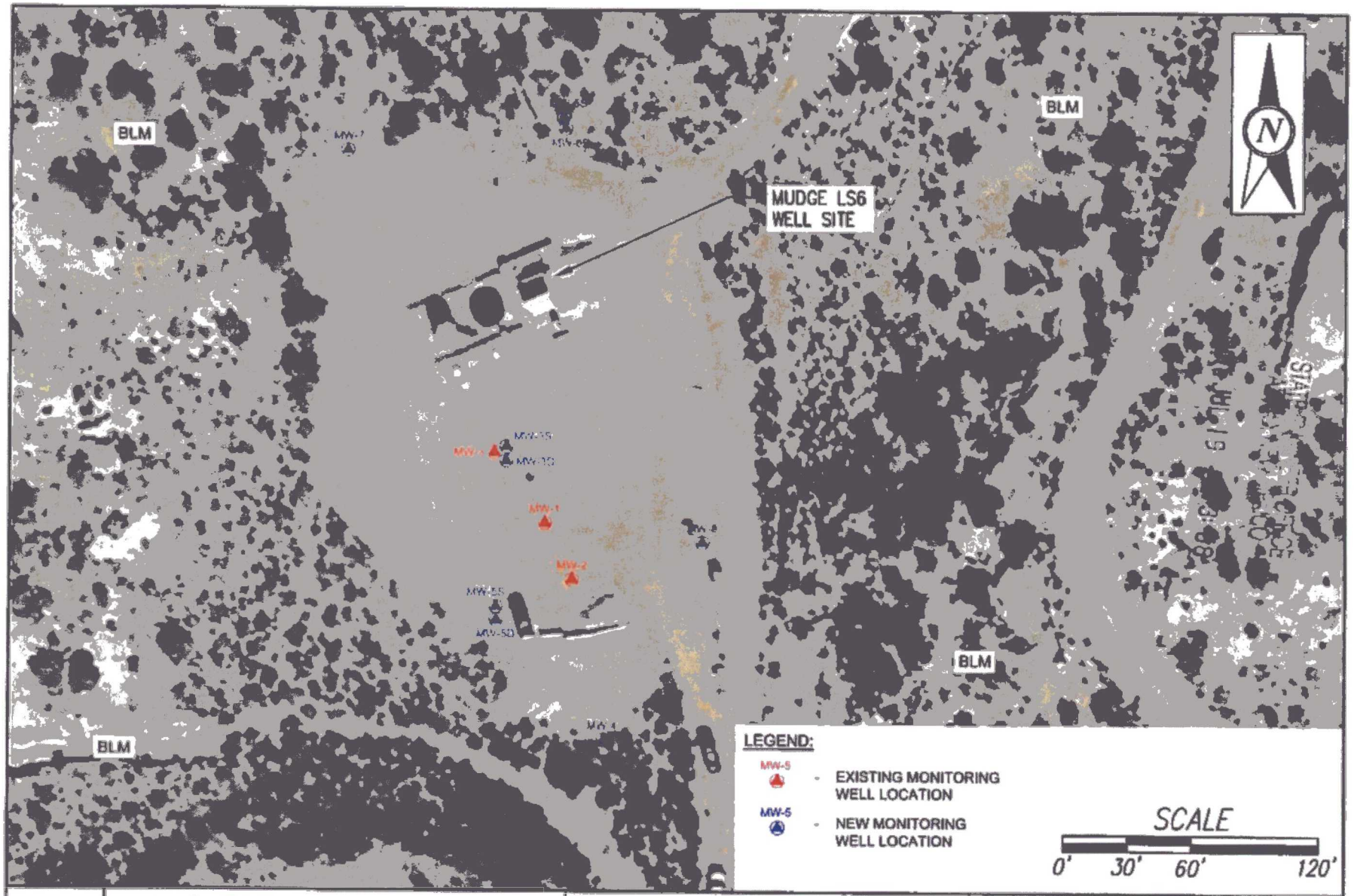

SMA
Engineering
Environmental
Surveying

SOUDER, MILLER & ASSOCIATES
401 West Broadway Avenue
Farmington, NM 87401-5927

BP
FARMINGTON, NEW MEXICO

MUDGE LS6
SITE MAP
SECTION 11, T31N, R11W
SAN JUAN COUNTY, NEW MEXICO

Designed	Drawn	Checked
SH	DJB	RSA

Date: JULY, 2015
Scale: Horiz. 1"=60 Vert. N/A
Project No: 5123917
Sheet: 2

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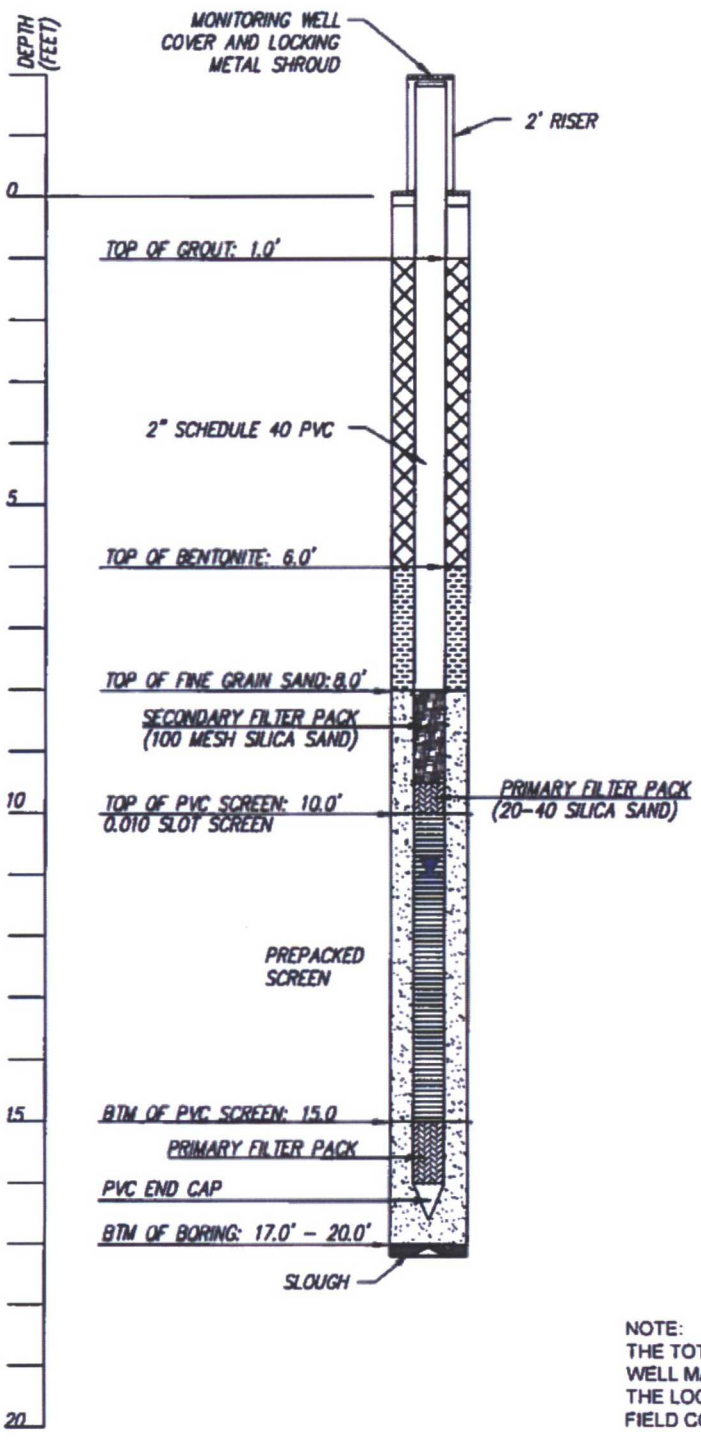

STATE ENGINEER OFFICE
AZTEC, NEW MEXICO
2016 JUL 19 PM 4:19

NOTE:
THE TOTAL DEPTH OF EACH MONITORING WELL MAY BE ADJUSTED DEPENDING ON THE LOCATION OF SATURATED SOILS AND FIELD CONDITIONS.

SOUDER, MILLER & ASSOCIATES
401 West Broadway Avenue
Farmington, NM 87401-5917
Serving the Southwest & Rocky Mountains

BP FARMINGTON, NEW MEXICO

PROPOSED SHALLOW MONITORING WELL LOG
MUDGE LS6
SECTION 11, T31N, R11W
SAN JUAN COUNTY, NEW MEXICO

Designed	Drawn	Checked
SH	DJB	RSA

Date JULY 2016
Scale Horiz 1" = 2000' Vert NA
Project No 5124371
Sheet 3

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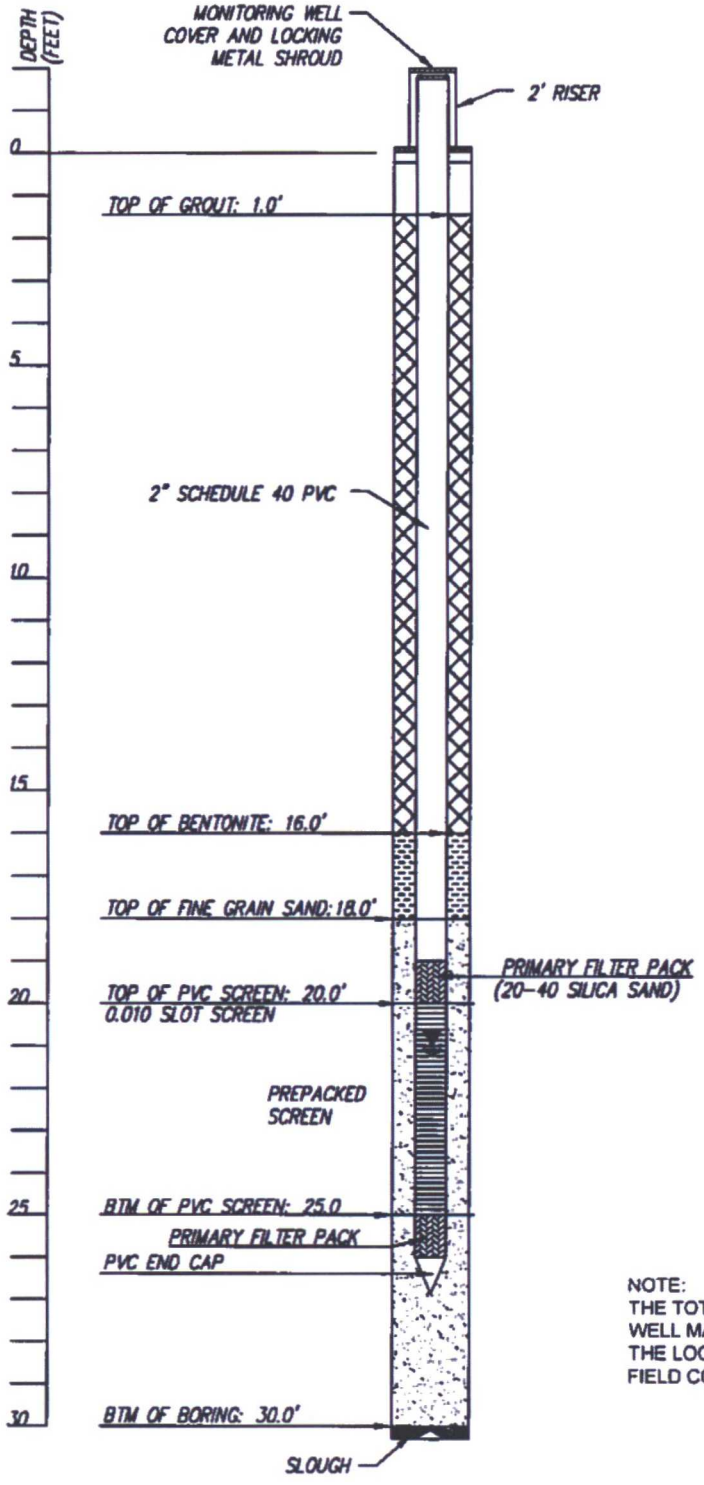

