Monitoring Well Installation and Regolith Sampling Completion Report

For Supplemental Hydrologic and Geochemical Characterization

Highland Uranium Mine
Douglas, Wyoming
February 25, 2016

Prepared For:
Nuclear Regulatory Commission

Prepared On Behalf of:
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

This Monitoring Well Installation and Regolith Sampling Completion Report provides an update and details for the completion of the majority of the field work pursuant to the Supplemental Hydrologic and Geochemical Characterization Work Plan (Work Plan) submitted as part of the Responses to NRC Requests for Additional Information Regarding the Highland Uranium Mine and Millsite Request for Amendment to Radioactive Materials License UA-1139 Application to Amend Existing Alternate Concentration Limit (AMEC, 2013).

The Highland Uranium Mine and Millsite (Site) is a reclaimed uranium mine encompassing approximately 1,750 acres that includes a pit lake, tailings impoundment, and overburden piles (Figure 1). The Site is located in Converse County, Wyoming and is regulated under the Nuclear Regulatory Commission (NRC) through a Radioactive Materials license (Source Materials License No. SUA-1139) issued to ExxonMobil Corporation (ExxonMobil). On May 12, 2011 ExxonMobil submitted a License Amendment Request (LAR) to NRC that included: (1) a proposed supplemental point of compliance (POC) well located to the southeast of the tailings impoundment and within the Southeast Drainage (well MFG-1, proposed uranium alternate concentration limit (ACL) of 0.7 mg/L), (2) a new proposed uranium ACL of 3 mg/L in existing POC Well 175, and (3) expansion of the long-term surveillance boundary (LTSB) with new proposed point of exposure (POE) locations for monitoring ACL constituents (Pit Lake and Well Tt-7 adjacent to North Fork Box Creek) (ExxonMobil, 2011). Based on a review of the LAR, the NRC staff provided written Requests for Additional Information (RAI) on May 29, 2012 pertaining to site hydrology and geochemistry. The NRC's primary requests included clarification of assumptions used in the numerical groundwater model prepared by Tetra Tech (Tetra Tech, 2007) and additional technical basis to support the conceptual hydrologic and geochemical site models as related to new proposed POC and POE locations.

In a meeting between ExxonMobil and NRC held on August 14th, 2012, the NRC requested that additional work be conducted to update the conceptual and numerical groundwater flow models for the Site. The NRC also requested that new Site investigations be performed to characterize potential secondary sources and extent of potential subsurface contamination in both the East and Southeast Drainages, and to the north of the tailings impoundment. ExxonMobil provided written responses to the RAI on April 8, 2013, which included the Work Plan to collect and evaluate further data to support the responses to the RAI (AMEC, 2013). On February 20, 2014, NRC provided written response indicating that the Work Plan was acceptable with some additional evaluations. This completion

report documents the field activities that have been completed to support the additional characterization and evaluations.

2.0 OBJECTIVES

In response to NRC's requests, the following work elements were developed based on review of available data and discussion with NRC:

- Install 20 new monitoring wells to collect water level and water quality data within the primary Ore-Body Sandstone (OBSS) units in the vicinity of the existing pit lake and Tailings Impoundment. In addition, one new monitoring well (8-BP) was placed in the backfilled material between the tailings impoundment and the pit lake at the request of the NRC (Letter dated February 20, 2014).
- Collect subsurface regolith samples in the Eastern and Southeast Drainages in order to:
  - Define the extent of potential contamination,
  - Evaluate the source term - Geochemical characterization of vadose zone and saturated zone aquifer materials will be conducted to identify potential secondary sources,
  - Characterize the subsurface geochemical properties, and
  - Identify contaminant attenuation mechanisms.

3.0 WORK PERFORMED TO DATE

3.1 Monitoring Well Installation

Twenty new monitoring wells were installed at the Highland Site between September 11, 2014 and August 30, 2015 (Figure 1). Boreholes were drilled using a Foremost Dual Rotary drill rig with temporary casing advance capability. Ten-inch diameter temporary steel casing was advanced during drilling to prevent borehole collapse and to ensure the integrity of the drill cuttings for geologic logging purposes. All wells were completed with 5-inch schedule 80 PVC pipe. Table 1 provides construction information for each new monitoring well. Borehole lithology logs are provided in Appendix A. Well completion diagrams are provided in Appendix B. Field notes are provided in Appendix C. Pictures of drill cuttings in chip trays are provided in Appendix D.