NOTE:
THE TOTAL DEPTH OF EACH MONITORING WELL MAY BE ADJUSTED DEPENDING ON THE LOCATION OF SATURATED SOILS AND FIELD CONDITIONS.

STATE ENGINEER OFFICE
AZTEC, NEW MEXICO
2016 JUL 19 PM 4:19

SOUDER, MILLER & ASSOCIATES
401 West Broadway Avenue
Farmington, NM 87401-5917
Phone: 505) 325-7535 Toll-free: (800) 519-6098 Fax: 505) 326-0843
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BP FARMINGTON, NEW MEXICO

PROPOSED DEEP MONITORING WELL LOG
MUDGE LS6
SECTION 11, T31N, R11W

SAN JUAN COUNTY, NEW MEXICO

Designed	Drawn	Checked
SH	DJB	RSA

Date JULY 2016
Scale Horiz NA Vert NA
Project No 5124371
Sheet 4

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P:\S-BP Mudge LS6 GW Investigation\5124371\CADD\r05123917 BP Mudge LS6 dwg, DJB, 7/19/2016 12:30 PM

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER
AZTEC

Tom Blaine, P.E.
State Engineer

100 Gossett Drive, Suite A
Aztec, New Mexico 87410

September 19, 2016

Loren Diede, Senior Scientist
Souder, Miller & Associates
401 W. Broadway
Farmington, NM 87401

RE: Permit Approval for Non-Consumptive Wells, SJ-4205 POD12, BP America Production Co., BP Mudge LS6 Release Investigation

Dear Mr. Diede:

On September 14, 2016, the New Mexico Office of the State Engineer (NMOSE) received an application to permit one new, recently installed groundwater monitoring well associated with the above referenced location. The application was submitted by Souder, Miller & Assoc. on behalf of BP America Production Co. Enclosed is a copy of the above numbered permit, which has been approved subject to the conditions set forth on the approval page and in the attached Conditions of Approval.

A standardized plugging method for the future abandonment of the wells covered by this permit has also been included in the Conditions of Approval. This eliminates the need to submit a separate Well Plugging Plan of Operations for approval by the NMOSE prior to plugging, unless an alternate plugging method is proposed, required by a separate oversight agency, necessary due to incompatibility with actual conditions, or artesian conditions are encountered. Please be aware that there are deadlines to submit well records for the newly installed monitoring wells and plugging records for any abandoned wells. These deadlines can be found in the attached Conditions of Approval. The well and plugging records should be sent to the NMOSE District V, 100 Gossett Drive, Suite A, Aztec, NM, 87410.

If you have any questions regarding this permitting action, please feel free to contact me at (505) 334-4751.

Sincerely,

Kimberly ~~Kirby~~
Water Resource Specialist
Water Rights Division District V

Enclosures

cc: Aztec Reading (w/o enclosures)
SJ-4205 File
WATERS
Steve Moskal, BP America Production Co., via email: Steven.Moskal@bp.com
Reid Allan, Souder, Miller & Assoc., via email: reid.allan@soudermiller.com

File No. SJ-4205 POD12

NEW MEXICO OFFICE OF THE STATE ENGINEER

APPLICATION FOR PERMIT TO DRILL A WELL WITH NO CONSUMPTIVE USE OF WATER

(check applicable box):

For fees, see State Engineer website: http://www.ose.state.nm.us/

2016 SEP 14 PM 3:53 STATE ENGINEER OFFICE AZTEC, NEW MEXICO

Purpose:
- ☐ Pollution Control And / Or Recovery
- ☐ Geo-Thermal
- ☐ Exploratory
- ☐ Construction Site De-Watering
- ☐ Other (Describe):
- ■ Monitoring
- ☐ Mineral De-Watering

A separate permit will be required to apply water to beneficial use.

■ Temporary Request - Requested Start Date: September 9, 2016 Requested End Date: October 1, 2016

Plugging Plan of Operations Submitted? ☐ Yes ■ No

OSE Notation: A standardized plugging method has been included in the Conditions of Approval for final abandonment of the well covered by this permit.

1. APPLICANT(S)

Name: BP America Production Co.; Represented by Souder Miller & Assoc.	Name: BP America Production Co.; Represented by Souder Miller & Assoc.
Contact or Agent: Loren Diede check here if Agent ■	Contact or Agent: Reid Allan check here if Agent ■
Mailing Address: 401 W Broadway	Mailing Address: 401 W Broadway
City: Farmington	City: Farmington
State: NM Zip Code: 87419	State: NM Zip Code: 87419
Phone: 505-334-8867 ☐ Home ■ Cell Phone (Work): 505-325-7535	Phone: 505-670-6812 ☐ Home ■ Cell Phone (Work): 505-325-7535
E-mail (optional): loren.diede@soudermiller.com	E-mail (optional): reid.allan@soudermiller.com

FOR OSE INTERNAL USE Application for Permit, Form wr-07, Rev 6/14/12

File No.: SJ-4205 POD12	Trn. No.:	Receipt No.:
Trans Description (optional):		
Sub-Basin:	PCW/LOG Due Date: Sept. 19, 2017	

2. **WELL(S)** Describe the well(s) applicable to this application.

Location Required: Coordinate location must be reported in NM State Plane (NAD 83), UTM (NAD 83), or Latitude/Longitude (Lat/Long - WGS84).
District II (Roswell) and District VII (Cimarron) customers, provide a PLSS location in addition to above.

☐ NM State Plane (NAD83) (Feet)
☐ NM West Zone
☐ NM East Zone
☐ NM Central Zone

☐ UTM (NAD83) (Meters)
☐ Zone 12N
☐ Zone 13N

■ Lat/Long (WGS84) (to the nearest 1/10th of second)

Well Number (if known):	X or Easting or Longitude:	Y or Northing or Latitude:	Provide if known: -Public Land Survey System (PLSS) (*Quarters or Halves , Section, Township, Range*) OR - Hydrographic Survey Map & Tract; OR - Lot, Block & Subdivision; OR - Land Grant Name
SJ-4205 POD12 MW-4D	-107.965590	36.908622	SW 1/4 of SW 1/4; sec.11, T31N, R11W

STATE ENGINEER OFFICE
AZTEC, NEW MEXICO
2016 SEP 14 PM 3:53

NOTE: If more well locations need to be described, complete form WR-08 (Attachment 1 – POD Descriptions)
Additional well descriptions are attached: ☐ **Yes** ☒ **No** **If yes, how many**_____

Other description relating well to common landmarks, streets, or other:
See attached map

Well is on land owned by: BLM

Well Information: NOTE: If more than one (1) well needs to be described, provide attachment. Attached? ☐ **Yes** ☐ **No**
If yes, how many_____

Approximate depth of well (feet): 19	Outside diameter of well casing (inches): 2.0"
Driller Name: Yellow Jacket Drilling Services	Driller License Number: WD-1458

3. **ADDITIONAL STATEMENTS OR EXPLANATIONS**

An application for 9 monitoring wells had previously been submitted and approved for this location, SJ 4205 POD 1-9.
The scope of work was modified after the permits were approved. A well was proposed as MW-4, Two wells were drilled at the MW-4 location, The original MW-4 on the SJ 4205 POD 3 was re-named MW-4S. This application is for the 2nd MW-4 well not previously permitted and is designated as MW-4D.
The well on SJ 4205, MW-6S was drilled and re-named MW-6.
A well on the SJ 4205, MW-8 POD 9 was not drilled.

FOR OSE INTERNAL USE — Application for Permit, Form wr-07

File No.: SJ-4205 POD12	Trn No.:

4. SPECIFIC REQUIREMENTS: The applicant must include the following, as applicable to each well type. Please check the appropriate boxes, to indicate the information has been included and/or attached to this application:

Exploratory: ☐ Include a description of any proposed pump test, if applicable.	**Pollution Control and/or Recovery:** ☐ Include a plan for pollution control/recovery, that includes the following: ☐ A description of the need for the pollution control or recovery operation. ☐ The estimated maximum period of time for completion of the operation. ☐ The annual diversion amount. ☐ The annual consumptive use amount. ☐ The maximum amount of water to be diverted and injected for the duration of the operation. ☐ The method and place of discharge.	**Construction De-Watering:** ☐ Include a description of the proposed dewatering operation, ☐ The estimated duration of the operation, ☐ The maximum amount of water to be diverted, ☐ A description of the need for the dewatering operation, and, ☐ A description of how the diverted water will be disposed of.	**Mine De-Watering:** ☐ Include a plan for pollution control/recovery, that includes the following: ☐ A description of the need for mine dewatering. ☐ The estimated maximum period of time for completion of the operation. ☐ The source(s) of the water to be diverted. ☐ The geohydrologic characteristics of the aquifer(s). ☐ The maximum amount of water to be diverted per annum. ☐ The maximum amount of water to be diverted for the duration of the operation. ☐ The quality of the water. ☐ The method of measurement of water diverted. ☐ The recharge of water to the aquifer. ☐ Description of the estimated area of hydrologic effect of the project. ☐ The method and place of discharge. ☐ An estimation of the effects on surface water rights and underground water rights from the mine dewatering project. ☐ A description of the methods employed to estimate effects on surface water rights and underground water rights. ☐ Information on existing wells, rivers, springs, and wetlands within the area of hydrologic effect.
Monitoring: ■ Include the reason for the monitoring well, and, ■ The duration of the planned monitoring.	☐ The method of measurement of water produced and discharged. ☐ The source of water to be injected. ☐ The method of measurement of water injected. ☐ The characteristics of the aquifer. ☐ The method of determining the resulting annual consumptive use of water and depletion from any related stream system. ☐ Proof of any permit required from the New Mexico Environment Department. ■ An access agreement if the applicant is not the owner of the land on which the pollution plume control or recovery well is to be located.	**Geo-Thermal:** ☐ Include a description of the geothermal heat exchange project, ☐ The amount of water to be diverted and re-injected for the project, ☐ The time frame for constructing the geothermal heat exchange project, and, ☐ The duration of the project. ☐ Preliminary surveys, design data, and additional information shall be included to provide all essential facts relating to the request.	

ACKNOWLEDGEMENT

I, We (name of applicant(s)), Souder Miller and Associates, Loren Diede and Reid Allan
Print Name(s)

affirm that the foregoing statements are true to the best of (my, our) knowledge and belief.

Applicant Signature

Applicant Signature

2016 SEP 14 PM 3:53
STATE ENGINEER OFFICE
AZTEC, NEW MEXICO

ACTION OF THE STATE ENGINEER

This application is:

☒ approved ☐ partially approved ☐ denied

provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare and further subject to the attached conditions of approval.

Witness my hand and seal this 19th day of September 20 16, for the State Engineer,

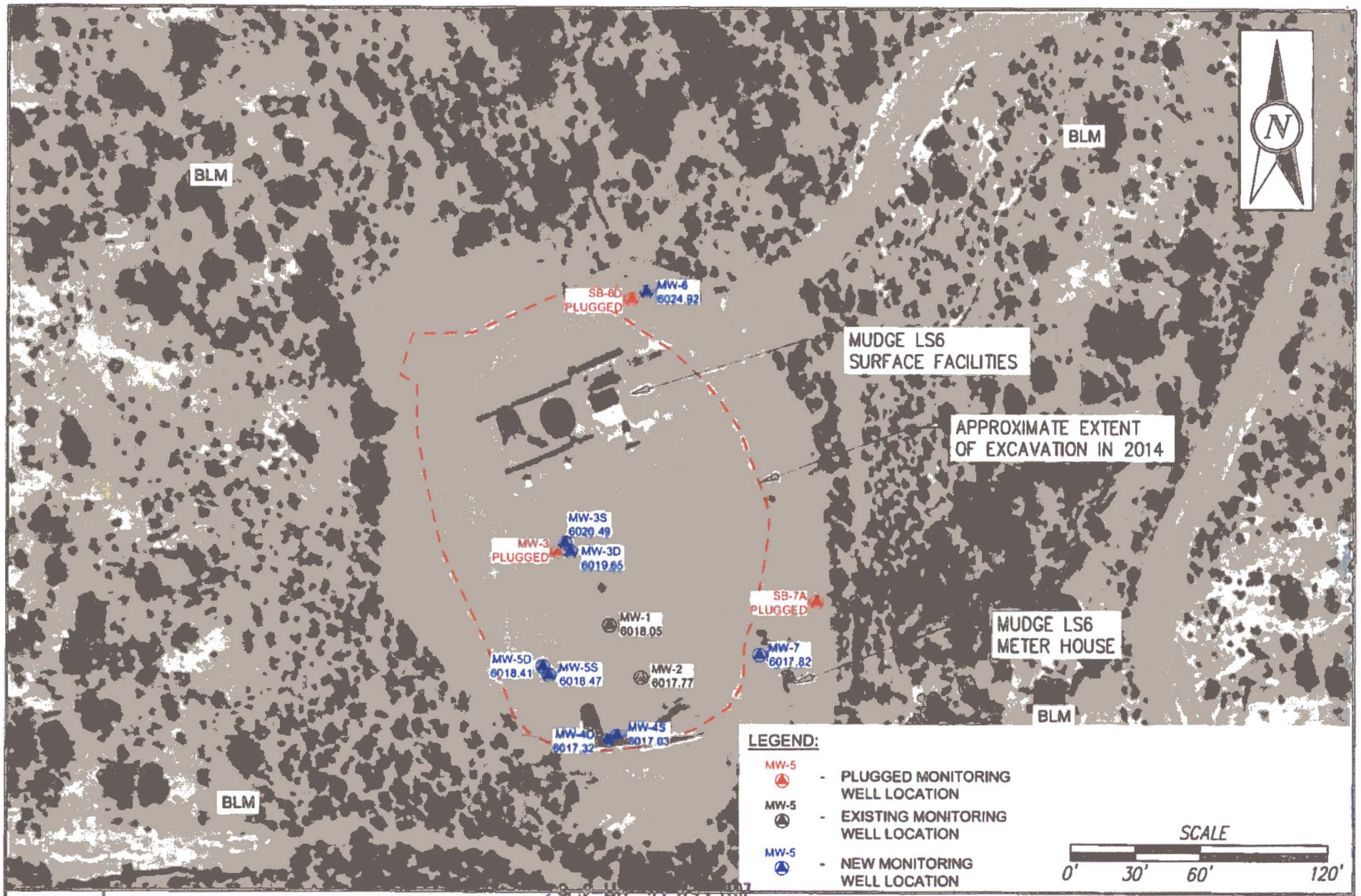
Tom Blaine, PE, State Engineer

By: _____ Kimberly Kirby
Signature Print

Title: Water Resource Specialist, Water Rights Division District V
Print

FOR OSE INTERNAL USE — Application for Permit, Form wr-07

File No.: SJ-4205 POD12	Trn No.



SMA
Engineering
Environmental
Surveying

SOUDER, MILLER & ASSOCIATES
401 West Broadway Avenue
Farmington, NM 87401-5907
Phone (505) 325-7535 Toll-Free (800) 519-8098 Fax (505) 326-6045
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FARMINGTON, NEW MEXICO

Designed: SH	Drawn: DJB	Checked: RSA

Date: JULY, 2016
Scale: Horiz: 1"=60' Vert: N/A
Project No: 5124371
Sheet: 3

MUDGE LS6
CURRENT SITE MAP
SECTION 11, T31N, R11W
SAN JUAN COUNTY, NEW MEXICO

STATE ENGINEER OFFICE
AZTEC, NEW MEXICO

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P:\0-BP Mudge LS6 GW Investigation 5124371\CADD\v5\123817 BP Mudge LS6.dwg, DJB, 9/6/2016 11:22 AM

NMOSE Permit to Drill a Non-Consumptive Well(s) - Conditions of Approval
SJ-4205 POD12

The New Mexico Office of the State Engineer (NMOSE) has determined that existing water rights will not be impaired by this activity. This application is approved without publication provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare of the state. This application approval (i.e., permit) is further subject to the following conditions of approval.

1. This permit is approved as follows:

Permittee(s): BP America Production Co.
via Souder, Miller & Associates, as Agent
401 W. Broadway
Farmington, NM 87401

Permit Number: SJ-4205

Application File Date: September 14, 2016

Priority: N/A

Source: Groundwater

Point(s) of Diversion: SJ-4205 POD12 is a new existing groundwater monitoring well recently installed for the site investigation at the BP Mudge LS6 release site, located on federal land managed by the Bureau of Land Management in San Juan County, New Mexico. The well (aka, point of diversion; POD) is located within the SW¼ SW¼ of Section 11, Township 31 North, Range 11 West, NMPM, at the following approximate point locations (Lat/Long, WGS84).

POD Name and Owner's Well Identification	Proposed Longitude (decimal deg.)	Proposed Latitude (decimal deg.)
SJ-4205 POD12 (MW-4D)	-107.965590	36.908622

Purpose of Use: Groundwater monitoring

Place of Use: N/A

Amount of Water: N/A

2. No water shall be appropriated and beneficially used from any wells or borings approved under this permit.

3. No water shall be diverted from the well(s) except for initial well development and periodic sampling purposes. Upon completion of monitoring activities the well(s) shall be plugged in accordance with Subsection C of 19.27.4.30 NMAC, unless a permit to use water is acquired from the NMOSE.

4. The well(s) may continue to be used indefinitely for groundwater sampling or monitoring required for the current site investigation and any associated remediation, so long as they remain in good repair. **A new permit shall be obtained from the NMOSE prior to replacing a well(s) or for any change in use as approved herein.**

5. Water well drilling and well drilling activities, including well plugging, are regulated under NMOSE Regulations 19.27.4 NMAC. These regulations apply, and provide both general and specific direction regarding the drilling of wells in New Mexico. Note that the construction of any well that allows groundwater to flow uncontrolled to the land surface or to move appreciably between geologic units is prohibited.

6. In accordance with Subsection A of 19.27.4.29 NMAC, on-site supervision of well drilling/plugging is required by the holder of a New Mexico Well Driller License or a NMOSE-registered Drill Rig Supervisor. The New Mexico licensed Well Driller shall ensure that well drilling activities are completed in accordance with 19.27.4.29, 19.27.4.30 and 19.27.4.31 NMAC. However, pursuant to 72-12-12 NMSA 1978 and 19.27.4.8 NMAC, a driller's license is not required for the construction of a driven well with an outside casing diameter of 2⅜ inches or less and that does not require the use of a drill rig (e.g., auger) for installation. This exemption is not applicable to well plugging.

7. The permittee has not indicated whether artesian conditions may be encountered at the proposed well location(s). If artesian conditions are encountered during drilling, all rules and regulations pertaining to the drilling and casing and plugging of artesian wells shall be followed.

8. A Well Record documenting the as-built well construction and materials used shall be filed for each of the new wells in accordance with Subsection K of 19.27.4.29 NMAC. **Well Records shall be filed with the State Engineer (NMOSE District V, 100 Gossett Drive, Suite A, Aztec, NM, 87410) within 20 days after completion of the well(s).** Well installation(s) shall be complete and the well record(s) filed no later than one year from the date of approval of this permit.

9. If the required Well Record documentation is not received within one year of the date of permit approval, this permit will automatically expire.