Monitoring wells were installed at eight predetermined locations on the Site (Figure 1). Wells were designed as nested sets (well clusters) to isolate the different hydrostratigraphic units within the Highland Sandstone Unit (HSU). Of the twenty new wells, seven wells were installed in the "50-Sand" hydrostratigraphic unit of the HSU, six wells were installed in the "40-Sand" hydrostratigraphic unit of the HSU, four wells were installed in the "30-Sand" hydrostratigraphic unit of the HSU, two wells

were installed in the Tailings Dam Sandstone (TDSS) hydrostratigraphic unit, and one well was installed in the backfilled material in the old Pit 1 (well 8-BP).

3.2 Monitoring Well Development

Wells were developed by Pronghorn Pump, LLC of Glenrock, Wyoming. Well clusters 1 and 6 were developed in November of 2014, while the remaining new wells were developed between August 15 and September 11, 2015. Pumping times and volumes for each new well are provided in Table 2. Dedicated pumps were installed in each well after development. Wells heads were surveyed by Siek Surveying Services of Casper, Wyoming on September 29, 2015.

3.3 Stratigraphic Validation of New Data Points

The geology of the Site consists of the sedimentary deposits within the Powder River Basin of northeastern Wyoming. The units of significance to this study lay within the upper Fort Union Formation (Paleocene), and, to a lesser extent, the lower Wasatch Formation (Eocene). A stratigraphic column of these units is presented on Figure 2.

The HSU of the Fort Union Formation is the host rock of most of the uranium ore in the area. The unit is 120 to 150 feet thick and consists of sand channel and floodplain facies (Hunter, 1999). Locally, the unit is divisible into three sandstone members that are separated by intervals of claystone and siltstone. Informal nomenclature refers to the sandstones from stratigraphically highest to lowest as 50-Sand, 40-Sand, and 30-Sand, and the fine-grained intervals as 45-Shale and 35-Shale (Hunter, 1999). All three members are laterally extensive throughout the study area and are generally composed of fine- to medium-grained, poorly lithified, arkosic sandstone that typically ranges from 20 to 50 feet in thickness. The fine-grained intervals are approximately 9 feet and 35 feet thick in the area of the Pit Lake, respectively, but, in some locations, are altogether absent, and the sandstones are in vertical contact (Hunter, 1999).

Overlying the HSU in the study area is the Tailings Dam Shale (TDSH), a laterally pervasive interval of siltstone and claystone that ranges from 20 feet to 50 feet in thickness. The TDSH is overlain by the Tailings Dam Sandstone (TDSS). The TDSS is composed of sand channel and floodplain facies similar to the sandstone members of the HSU and is typically 30 feet to 50 feet in thickness. Unlike the underlying deposits, the TDSS is not laterally extensive across the study area. This unit has a well-defined northwest-trending western edge approximately 1 mile west of the Pit Lake (Hunter, 1999). Along this line, the TDSS grades laterally to finer-grained siltstone and claystone. Overlying

the TDSS is a thick sequence of interbedded sandstone, siltstone, and claystone of the upper Fort Union Formation and the lower Wasatch Formation.

The undifferentiated Fort Union and Wasatch deposits are exposed at the surface over the majority of the area. Because the strata dip to the northwest, and topography slopes to the southeast, depth to the TDSS, TDSH, and HSU decreases from northwest to southeast until these units eventually outcrop in the eastern portion of the Site.

Upon completion of the drilling program, survey elevation data was combined with borehole stratigraphy and potentiometric soundings of groundwater in each well to create three cross-sections of the Site (Figures 3, 4 and 5). These cross-sections were compared to the Conceptual Site Model (CSM) in order to confirm completion intervals at each well cluster. Historic wells completed in the backfilled material were not included on cross-sections.

Regionally, the strata dip towards the west (Hunter, 1999), but in the study area, dip is approximately 0.5 degrees to the northwest. Figure 3 depicts this regional dip most notably. Note the elevation of the TDSS and the HSU units get progressively lower in elevation with distance across the site from well cluster #5 to well cluster #1. The regional dip of the stratigraphy from east to west is also captured in Figure 4. Note the TDSS in well cluster #7 is higher in elevation than at well clusters #6 or #1.

The completion interval for each well has been designated on the cross-sections so that the elevation and stratigraphy of each individual well can be compared to the entire data set. All wells have been given an ID that matches the stratigraphic unit of completion (e.g. well completed in the 30-Sand at well cluster #1 is "1-30").