10. When the permittee receives approval or direction to permanently abandon the well(s)/borehole(s), plugging shall be performed by a New Mexico licensed well driller. The well(s)/borehole(s) shall be plugged pursuant to Subsection C of 19.27.4.30 NMAC using the following method, unless an alternate plugging method has been proposed by or on behalf of the well owner and approved by the NMOSE. If a well/borehole has encountered artesian conditions, a Well Plugging Plan of Operations shall be submitted and NMOSE approval obtained *prior* to the initiation of *any* well plugging activities concerning artesian wells. Additionally, if the following standardized plugging sealant is not appropriate for use due to incompatibility with the water quality or any soil and water contaminates encountered, a Well Plugging Plan of Operations shall be submitted and NMOSE approval obtained *prior* to the initiation of *any* well plugging activities.

    a. Obstructions in a well/borehole shall be identified and removed if possible. If an obstruction cannot be removed, the method used to grout below and around the obstruction shall be described in detail in the plugging record.

    b. Prior to plugging, calculate the theoretical volume of sealant needed for abandonment of the well/borehole based on the actual measured pluggable depth of the well/borehole and the volume factor for the casing/borehole diameter. Compare the actual volume of sealant placed in the well/borehole with the theoretical volume to verify the actual volume of sealant is equal to or exceeds the theoretical volume.

c. Portland Type I/II cement shall be used for the plugging sealant. The water mixed with the cement to create the plugging sealant shall be potable water or of similar quality. Portland cement has a fundamental water demand of 5.2 gallons of water per 94-lb sack of cement. Up to a maximum of 6.0 gallons per 94-lb sack is acceptable to allow for greater pumpability.

Pure bentonite powder ("90 barrel yield") is allowed as a cement additive by NMOSE and American Water Works Association (AWWA) guidelines. If a bentonite additive is used, the following rates and mixing guidelines shall be followed. For a rate or a mixing procedure other than that provided below, the NMOSE District V office must be contacted for pre-approval. Neither granular bentonite nor extended-yield bentonite shall be mixed with cement for the purpose of this plugging activity. When supplementing a cement slurry with bentonite powder, water demand for the mix increases at a rate of approximately 0.65 gallon of water for each 1% increment of bentonite bdwc (by dry weight cement) above the stated base water demand of 5.2 gallons water per 94-lb sack of cement for neat cement. Bentonite powder must be hydrated separately with its required increment of water before being mixed into the wet neat cement. If water is otherwise added to the combination of dry ingredients or the dry bentonite is blended into wet cement, the alkalinity of the cement will restrict the yield of the bentonite powder, resulting in excess free water in the slurry and excessive cement shrinkage upon curing.

d. Placement of the sealant within the well/borehole shall be by pumping through a tremie pipe extended to near the bottom of the well/borehole and kept below the top of the slurry column (i.e., immersed in the slurry) as the well/borehole is plugged from bottom upwards in a manner that displaces the standing water column.

e. Prior to, or upon completion of plugging, the well casing may be cut-off below grade as necessary to allow for approved construction onsite, provided a minimum six-inch thickness of reinforced abandonment plugging sealant or concrete completely covers the top of the cut-off casing. Any remaining void to the surface may be filled with native soil, concrete, or asphalt as needed to match the surrounding surface material and blended with the surface topography to prevent ponding.

f. **Within 20 days after completion of well/borehole plugging, a complete Plugging Record shall be filed with the State Engineer** in accordance with Paragraph (3) of Subsection C of 19.27.4.30 NMAC for each well/boring plugged. The Well Plugging Record(s) shall be filed with the State Engineer at the NMOSE District V Office, 100 Gossett Drive, Suite A, Aztec, NM 87410. The required well plugging record form is available at http://www.ose.state.nm.us/PDF/WellDrillers/WD-11.pdf.

11. Should another regulatory agency sharing jurisdiction of the project authorize, or by regulation require, more stringent requirements than stated herein, the more stringent procedure should be followed. These, among others, may include provisions regarding pre-authorization to proceed, type of methods and materials used, inspection, or prohibition of free discharge of any fluid or other material to or from the well that is related to the drilling and/or monitoring process.

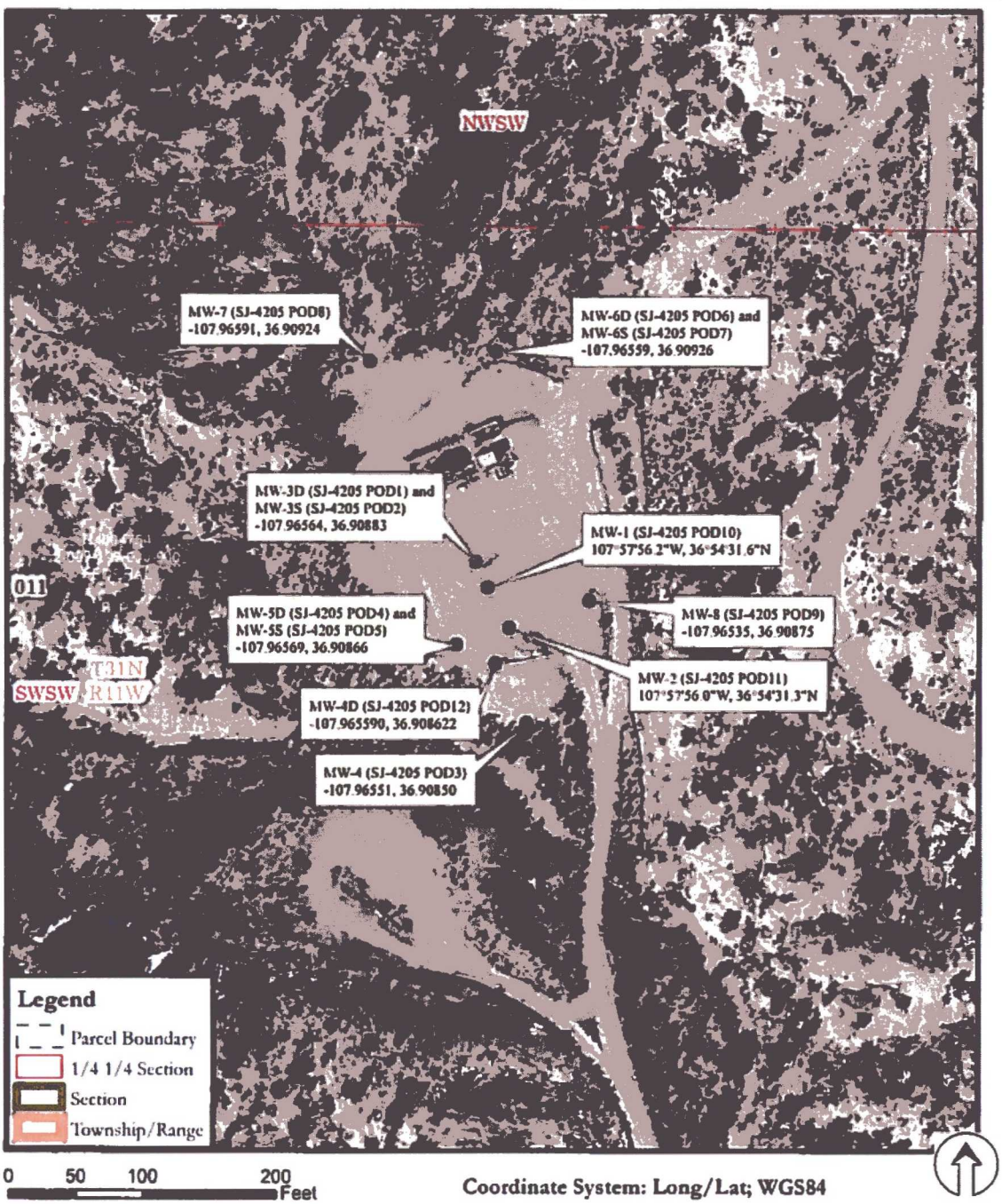
12. Pursuant to 72-12-3 NMSA 1978, the applicant has provided written documentation with the application, which the applicant claims as confirmation that access has been granted for the aforementioned well(s) to be located on property owned by someone other than the well owner/applicant. NMOSE approval of this permit in no way infers the right of access to land not owned by the well owner/applicant.

13. The State Engineer retains jurisdiction of this permit.

The application for non-consumptive use for well(s) SJ-4205 POD12, submitted on September 14, 2016, is hereby approved with the aforesaid conditions applied, when signed by an authorized designee of the State Engineer:

Witness my hand and seal this 19th day of September, A.D. 2016.
Tom Blaine, P.E., State Engineer

By: _____
Kimberly Kirby, Water Resource Specialist
Water Rights Division District V



Map Description: BP America Production Co.
Groundwater Investigation, BP Mudge LS6
Data sources: Application
File number: SJ-4205
Aerial Photography: 2015

STATE OF NEW MEXICO
Office of the State Engineer
Tom Blaine, P.E.
State Engineer

District V Office, Aztec
Well Location Map

SUBJECT Mudge LS #006 (SB-65) PROJECT PAGE 1

CLIENT BP DATE 8-1-2016 BY LLD

CHECKED BY

0730: meet YJD in Aztec, drive to location

0800: Arrive on location, meet with Bobby Shurman and Steve Moskal. Conduct PJSM, review well locations. Rig up YJD on borehole SB-65, Start drilling.

1050 & Collect 5' Split spoon sample. 14 blows, 18"

1104: Collect 10' split spoon sample 16 blows, 18"

1125: Found blue sand top at 12.5'

1140: Moving rig 5' to drill SB-6D

1215: SB-6D started drilling hard @ 10.5', collected split spoon sample from 10.5', took 39 blows to advance 6", Got sample of 9".

1245: Finish first day - stopped due to waiting for more YJD equipment, cement etc. SD, Secure location, travel back to town.

SUBJECT Mudge LS #006 (SB-6D) PROJECT PAGE 2

CLIENT BP DATE 8-2-2016 BY LLD

CHECKED BY

0600 : meet YJD in Aztec, drive to location

0645 : Arrive on location, PJSM, discuss SOW for the SB-6D.

0700 : Drill SB-6D, advance casing to 13' with 5 6 blows, 6" 1.5' stick up — Collect SplitSpoon to define contact @ 10.5'

0925 : Begin coring on SB-6D. (Had delays due to equipment issues)

1054 : Begin coring @ 13.0'.

1105 : Retrieve 1st core 13.0 to 16.5'

1315 : Driller had 4-Gas monitor alarm. stopped drilling @ 22.5', checked top of hole with PID - reading 4990 ppm max. checked top of hole with 4-Gas monitor LEL 15-18, H_2S 2-3. wait 5 min & check again - no alarms

1320 : Core barrel back in hole, continue operations, Hole Sloughing - work core barrel back to 22.5'.

1400 : Core from 27' to 30'. Lost air circulation core to 30', stop drilling, pull core. Recovered 1' Core from 29' to 30'. Dark grey fractured shale.