3.4 Hydrologic Validation of New Data Points

A Site-wide numerical groundwater model has been developed to estimate the transient groundwater component of the Pit Lake (Tetra Tech, 2007). The analysis incorporates both the interdependent behavior of the groundwater and Pit Lake hydrology, as well as the distinct processes and components unique to each system. The results indicate that the Pit Lake will continue to fill until the water level reaches a steady-state elevation of approximately 5,060 feet above mean sea level (amsl) in approximately 40 years. Under these conditions, the Pit Lake elevation will remain well below the elevation of the regional discharge area in North Fork Box Creek and its tributaries. As a result, the Pit Lake will not discharge water to the groundwater system and will not become a flow-through system (Tetra Tech, 2007).

Groundwater levels have been collected monthly from the newly-installed wells since installation. Water level data collected to date is presented in Table 3. Monitoring well completion intervals and water levels were placed on the cross-sections to validate the hydraulic unit screened and compare it to the Site-wide groundwater model (see Figures 3-5). Groundwater elevations in all of the new HSU monitoring wells are between 5,050 feet amsl and 5,070 feet amsl (except well 1-40) and are consistent with the numerical groundwater model. In addition, the groundwater elevation in well 8-BP indicates that groundwater in the backfilled pit area is consistent with the elevation of the HSU groundwater table (Figures 4 and 5).

Well 1-40 has exhibited significant variation in the static groundwater elevation since being installed on August 22, 2015. The day after it was installed, groundwater was measured at 222.07 feet below ground surface (bgs). This measurement was consistent with the 224.05 feet bgs measurement collected at 1-30 on the same day. On August 28, 2015, depth to groundwater in well 1-40 was measured at 222.17 feet bgs (well 1-30 measured 224.15 feet bgs). On September 29, 2015 groundwater in well 1-40 was measured at 78.40 feet bgs, a rise of 143.77 feet (groundwater elevation in both wells 1-50 and 1-30 exhibited no significant changes). However, on October 14, 2015 groundwater in well 1-40 was measured at 149.72 feet bgs; a drop of 71.32 feet. Both wells 1-30 and 1-40 have had a video inspection of the casing for damage or irregularities in the well completion. Both wells appear normal and appear to be functioning properly.

No explanation can be made at this time as to the cause of the water level changes in 1-40. Water level pressure transducers have been installed in wells 1-30, 1-40 and 1-50. Water level measurements were collected every 8 hours for the first reporting period presented herein. Readings were increased to every hour starting January 11, 2016. Readings collected between November 19, 2015 and January 11, 2016 suggest that groundwater in well 1-40 is acting independently of the groundwater in wells 1-30 and 1-50. These data are presented in Appendix E.

Figure 6 provides the groundwater elevations in the 1-30, 1-40, and 1-50 wells. The groundwater in wells 1-30 and 1-50 are nearly identical in elevation, while the groundwater elevation in well 1-40 is significantly higher than the other wells in Cluster 1 (Figure 6).

To compare water levels in all three wells, the data from each well was normalized to show the relative change in water level (measured in feet) in each well (Figure 7). The resulting graph shows that the water levels in wells 1-30 and 1-50 fluctuate similarly and less than one foot, most likely due to atmospheric pressure changes. However, well 1-40 fluctuates nearly 5 feet over the same period suggesting an independent influence on the 40-sand in this area that is not being observed in well 1-

30 or well 1-50. Results of the water level monitoring and further analysis of the variation in the water level in well 1-40 will be reported in the Supplemental Hydrological Characterization Report.

3.5 Deviations from Work Plan – Monitoring Wells

Drilling operations targeted the 30-Sand, 40-Sand and 50-Sand in the HSU using drill cuttings, relative elevations and geophysical borehole logs to determine the depth and thickness of the HSU units. In several locations, the completion unit was misidentified until it was compared to regional site-wide stratigraphy and water level information and subsequently re-named.

At well cluster #3, a sand unit was encountered between 90 feet and 105 feet bgs. Pre-existing well 134 is completed in the TDSS between 40 feet and 70 feet bgs. Therefore, the sand unit from 90 feet to 105 feet bgs was initially interpreted as the 50-Sand during drilling operations. However, the potentiometric surface of this sand unit is in communication with the TDSS and has therefore been reinterpreted as a well in the TDSS at this location. As a result, there is not a well completed in the 30-Sand at this location. A review of the boring log in cross-section reveals that the borehole was drilled to an elevation below the bottom of the Pit (Figure 5). Well clusters #2 and #4, which are closer to the Pit than cluster #3 do have wells completed in the 30-Sand.

At cluster #7, the TDSS was misidentified as the 50-Sand during drilling operations. As a result, wells were only completed in the 40-Sand and the 50-Sand at this location. However, a review of water levels at well cluster #7 reveals that the potentiometric surfaces in wells 7-40 and 7-50 are nearly identical. In addition, the potentiometric surface in well 7-50 is slightly higher than that of well 7-40, suggesting that the highest potentiometric surface in the HSU has been captured at this location and the absence of a well in the 30-Sand does not have a significant bearing on the results for future interpretation.

At well cluster #6, the TDSS was also misidentified as the 50-Sand during drilling operations. In addition, the work plan indicated that the 30-Sand was well below the bottom of the Pit at this location and, therefore, did not need a deep well at this location. As a result, wells were completed in the 50-Sand and the TDSS at this location. A review of the borehole log in cross-section shows that the boring for well 6-50 was drilled to the bottom of the Pit. Therefore, the 40-Sand is below the bottom of the Pit and is not in direct communication with the Pit at this location.

Borehole geophysics were used to identify the sand units at well clusters #2, #4 and #6. In each case, the geophysical probe caused the borehole to collapse, requiring the borehole to be re-drilled. Given that the drill cuttings were matching the geophysical logs, the geophysical logs were deemed to be

duplicative. Therefore, the geophysical logging was abandoned in an effort to preserve the borehole integrity for well casing installation.

3.6 Supplemental Geochemical Characterization

The geochemical component of the work plan was designed to complete data gaps associated with the stated guidelines for characterization of geochemical conditions and water quality presented in Section 4.1.3 (3) of NUREG-1620 (USNRC, 2003). Additional data was collected to:

- Evaluate the source term. Geochemical characterization of vadose zone and saturated zone aquifer materials has been conducted to identify potential secondary sources.
- Characterize the subsurface geochemical properties. The chemical and mineralogical properties of aquifer materials have been characterized to refine inputs for geochemical modeling.
- Identify contaminant attenuation mechanisms. Knowledge of attenuation mechanisms is ultimately required to improve the CSM and for geochemical modeling (USNRC, 2003). The chemical and mineralogical characterization of the aquifer materials provide insight into mechanisms such as ion exchange by clay minerals, surface adsorption by mineral oxides, and possible redox reactions.

3.6.1 Sample Collection

Sample collection was completed in February 2015. Between February 3, 2015 and February 7, 2015, five regolith borings were drilled in the East Drainage, eight regolith borings were drilled in the Southeast Drainage and two regolith borings were drilled in the North Area using hollow stem auger drilling methods (Figure 1). Two samples were collected from each boring, one above and one below the water table as per the Work Plan (AMEC, 2013). Total depth, depth to bedrock, depth to water table and sample intervals for each boring are presented in Table 4. Borehole lithology logs are provided in Appendix F. Copies of the field notes are provided in Appendix C.

3.7 Analytical Laboratory Results

Samples were analyzed by ACZ Laboratories for concentrations of total and extractable hazardous constituents (arsenic, chromium, gross alpha, nickel, cadmium, lead, radium-226 + 228, uranium, selenium, and thorium-230). Total concentrations were measured from a strong-acid digestion of the samples (e.g. Method SW 3050). Analytical results are provided in Table 5. Laboratory reports are provided in Appendix G.

Extractable concentrations of hazardous constituents and indicator parameters (pH, chloride, and sulfate) were measured using the Meteoric Water Mobility Procedure (MWMP) to evaluate the

potential for their dissolution and mobility in the subsurface (ASTM, 2003). Analytical results are provided in Table 6. Laboratory reports are provided in Appendix G.

Radiological Analysis was conducted by Energy Labs. Samples were analyzed for Gross Alpha, Ra-226, Ra-228 and Th-230. Analytical Results are presented in Table 7. Laboratory reports are presented in Appendix G.

Additional aquifer sample characterization included total organic carbon content, bulk and clay mineralogy using X-ray diffraction (XRD) analysis, cation exchange capacity, calcite content, and amorphous iron content. The chemical and mineralogical characterizations provide direct measurements of those geochemical parameters necessary to understand the potential for attenuation of groundwater contaminants (USNRC, 2003). Analytical results submitted by Mineralogy Inc. are provided in Table 8. Laboratory reports are provided in Appendix G.