1500 : Driller noticed that water level in hole was rising. Noticed when water level was 10' BGL. In 20 minutes, water was at 5' BGL

1530 : Contacted BP, OSE and YJD regarding the artesian flow in SB-6D.
BP decided to abandon this hole, SMA made contact with OSE, got verbal approval to abandon the hole from Shawn @ OSE

1615 : Cemented the SB-6D with cement grout from TD to surface with type I&II cement + 3% bentonite via tremmie pipe.

1630 : SD, Secure location - travel back to town.

SUBJECT Mudge LS #6 (SB-7, MW-3 PROJECT SB-6S) PAGE 3

CLIENT BP DATE 8-3-2016 BY LLD

CHECKED BY

0600: Meet YJD in Aztec, drive to location

0700: PJSM. Move rig from SB-6D to SB-7.(A) Discuss SB-6D work with Rudy & Steve via phone. Review possible SB-7(A) locations with Bobby and Steve.

0845: Start drilling SB-7(A) collect split spoon sample @ 5.0', drill to 6.5, collect split spoon sample from 6.5' to 7.0'. Contact of brown to blue grey sand at 6.5'.

0930: Discussion with BP regarding the SB-7(A) borehole

1010: BP decided to abandon the SB-7(A) will find alternate location for the SB-7. → will be SB-7B will move to MW-3 and abandon that wellbore.

1025: Measure fluid level on the MW-3, found at 18.0'

1045: Pump cement via tremmie pipe into the 2" PVC on the MW-3.

1145: Start drilling out 2" PVC in MW-3 to 20'. Driller indicated that he was able to stay in the original wellbore to the top of cement just placed.

1220: Cemented the MW-3 from 20' to surface with Type I & II cement + 3% bentonite.

1230: Rig down from MW-3, move to SB-6S to construct well.

1330: Construct SB-6S to MW-6S as follows: TD 12.5', 1' sump, 5' screen, coarse sand around screen +6' above screen, 1' fine choke sand, 1' bentonite pellets. Dump water on pellets to hydrate. Cement grout to surface. 2' stick up. Steel riser with cover installed, a 3' circular pad poured with concrete. 3 bollards installed to protect the MW-6S.

1' cement on bottom

1530: SD, secure location and travel back to town.

SUBJECT Mudge LS #06 (SB-3S, SB-3D, SB-7B) PROJECT _____ PAGE 4

CLIENT BP DATE 8-4-2016 BY LLD

CHECKED BY

0600: Meet YJD in Aztec, drive to location.
0645: PJSM, review SOW for SB-3S & SB-3D.
0710: Start drilling SB-3S
0717: Collect 5' sample 17 blows, 12"
0725: Collect 10' sample 14 blows 16"
0740: Collect 14' sample, 7 blows 1st 1.0', then 70 blows for total of 16". Contact with blue sand at 14.0'
0800: RD on SB-3S to SB-3D
0835: Start drilling SB-3D. NOTE: (in discussion with Jesse, we discussed the "loose sand layer" at the brown/blue contact. This may not be present in the excavated area on the well pad).
0848: Found SB-3D brown/blue contact at 11.0'. Collected splitspoon sample from 11.4' to 12.2' (100 blows for 10")
0940: Casing set to coring point @ 12.6'. Core to TD of 19.5'
1205: Construct SB-3D to MW-3D as follows: TD 19.5', 1' sump, 5' prepacked screen, coarse sand around screen + 6", 1.0' fine choke sand, 2' bentonite pellets, Dump water on bentonite to hydrate. Cement grout to surface. 2' stickup. Install riser pipe
1235: RD, move to SB-3S to construct as MW-3S as follows: Plug back SB-3S to 13.0' with cement grout, 1' fine sand, 15' screen, coarse Sand around screen + 6" above screen, 1' bentonite pellets, dump water to hydrate bentonite, cement grout to surface with 2' stick up. Install steel riser pipe.

Note: Brown/blue contact was not sampled in the SB-3D. We drilled through the contact before it was expected. The contact was split spoon sampled in the SB-3S. The SB-3S sample SB-3S ID is: SB3-S-14.0-160804 is the contact sample for the MW-3 well cluster. The contact variation from SB-3S to SB-3D may be due to an uneven surface from the previous excavation

Area for the new SB-7 (B) # SB-4 wells was hydrovaced to expose buried communication lines & pipeline
1330: RD from SB-3S, move to SB-7B.
1425: Collect sample from SB-7B @ 4'-5'. 20 blows, 18"
1435: Collect sample from 9.5' to 10.5'. The brown/blue contact is 10.0'. Contact not as definitive as some others.
1515: Weather moving in, lightening, SD due to weather secure location, drive back to town

(9.5 - 10.5' sample Top, 30 blows, 6", Bottom 70 blows, 6")

SUBJECT Mudge LS #06 (SB-7B, SB-7A) PROJECT PAGE 5

CLIENT BP DATE 8-5-2016 BY LLD

CHECKED BY

0600 : meet y'D in Aztec, drive to location

0630 : PJSM, discuss SOW.
0645 : collect sample from 10.0' to 11.0'. Beginning to rain, SD to observe weather.
0705 : weather improved, back to determine definitive contact point. Drill to 11.5'.
0715 : Collect sample from 11.0' to 12.0' 107 blows for 7" Studied samples & drilling, agreed that contact point is 10.0'.
0745 : Plug back SB-7B from 11.5' to 9.5' with cement grout.
0755 : move to the original SB-7(A) to plug that borehole Pulled casing, plugged with cement grout from 6.5' to surface.
0815 : move to SB-5 well cluster
0830 : SD due to weather. Secure location, drive back to town. Road getting very slick.

SUBJECT Mudge LS #006 (SB-5S, SB-5D, SB-7B) PROJECT PAGE 6

CLIENT BP DATE 8-8-2016 BY LLD

CHECKED BY

0600: Meet YJD in Aztec, drive to location

0700: PJSM, discuss day's work to be done start drilling on SB-5S (later D). Sample collected @ 5.0' 28 blows, 18" (consider contact due to hardness)

0710: Sample split spoon from 6.0 to 6.8' - 100 blows for 7" change in density and color. Changed to SB-5D & prepare to core.

0803: Finish cutting core from 7.5' to 11.5': Contact at 9.0'. At 9.0' sample had odor - was collected as separate sample for analyses - PID reading was 128.7. (questionable (see above)) After 9.0' sample core had a clayey layer (questionable (see above)) at 10.0', "true" blue sand contact was found at 10.5-11.0'.

0830: Cut core from 11.5' to 14.0'. Found brown sand again from 11.5' to 12.5', 12.5' to 13.0' bluish grey, 13.0' to 14.0 grey silty sandstone with clay.

0945: move to SB-5S

0950: Collect sample from 4.0' to 5.5' 28 blows, 18"

1000: collect sample from 6.3' to 7.3' 100 blows, 14" Separated sample into 2. Contact determined to be at 6.8' Collected "contact" sample in 2- 8oz jars from 6.3' to 7.3' - labled 6.8'

1010: Crossfire on site to move "Jersey Barriers" from the SB-4 area. Constructed SB-5D as MW-5D as follows: TD 14.0', 1' Sump, 5' Pre packed screen from 13.0 to 8.0', coarse sand around screen +6", 1' fine choke sand, 2' bentonite pellets, dumped water to hydrate bentonite, cement grout to surface.

1040: Construct SB-5S as MW-5S as follows: Plugged back to 6.5' with cement grout, cut a 5' screen to 3' length. Ran 3' screen, coarse sand around screen +6", 1' fine choke sand, 1' bentonite pellets, dump water to hydrate bentonite, cement grout to surface.

1050: Install steel riser pipes with caps

1120: Construct SB-7B as MW-7 as follows: TD 9.5' (measure today), 5' screen, coarse sand around screen +6", 1' bentonite pellets, dump water to hydrate pellets, cement grout to surface (1' fine sand) Install steel riser pipe with cap.

SUBJECT Mudge LS0006 (SB-4S, SB-4D) PROJECT PAGE 6 (cont)

CLIENT BP DATE 8-8-2016 BY LLD

CHECKED BY

1225 : Move to SB-4S, SD, wait on Enterprise due to proximity to pipeline.
While waiting, crew installed bollards on; SB-3S, SB-3D, SB-5S, SB-6D wells.

1344 : Start on SB-4S, Collect sample from 4.0' to 5.5' 15 blows for 18", Collect sample 9.0' to 10.0' 11 blows for 18"

1402 : Collect sample ~~10.0'~~ to ~~11.0'~~, 114 blows for 12". ~~Contact point determined to be at 11.5'~~. SB-4S will now become SB-4D due to missing a good contact sample collection.

1415 : Core from 11.5' to 15.5', Lost 3.0' of core use 11.5' sample for contact sample

1450 : Core from 15.5' to 18.0', Lost 3.5' of core

1515 : Drill to 19.0' to TD. Construct well SB-4D as MW-4D as follows: 1' sump, 5' pre packed screen, coarse sand around screen and 6" above, 1' fine choke sand, 2' bentonite pellets, dump water to hydrate bentonite, cement grout to surface

1602 : move to SB-4S, drill to 4.0' collect sample from 4.0 to 5.5', 8 blows, 18"

1616 : Collect sample from 9.0' to 10.5' 12 blows for 18" Did not find definitive brown/blue contact. Stopped just short of contact to construct shallow well.
SB-4S as MW-4S
Drilled to 10.0', then constructed well as follows: TD 10.0', 5' screen, coarse sand around screen +6" above, 1' fine chokesand, 1' bentonite pellets, dump water to hydrate bentonite, cement grout to surface.

1715 : SD, Secure location, travel back to town.

SUBJECT Mudge LS #6 PROJECT PAGE 7

CLIENT BP DATE 8-9-2016 BY LLD

CHECKED BY

0600: X JD to location

0630: PJSM, discuss SOW for the day.

0700: Install remaining steel risers with caps on mw-4S & mw-4D.
Install bollards.

1100: Clean location- prepare to load all equipment and Rig down & move off.

1200: Check all wells for fluid level.

mw-3S	Dry
mw-3D	1.39' water
mw-4S	Dry
mw-4D	0.07' water
mw-5S	Dry
mw-5D	Dry
mw-6	Dry
mw-7	Dry

1400: Secure location, check for trash & debries travel back to town

SUBJECT Mudge LS 0006 PROJECT PAGE 8

CLIENT BP DATE 8-11-2016 BY LLD

CHECKED BY

1000 : SMA Surveyors arrive on location PJSM, discuss survey operations & fluid level measurment operations.