3.7.1 Potential Data Gaps – Regolith Sampling

An objective of the regolith sampling was to collect one sample in the vadose zone and another in the saturated zone in each boring in order to identify potential secondary sources. In four of the borings, drilling hit refusal at the Regolith-Bedrock interface before groundwater was encountered (Table 4). In each case, two samples were collected from the borehole even though both samples were dry. Therefore, these samples should be given special consideration as vadose zone samples during geochemical evaluation of these borings. Given the large data set (19 samples collected in the vadose zone and 11 samples collected in the saturated zone), a fair assessment can be made with regard to source term in the regolith in the Eastern and Southeast Drainages.

4.0 REPORTING

ExxonMobil will use the data collected herein, along with future water quality and groundwater elevation data to prepare an addendum to the responses to RAIs, which will include:

1. A Supplemental Hydrological Characterization report that will include:
    a. A detailed review of publically available regional hydrogeologic data.
    b. Updates to the Site and regional conceptual model of groundwater flow and constituent transport, focusing on both the Highland open pit and the Southeast Drainage.
    c. Additional predictive assessments as necessary, including the potential development of a numerical groundwater flow model, to evaluate long-term conditions related to regional groundwater flow, pit lake development, and flow within the Southeast Drainage.

2. A Supplemental Geochemical Characterization Report that will:
    a. Evaluate the source term with respect to the vadose zone vs. saturated zone.
    b. Characterize the subsurface geochemical properties for geochemical modeling.
    c. Identify contaminant attenuation mechanisms for geochemical modeling.
    d. Define the extent of contamination on the Site paying special attention to areas surrounding the Pit Lake and the Southeast Drainage.

The *Highland Mine and Millsite Supplemental Hydrologic and Geochemical Characterization Work Plan* specifies that at least 6 months of groundwater elevation data and two quarters of groundwater sampling data will be collected before an evaluation of the data can be made. The Supplemental Hydrological and Geochemical Reports will be prepared once this new data has been collected and evaluated.

5.0 FUTURE WORK

5.1 Well Abandonment

Five dewatering wells at the Site are screened across multiple HSU hydrologic units (Table 9). ExxonMobil proposes abandoning/decommissioning these wells to prevent cross-contamination of the hydrostatic units. The dewatering wells are sampled during the first and third quarters and the results are provided to the Wyoming Department of Environmental Quality (WDEQ). Each dewatering well has a new nested cluster of monitoring wells installed as a replacement (Table 9).