1015 : Unlock risers on all 8 new wells and the 2 old mw wells. Mark all wells with proper IDs inside the locking caps. Notched PVC casing on north side. Instructed Surveyors as to reference point.

Surveyors - working on the topographic survey

1030 : Fluid level on the mw-6, mw-7, mw 5S & 5D, mw 4S, mw 3S all dry. The mw-3D had 1.39' water in well, same as on 8-9-16. The mw-4D had 0.07' water. Too little to pump.

1105 : After discussion with Steve & Reid, pumped water out of the mw-3D, recovered 950 ml clear water.

1158 : Checked fluid level in mw-3D for recharge, No change - no fluid recharge.

1231 : Check fluid level in mw-1 & mw-2
mw-1 FL. @ 20.45', TD @ 25.43'
mw-2 FL @ 21.21', TD @ 31.34'

1300 : Secure location, Lock all mw caps, WD-40 the locks, Decon pump & waterlevel tape. Surveyors done with topographic survey Travel back to town.

SUBJECT Mudge LS 006 PROJECT PAGE 9

CLIENT BP DATE 8-19-16 BY LLD

CHECKED BY

0800: Arrive on location. Unlock all mw wells. Measure fluid levels on all wells:

well	Fluid level	TD	Fluid in WB
mw-6	N/A	13.04'	∅ Dry
mw-7	N/A	11.08'	∅ Dry
mw-5S	N/A	7.99'	∅ Dry
mw-5D	N/A	15.99'	∅ Dry
mw-4S	N/A	12.07'	∅ Dry
mw-3S	N/A	14.78'	∅ Dry
mw-4D	21.04'	21.10'	0.06' Too Small to pump
mw-3D	20.35'	21.10'	0.76'
mw-1	20.35'	25.43'	5.08'
mw-2	21.01'	31.34'	10.33'

0930 : Contacted Reid, discussed mw-3D as possible residual water from hydration of bentonite that had come out of sand pack. Decision made by Steve to pump off. Pumped well, recovered 450ml clear water. Waited 30 minutes, check fluid level, no recharge.

1000 : Secure location, Lock all well caps. Decon all equipment. Travel back to town.

Project: BP Mudge LS #06 Borehole#: SB-3S Start Date/Time: 0710 8-4-16

Project #: Rig/SamplerType: Stop Date/Time:

SMA Field Tech: Diede/Sprague Driller: Yellow Jacket Borehole Diameter:

Sample Depth	Time	Color	Secondary Soil Type	Primary Soil Type	Sorted	Grain Size (Sands Only)	Consolidation	Moisture	OVA results (ppm)	Remarks (Use trace, occasional, freguent and with to desribe increasing amounts)
5.0'	0717	Light tan / Dark brown / gray yellow / olive red	Gravelly / Sandy / Silty / Clayey	Boulder Sand / Cobble Silt / Pebble Clay / Gravel	Poorly / mod / Well	Very Coarse / Coarse / Medium / Fine / Very Fine	Rock / Semi-consolidated / Dense / Plastic / Unconsolidated	Dry / Moist / Wet	0.4	Fine to med grained, moderate to poorly sorted sand. clayey 80-90% quartz slightly plastic. calcareous. Blows - 17 for 12" 5YR 4/3
10.0'	0725	Light tan / Dark brown / gray yellow / olive red	Gravelly / Sandy / Silty / Clayey	Boulder Sand / Cobble Silt / Pebble Clay / Gravel	Poorly / mod / Well	Very Coarse / Coarse / Medium / Fine / Very Fine	Rock / Semi-consolidated / Dense / Plastic / Unconsolidated	Dry / Moist / Wet	1.1	Fine to med grained, moderate to poorly sorted Sand. Some pebbles. Slightly calcareous. 80-90% quartz Blows- 14 for 16" 5YR4/3
13.0	0740	Light tan / Dark brown / gray yellow / olive red	Gravelly / Sandy / Silty / Clayey	Boulder Sand / Cobble Silt / Pebble Clay / Gravel	Poorly / mod / Well	Very Coarse / Coarse / Medium / Fine / Very Fine	Rock / Semi-consolidated / Dense / Plastic / Unconsolidated	Dry / Moist / Wet	0.3	Contact between brown Sand & blue gray sand @ 14.0'. Fine to med grained. moderate sorting, to poor clayey, slightly plastic. slightly calcareous. Blows. 7 for 12". 5YR 4/3
14.0	0745	Light tan / Dark brown / gray yellow / olive red	Gravelly / Sandy / Silty / Clayey	Boulder Sand / Cobble Silt / Pebble Clay / Gravel	Poorly / Well	Very Coarse / Coarse / Medium / Fine / Very Fine	Rock / Semi-consolidated / Dense / Plastic / Unconsolidated	Dry / Moist / Wet	2.0	Angular to sub angular gray / Light brown Sand. medium grained, well sorted, non-calcareous cemented. 90%+ quartz. Minor mica & biotite. Cementing contains some vf.gr. quartz. minor rose quartz. ~~10YR4/1~~ 10YR4/1
		Light tan / Dark brown / gray yellow / olive red	Gravelly / Sandy / Silty / Clayey	Boulder Sand / Cobble Silt / Pebble Clay / Gravel	Poorly / Well	Very Coarse / Coarse / Medium / Fine / Very Fine	Rock / Semi-consolidated / Dense / Plastic / Unconsolidated	Dry / Moist / Wet		
		Light tan / Dark brown / gray yellow / olive red	Gravelly / Sandy / Silty / Clayey	Boulder Sand / Cobble Silt / Pebble Clay / Gravel	Poorly / Well	Very Coarse / Coarse / Medium / Fine / Very Fine	Rock / Semi-consolidated / Dense / Plastic / Unconsolidated	Dry / Moist / Wet		
		Light tan / Dark brown / gray yellow / olive red	Gravelly / Sandy / Silty / Clayey	Boulder Sand / Cobble Silt / Pebble Clay / Gravel	Poorly / Well	Very Coarse / Coarse / Medium / Fine / Very Fine	Rock / Semi-consolidated / Dense / Plastic / Unconsolidated	Dry / Moist / Wet		
		Light tan / Dark brown / gray yellow / olive red	Gravelly / Sandy / Silty / Clayey	Boulder Sand / Cobble Silt / Pebble Clay / Gravel	Poorly / Well	Very Coarse / Coarse / Medium / Fine / Very Fine	Rock / Semi-consolidated / Dense / Plastic / Unconsolidated	Dry / Moist / Wet		

Notes:

Project: BP Mudge LS #06 Borehole# SB 3D Start Date/Time: 0848 8-4-16

Project # Rig/SamplerType: Stop Date/Time:

SMA Field Tech: Diede/Sprague Driller: Yellow Jacket Borehole Diameter:

Sample Depth	Time	Color	Secondary Soil Type	Primary Soil Type	Sorted	Grain Size (Sands Only)	Consolidation	Moisture	OVA results (ppm)	Remarks (Use trace, occasional, freguent and with to desribe increasing amounts)
11.4	0915	Light tan / Dark brown / gray / olive red yellow	Gravelly / Sandy / Silty / Clayey	Boulder Cobble Pebble Gravel / Sand Silt Clay	Poorly / mod / Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry / Moist / Wet	3.5	Sub angular med-fine grained blue grey sand mod to well sorted 90+% quartz, minor mica - non-calcareous cementation. minor coarse quartz frag. (Brown/Grey Contact above 11.4') 10YR 5/2
12.6	1000	Light tan / Dark brown / gray / olive red yellow	Gravelly / Sandy / Silty / Clayey	Boulder Cobble Pebble Gravel / Sand Silt Clay	Poorly / mod / Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry / Moist / Wet	3.0	angular to sub angular, med to coarse grained brown-grey sand. Staining in cementation. minor mica. non-calcareous cement 10YR 6/4
14.5	1001	Light tan / Dark brown / gray / olive red yellow	Gravelly / Sandy / Silty / Clayey	Boulder Cobble Pebble Gravel / Sand Silt Clay	Poorly / mod / Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry / Moist / Wet	0.9	angular to sub angular, med to coarse grained brown-grey sand, non-calcareous cement 10YR 6/4
16.0	1002	Light tan / Dark brown / gray / olive red yellow	Gravelly / Sandy / Silty / Clayey	Boulder Cobble Pebble Gravel / Sand Silt Clay	Poorly / mod / Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry / Moist / Wet	1.0	angular (some sub angular) med to coarse grained grey-blue sand, non calcareous cement GLEY2 6/5B
17.0	1020	Light tan / Dark brown / gray / olive red yellow	Gravelly / Sandy / Silty / Clayey	Boulder Cobble Pebble Gravel / Sand Silt Clay	Poorly / mod / Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry / Moist / Wet	2.1	angular to sub angular med to coarse grained grey sand. Large pieces & Linear coal inclusions. Gypsum Layers in core. GLEY2 6/5B
19.0	1021	Light tan / Dark brown / gray / olive red yellow	Gravelly / Sandy / Silty / Clayey	Boulder Cobble Pebble Gravel / Sand Silt Clay	Poorly / mod / Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry / Moist / Wet	1.9	angular to sub angular med to coarse grained grey sand. Some coal pieces & Linear inclusions. Gypsum streaks & layers in core mod. sorted GLEY2 6/5B
		Light tan / Dark brown / gray / olive red yellow	Gravelly / Sandy / Silty / Clayey	Boulder Cobble Pebble Gravel / Sand Silt Clay	Poorly / Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry / Moist / Wet		
		Light tan / Dark brown / gray / olive red yellow	Gravelly / Sandy / Silty / Clayey	Boulder Cobble Pebble Gravel / Sand Silt Clay	Poorly / Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry / Moist / Wet		

Notes: Blue Sand top in SB-3S was found at 14.0'
Blue Sand top in SB-3D was found at 11.0'
These boreholes are in the excavated area & the surface of the original excavation is uneven - therefore the top of the blue sand will vary.