6.0 REFERENCES

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Tables

Table 1. Monitoring Well Completion Data

Well Name	Screened Unit	Date Installed	Latitude (NAD 83)	Longitude (NAD 83)	Northing (NAD 83)	Easting (NAD 83)	Elevation Collar (ft amsl)	Elevation Ground (ft amsl)	Total Depth (ft toc)	Total Depth (ft bgs)	Total Depth (ft amsl)	Screen Length (ft)	Screen Top (ft bgs)	Screen Top (ft amsl)	Screen Bottom (ft bgs)	Screen Bottom (ft amsl)	Well Diameter (inches)
1-50	50 Sand	8/26/2015	43°04'13.70014" N	105°31'46.17503" W	936829.45'	559219.52'	5279.63	5278.0	293.1	291.5	4986.5	10	282.6	4995.4	291.0	4987.0	5
1-40	40 Sand	8/12/2015	43°04'14.11719" N	105°31'45.98868" W	936871.61'	559233.54'	5281.43	5279.9	336.2	334.7	4945.2	20	315.7	4964.2	334.2	4945.7	5
1-30	30 Sand	8/8/2015	43°04'14.58236" N	105°31'45.77495" W	936918.64'	559249.60'	5283.64	5282.1	367.5	366.0	4916.1	10	357.0	4925.1	365.5	4916.6	5
2-50	50 Sand	10/2/2014	43°03'50.02754" N	105°31'32.80663" W	934428.60'	560201.50'	5259.07	5257.5	260.0	258.4	4999.1	10	249.5	5008.0	257.9	4999.6	5
2-40	40 Sand	9/29/2014	43°03'49.71582" N	105°31'32.40342" W	934396.91'	560231.29'	5259.08	5257.5	296.8	295.2	4962.3	10	286.3	4971.2	294.7	4962.8	5
2-30	30 Sand	9/18/2014	43°03'49.40899" N	105°31'31.99493" W	934365.72'	560261.48'	5260.00	5258.5	336.0	334.5	4924.0	10	325.5	4933.0	334.0	4924.5	5
3-TDSS	TDSS	7/1/2015	43°03'25.10724" N	105°30'58.21026" W	931894.86'	562759.09'	5163.74	5161.9	96.8	95.0	5066.9	10	86.3	5075.6	94.5	5067.4	5
3-50	50 Sand	6/30/2015	43°03'25.27105" N	105°30'58.83624" W	931911.64'	562712.68'	5165.20	5163.3	177.1	175.2	4988.1	10	166.6	4996.7	174.7	4988.6	5
3-40	40 Sand	6/27/2015	43°03'25.43065" N	105°30'59.44425" W	931927.99'	562667.61'	5166.28	5164.6	222.4	220.7	4943.9	20	201.9	4962.7	220.2	4944.4	5
4-50	50 Sand	5/18/2015	43°03'35.48638" N	105°30'48.74231" W	932942.72'	563466.32'	5243.33	5241.4	237.5	235.6	5005.8	10	227.0	5014.4	235.1	5006.3	5
4-40	40 Sand	5/30/2015	43°03'35.42375" N	105°30'49.37725" W	932936.57'	563419.15'	5245.23	5243.1	294.9	292.8	4950.3	10	284.4	4958.7	292.3	4950.8	5
4-30	30 Sand	6/5/2015	43°03'35.36141" N	105°30'50.04324" W	932930.46'	563369.69'	5246.55	5244.7	317.2	315.4	4929.3	10	306.7	4938.0	314.9	4929.8	5
5-50	50 Sand	6/16/2015	43°03'53.01024" N	105°29'53.97454" W	934700.37'	567539.01'	5266.69	5264.9	220.3	218.5	5046.4	20	199.8	5065.1	218.0	5046.9	5
5-40	40 Sand	6/14/2014	43°03'53.41173" N	105°29'53.60227" W	934740.90'	567566.81'	5267.09	5265.4	280.0	278.3	4987.1	20	259.5	5005.9	277.8	4987.6	5
5-30	30 Sand	6/19/2015	43°03'52.63992" N	105°29'54.32282" W	934662.98'	567513.01'	5266.34	5264.6	314.3	312.6	4952.0	10	303.8	4960.8	312.1	4952.5	5
6-TDSS	TDSS	11/1/2014	43°04'25.95618" N	105°30'52.69685" W	938053.42'	563193.94'	5306.69	5304.9	255.0	253.2	5051.7	20	234.5	5070.4	252.7	5052.2	5
6-50	50 Sand	10/12/2014	43°04'26.23019" N	105°30'53.28738" W	938081.34'	563150.23'	5306.45	5304.8	324.0	322.4	4982.5	10	313.5	4991.3	321.9	4983.0	5
7-50	50 Sand	7/24/2015	43°04'33.41817" N	105°30'06.04437" W	938794.77'	566659.42'	5307.16	5305.7	282.9	281.4	5024.3	20	262.4	5043.3	280.9	5024.8	5
7-40	40 Sand	7/13/2015	43°04'34.12465" N	105°30'06.35539" W	938866.38'	566636.62'	5308.19	5306.4	315.0	313.2	4993.2	10	304.5	5001.9	312.7	4993.7	5
8BP	Backfill	8/30/2015	43°04'03.89767" N	105°30'25.30039" W	935811.91'	565218.19'	5329.17	5327.4	298.2	296.4	5031.0	30	267.7	5059.7	295.9	5031.5	5

ft = feet
amsl = above mean sea level
bgs = below ground surface
toc = top of collar

Table 2. Monitoring Well Development Data

Well	Total Depth	Static Water Level	Casing	Pump Setting	Pump Type	Pump Brand	Casing Volume	Total Gallons Pumped	pH	Temp	Cond.
1-50	293.1	222.25	5" pvc	270	3/4-hp, 10-gpm	Myers	115	16560	7.50	12.9	478
1-40	336.2	78.05	5" pvc	315	1/2-hp, 5-gpm	Franklin	48	25104	7.75	13.4	571
1-30	367.5	224.1	5" pvc	345	1-hp, 10-gpm	Meyers	96	27840	7.73	13.3	545
2-50	260	209.25	5" pvc	240	3/4-hp, 5-gpm	Grundfos	60	6303	7.52	11.4	961
2-40	304.0	205.78	5" pvc	280	3/4-hp, 10-gpm	Grundfos	80	15951	7.77	11.0	663
2-30	336.0	200.1	5" pvc	320	3/4-hp, 