Project:_____ Borehole# SB 45 Start Date/Time: 1602 8-8-16

Project #_____ Rig/SamplerType:_____ Stop Date/Time:_____

SMA Field Tech:_____ Driller:_____ Borehole Diameter:_____

Sample Depth	Time	Color	Secondary Soil Type	Primary Soil Type	Sorted	Grain Size (Sands Only)	Consolidation	Moisture	OVA results (ppm)	Remarks (Use trace, occasional, freguent and with to desribe increasing amounts)
4.0	1604	*Light* tan *Dark* brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet	2.0	Subrounded brown v. fine to coarse grained poorly sorted sand. Some pebbles 8 blows for 18" 10YR 4/3
9.0	1606	*Light* tan *Dark* brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet	3.1	Subangular sub rounded v. fine to med grained poorly sorted brown sand. High clay content, semi plastic 12 blows for 18" 2.5Y 5/2
10.0	1612	*Light* tan *Dark* brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet	3.0	Subrounded to rounded v. fine to coarse brown sand. 10YR 4/3
		Light tan *Dark* brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light tan *Dark* brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light tan *Dark* brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light tan *Dark* brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light tan *Dark* brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		

Notes:

Change from shallow to deep

Project: _____ Borehole# SB-4XD Start Date/Time: 1335 8-8-16

Project # _____ Rig/SamplerType: _____ Stop Date/Time: _____

SMA Field Tech: _____ Driller: _____ Borehole Diameter: _____

Sample Depth	Time	Color	Secondary Soil Type	Primary Soil Type	Sorted	Grain Size (Sands Only)	Consolidation	Moisture	OVA results (ppm)	Remarks (Use trace, occasional, freguent and with to desribe increasing amounts)
4.0	1344	Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly mod Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet	1.7	Subrounded fine to med Sand mod sorted clay film 15 blows for 18" 10YR 5/3
9.0 10.0	1350	Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly mod Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet	1.2	subrounded fine to med Sand mod. Sorted clay film & clay nodules. 11 blows for 18" 10YR 5/3
10.0 11.0	1402	Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly mod Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet	2.6	Sub rounded fine to med Sand mod Sorted brown grey Sand clay film minor mica 114 blows for 12" 10YR 5/3
CORE 11.5	1430	Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly mod Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet	10.3	Angular Subangular med to coarse grey-brown Sand. mod to well sorted clay in pores. Trace mica. (lost 3' of unconsolidated core) GLEY2 5/5BG
CORE 18.0	1450	Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet	53	Subangular to subrounded fine to coarse dark grey Sand. Poorly Sorted. Some v. dark grey shale. (lost 3.5' of unconsolidated core) GLEY2 5/10B
		Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		

contact 11.5'

Notes:

Project: BP Mudge LS 006 Borehole# SB 5 S Start Date/Time: 0945 8-8-16

Project # Rig/SamplerType: Stop Date/Time:

SMA Field Tech: Driller: Borehole Diameter:

Sample Depth	Time	Color	Secondary Soil Type	Primary Soil Type	Sorted	Grain Size (Sands Only)	Consolidation	Moisture	OVA results (ppm)	Remarks (Use trace, occasional, freguent and with to desribe increasing amounts)
4.5	0955	Light tan / Dark brown / gray yellow / olive red	Gravelly / Sandy / Silty / Clayey	Boulder Sand / Cobble Silt / Pebble Clay / Gravel	Poorly / Well	Very Coarse / Coarse / Medium / Fine / Very Fine	Rock / Semi-consolidated / Dense / Plastic / Unconsolidated	Dry / Moist / Wet	6.4	Subrounded, fine to coarse, poorly sorted brown sand, Arcosic, clay films. non calcareous cementation 28 blows for 18" 10YR 5/4
6.3	1080	Light tan / Dark brown / gray yellow / olive red	Gravelly / Sandy / Silty / Clayey	Boulder Sand / Cobble Silt / Pebble Clay / Gravel	Poorly / mod / Well	Very Coarse / Coarse / Medium / Fine / Very Fine	Rock / Semi-consolidated / Dense / Plastic / Unconsolidated	Dry / Moist / Wet		Sample 2 — Subrounded. fine to v. fine grained moderately sorted sand. Brown grey non calcareous cementation. Moderate mica 100 blows for 14" 2.5Y 6/2
6.8	1000	Light tan / Dark brown / gray yellow / olive red	Gravelly / Sandy / Silty / Clayey	Boulder Sand / Cobble Silt / Pebble Clay / Gravel	Poorly / Well	Very Coarse / Coarse / Medium / Fine / Very Fine	Rock / Semi-consolidated / Dense / Plastic / Unconsolidated	Dry / Moist / Wet	1.3	contact @ 6.8: Subrounded. Subangular. fine to med grained well sorted Sand. clayey non calcareous cementation 2.5Y 5/2
		Light tan / Dark brown / gray yellow / olive red	Gravelly / Sandy / Silty / Clayey	Boulder Sand / Cobble Silt / Pebble Clay / Gravel	Poorly / Well	Very Coarse / Coarse / Medium / Fine / Very Fine	Rock / Semi-consolidated / Dense / Plastic / Unconsolidated	Dry / Moist / Wet		→ Top 6" 20 blows Bott 6" 80 blows
		Light tan / Dark brown / gray yellow / olive red	Gravelly / Sandy / Silty / Clayey	Boulder Sand / Cobble Silt / Pebble Clay / Gravel	Poorly / Well	Very Coarse / Coarse / Medium / Fine / Very Fine	Rock / Semi-consolidated / Dense / Plastic / Unconsolidated	Dry / Moist / Wet		
		Light tan / Dark brown / gray yellow / olive red	Gravelly / Sandy / Silty / Clayey	Boulder Sand / Cobble Silt / Pebble Clay / Gravel	Poorly / Well	Very Coarse / Coarse / Medium / Fine / Very Fine	Rock / Semi-consolidated / Dense / Plastic / Unconsolidated	Dry / Moist / Wet		
		Light tan / Dark brown / gray yellow / olive red	Gravelly / Sandy / Silty / Clayey	Boulder Sand / Cobble Silt / Pebble Clay / Gravel	Poorly / Well	Very Coarse / Coarse / Medium / Fine / Very Fine	Rock / Semi-consolidated / Dense / Plastic / Unconsolidated	Dry / Moist / Wet		
		Light tan / Dark brown / gray yellow / olive red	Gravelly / Sandy / Silty / Clayey	Boulder Sand / Cobble Silt / Pebble Clay / Gravel	Poorly / Well	Very Coarse / Coarse / Medium / Fine / Very Fine	Rock / Semi-consolidated / Dense / Plastic / Unconsolidated	Dry / Moist / Wet		

Notes:

change from shallow to deep

Project: BP Midge LS006 Borehole# SB-5~~S~~D (1) Start Date/Time: 0815 8-5-16

Project # Rig/SamplerType: Stop Date/Time:

SMA Field Tech: Diede / Sprague Driller: Yellow Jacket Borehole Diameter:

Sample Depth	Time	Color	Secondary Soil Type	Primary Soil Type	Sorted	Grain Size (Sands Only)	Consolidation	Moisture	OVA results (ppm)	Remarks (Use trace, occasional, freguent and with to desribe increasing amounts)
5.0	~~8-8-16~~ 0700	Light, Dark, gray, olive / tan, brown, yellow, red	Gravelly, Sandy, Silty, Clayey	Boulder, Cobble, Pebble, Gravel / Sand, Silt, Clay	Poorly, Well	Very Coarse, Coarse, Medium, Fine, Very Fine	Rock, Semi-consolidated, Dense, Plastic, Unconsolidated	Dry, Moist, Wet	6.3	Subangular fine to V. Coarse mixed sand brown with some pebbles. minor grey clay inclusions 39 blows for 18" 5YR 5/4
6.0	0710	Light, Dark, gray, olive / tan, brown, yellow, red	Gravelly, Sandy, Silty, Clayey	Boulder, Cobble, Pebble, Gravel / Sand, Silt, Clay	Poorly, mod, Well	Very Coarse, Coarse, Medium, Fine, Very Fine	Rock, Semi-consolidated, Dense, Plastic, Unconsolidated	Dry, Moist, Wet	2.2	Angular to Subangular fine grained to V. fine grained grey-brown. Well to mod Sorted sand. Minor mica. Clayey, non calcareous cementation. 100 blows for 7" 2.5Y 5/1 Contact 6.0'
core1 7.5	0750	Light, Dark, gray, olive / tan, brown, yellow, red	Gravelly, Sandy, Silty, Clayey	Boulder, Cobble, Pebble, Gravel / Sand, Silt, Clay	Poorly, mod, Well	Very Coarse, Coarse, Medium, Fine, Very Fine	Rock, Semi-consolidated, Dense, Plastic, Unconsolidated	Dry, Moist, Wet	2.3	Angular Subangular fine grained to V. fine grained grey brown. well to mod Sorted sand, minor mica. non calcareous cementation. 2.5Y 5/1
9.0	0800	Light, Dark, gray, olive / tan, brown, yellow, red	Gravelly, Sandy, Silty, Clayey	Boulder, Cobble, Pebble, Gravel / Sand, Silt, Clay	Poorly, mod, Well	Very Coarse, Coarse, Medium, Fine, Very Fine	Rock, Semi-consolidated, Dense, Plastic, Unconsolidated	Dry, Moist, Wet	128.7	Angular Subangular fine grained to v. fine grained grey brown. well to mod sorted sand, minor mica. non calcareous cementation 2.5Y 6/3
10.0	0802	Light, Dark, gray, olive / tan, brown, yellow, red	Gravelly, Sandy, Silty, Clayey	Boulder, Cobble, Pebble, Gravel / Sand, Silt, Clay	Poorly, mod, Well	Very Coarse, Coarse, Medium, Fine, Very Fine	Rock, Semi-consolidated, Dense, Plastic, Unconsolidated	Dry, Moist, Wet	21.7	Angular Subangular fine grained to V. fine grained grey brown and well to mod sorted sand, minor mica. non calcareous cementation. 10YR 6/2
11.0	0803	Light, Dark, gray, olive / tan, brown, yellow, red	Gravelly, Sandy, Silty, Clayey	Boulder, Cobble, Pebble, Gravel / Sand, Silt, Clay	Poorly, mod, Well	Very Coarse, Coarse, Medium, Fine, Very Fine	Rock, Semi-consolidated, Dense, Plastic, Unconsolidated	Dry, Moist, Wet	112.2	Angular subangular fine to med grained grey Sand moderatly sorted. Abundant mica. non calcareous cementation GLEY 2 5/10B
core2 12.0	0830	Light, Dark, gray, olive / tan, brown, yellow, red	Gravelly, Sandy, Silty, Clayey	Boulder, Cobble, Pebble, Gravel / Sand, Silt, Clay	Poorly, mod, Well	Very Coarse, Coarse, Medium, Fine, Very Fine	Rock, Semi-consolidated, Dense, Plastic, Unconsolidated	Dry, Moist, Wet	148.2	Angular Subangular fine to med grain sand with silt. poorly sorted. minor mica. 2.5 Y 5/3
12.5	0832	Light, Dark, gray, olive / tan, brown, yellow, red	Gravelly, Sandy, Silty, Clayey	Boulder, Cobble, Pebble, Gravel / Sand, Silt, Clay	Poorly, mod, Well	Very Coarse, Coarse, Medium, Fine, Very Fine	Rock, Semi-consolidated, Dense, Plastic, Unconsolidated	Dry, Moist, Wet	64.3	Angular Subangular fine to med grain Sand. minor mica. mod sorted. 2.5Y 5/2

Notes:

Project:_____ Borehole# SB 5D (2) Start Date/Time:_____

Project #_____ Rig/SamplerType:_____ Stop Date/Time:_____

SMA Field Tech:_____ Driller:_____ Borehole Diameter:_____

Sample Depth	Time	Color	Secondary Soil Type	Primary Soil Type	Sorted	Grain Size (Sands Only)	Consolidation	Moisture	OVA results (ppm)	Remarks (Use trace, occasional, freguent and with to desribe increasing amounts)
13.0	0834	*Light* tan *Dark* brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly mod Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet	10.6	Angular Sub angular med. fine grained grey sand. Heavily clay cemented. GLEY 2 6/5BG
		Light tan *Dark* brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light tan *Dark* brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light tan *Dark* brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light tan *Dark* brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light tan *Dark* brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light tan *Dark* brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light tan *Dark* brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		

Notes:

Project: BP Mudge LS #6 Borehole# SB-65 Start Date/Time: 1045 8-1-16

Project # Rig/SamplerType: Stop Date/Time: 11:45

SMA Field Tech: Diede/Sprague Driller: yellow jacket Borehole Diameter:

Sample Depth	Time	Color	Secondary Soil Type	Primary Soil Type	Sorted	Grain Size (Sands Only)	Consolidation	Moisture	OVA results (ppm)	Remarks (Use trace, occasional, freguent and with to desribe increasing amounts)
5'	1050	Light Dark gray olive / tan brown yellow red	Gravelly Sandy Silty Clayey	Boulder Cobble Pebble Gravel / Sand Silt Clay	Poorly mod Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet	4.6	Very thin/sparse clay films 10YR4/4 ~80% Qtz grain 14Blows/18" Some red fine grain sand, Plagioclase, calcium
10'	1104	Light Dark gray olive / tan brown yellow red	Gravelly Sandy Silty Clayey	Boulder Cobble Pebble Gravel / Sand Silt Clay	Poorly mod Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet	4.4	Some clay film, coatings 10YR4/4 >90% Qtz grains, few tone feldspars, U. few dark grains Some fine grains 16 Blows/18"
		Light Dark gray olive / tan brown yellow red	Gravelly Sandy Silty Clayey	Boulder Cobble Pebble Gravel / Sand Silt Clay	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light Dark gray olive / tan brown yellow red	Gravelly Sandy Silty Clayey	Boulder Cobble Pebble Gravel / Sand Silt Clay	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light Dark gray olive / tan brown yellow red	Gravelly Sandy Silty Clayey	Boulder Cobble Pebble Gravel / Sand Silt Clay	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light Dark gray olive / tan brown yellow red	Gravelly Sandy Silty Clayey	Boulder Cobble Pebble Gravel / Sand Silt Clay	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light Dark gray olive / tan brown yellow red	Gravelly Sandy Silty Clayey	Boulder Cobble Pebble Gravel / Sand Silt Clay	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light Dark gray olive / tan brown yellow red	Gravelly Sandy Silty Clayey	Boulder Cobble Pebble Gravel / Sand Silt Clay	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		

Notes:

Project: BP Mudge LS #006 | Borehole# SB 6D | Start Date/Time: 11:45 8-1-16

Project #: | Rig/SamplerType: | Stop Date/Time:

SMA Field Tech: Diede/Sprague | Driller: Yellow Jacket | Borehole Diameter:

Sample Depth	Time	Color	Secondary Soil Type	Primary Soil Type	Sorted	Grain Size (Sands Only)	Consolidation	Moisture	OVA results (ppm)	Remarks (Use trace, occasional, freguent and with to desribe increasing amounts)
10.5	8-1 1215	Light Dark (gray) olive / tan brown yellow red	Gravelly Sandy Silty Clayey	Boulder Cobble Pebble Gravel / (Sand) Silt Clay	Poorly mod Well	Very Coarse Coarse Medium (Fine) Very Fine	Rock Semi-consolidated Dense Plastic (Unconsolidated)	Dry (Moist) Wet	1.9	grey/blue Sand. high feldspar, amphibole, mica pieces. moderate cementation, clay cemenation, cemenated nodules Blows - 39 for 6" GLEY2 7/5B
13.0 To 16.5	8-2 1105	Light Dark (gray) olive / tan brown yellow red	Gravelly (Sandy) Silty (Clayey)	Boulder Cobble Pebble Gravel / (Sand) Silt Clay	Poorly mod Well	Very Coarse Coarse (Medium) Fine Very Fine	Rock (Semi-consolidated) Dense Plastic Unconsolidated	Dry (Moist) Wet	3.2 5.0	grey/blue Sandstone, subangular fine to medium grain. 95+% quartz non calc cementation. minor mica. [redacted] GLEY2 7/5B
17.0 To 22.0	1230	Light Dark (gray) olive / tan brown yellow red	Gravelly (Sandy) Silty Clayey	Boulder Cobble Pebble Gravel / (Sand) Silt Clay	Poorly mod (Well)	Very Coarse Coarse Medium (Fine) Very Fine	Rock (Semi-consolidated) Dense Plastic Unconsolidated	Dry (Moist) Wet	6.5 4.0	grey/blue Sandstone, subrounded fine grained, minor med grained, 95+% qtz minor mica and biotite. clay cementation [redacted] GLEY2 7/10B
23.7 TO 27.0	1330	Light Dark (gray) olive / tan brown yellow red	Gravelly (Sandy) Silty Clayey	Boulder Cobble Pebble Gravel / (Sand) Silt Clay	Poorly Well	Very Coarse Coarse Medium (Fine) Very Fine	(Rock Semi-consolidated) Dense Plastic Unconsolidated	Dry (Moist) Wet	9.0 10.5	grey/blue Sandstone, subangular to subrounded fine grained w/ small interval of subangular fine to med grained. 95+% qtz minor mica & biotite. clay cemntation. [redacted] GLEY2 7/5PB
29.0 To 30.0	1420	Light (Dark) gray olive / tan brown yellow red	Gravelly Sandy (Silty) (Clayey)	Boulder Cobble Pebble Gravel / Sand (Silt) (Clay)	(Well)	Very Coarse Coarse Medium Fine (Very Fine)	(Rock Semi-consolidated) Dense Plastic Unconsolidated	Dry Moist (Wet)	7.9	dark grey shale. Core very broken recover less than 1' of 3' cored 5Y5/1
	1500	Light Dark gray olive / tan brown yellow red	Gravelly Sandy Silty Clayey	Boulder Cobble Pebble Gravel / Sand Silt Clay	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		Artesian flow detected @ 15:00 Source is from 29.0' to 30.0'.
		Light Dark gray olive / tan brown yellow red	Gravelly Sandy Silty Clayey	Boulder Cobble Pebble Gravel / Sand Silt Clay	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light Dark gray olive / tan brown yellow red	Gravelly Sandy Silty Clayey	Boulder Cobble Pebble Gravel / Sand Silt Clay	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		

Notes:

Project: BP Mudge LS #6 | Borehole#: SB 7 A | Start Date/Time: 0830 8-3-16

Project #: | Rig/SamplerType: | Stop Date/Time:

SMA Field Tech: Diede / Sprague | Driller: Yellow Jacket | Borehole Diameter:

Sample Depth	Time	Color	Secondary Soil Type	Primary Soil Type	Sorted	Grain Size (Sands Only)	Consolidation	Moisture	OVA results (ppm)	Remarks (Use trace, occasional, freguent and with to desribe increasing amounts)
5.0	0915	Light tan Dark **brown** gray yellow olive red	Gravelly Sandy Silty **Clayey**	Boulder Sand Cobble **Silt** Pebble **Clay** Gravel	Poorly mod Well	Very Coarse Coarse Medium Fine **Very Fine**	Rock Semi-consolidated **Dense** Plastic Unconsolidated	**Dry** Moist Wet	Ø	Brown fine, very fine silt, clay, dense dry. Moderate sorting. 10YR 5/3 100 blows for 8".
6.5	0935	Light tan Dark brown **gray** yellow olive red	**Sandy** Silty Clayey	Boulder **Sand** Cobble Silt Pebble Clay Gravel	Poorly mod Well	Very Coarse Coarse **Medium** **Fine** Very Fine	Rock Semi-consolidated Dense Plastic **Unconsolidated**	Dry **Moist** Wet	23	Subangular, med to fine Sand blue-grey moderate sorted. GLEY2 5/5PB 100 blows for 7".
		Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		

Notes:

Project: B Pmudge LS 006
Project #
SMA Field Tech: Diede/Sprague

Borehole# SB 7B
Rig/SamplerType:
Driller: Yellow Jacket

Start Date/Time: 1400 8-4-2016
Stop Date/Time:
Borehole Diameter:

Sample Depth	Time	Color	Secondary Soil Type	Primary Soil Type	Sorted	Grain Size (Sands Only)	Consolidation	Moisture	OVA results (ppm)	Remarks (Use trace, occasional, freguent and with to desribe increasing amounts)
4.0	1425	Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet	1.2	Angular to Subangular fine to coarse poorly sorted brown sand. minor pebbles. Arkosic with no apparent cementation. 75-80% gt3. 4.0'-5.5' spoon 5YR 4/2
9.5	1435	Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet	2.0	Angular to subangular fine to coarse poorly sorted brown-grey sand. minor pebbles. Arkosic with no apparent cementation. 75-80% gt3 9.5' to 10.5 spoon ~~10YR 3/3~~ 5YR 4/2 10P 30blows,6" BOT 70blows,6"
10.0	1436	Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet	4.9 10.0'-10.5'	Subangular to subrounded fine to medium brown-grey & mottled green-blue-grey. minor mica & clay fraction, slightly plastic 85% gt3 10YR 3/3
11.5	8-5	Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly mod Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet	1.4	angular to subangular fine to med grained moderate sorting. Brown with green-blue-grey mottled. ~~Sandy~~ clay-semiplastic 10YR 3/3
		Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		↑ 10 7blows, 7"
		Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		
		Light tan Dark brown gray yellow olive red	Gravelly Sandy Silty Clayey	Boulder Sand Cobble Silt Pebble Clay Gravel	Poorly Well	Very Coarse Coarse Medium Fine Very Fine	Rock Semi-consolidated Dense Plastic Unconsolidated	Dry Moist Wet		

Notes: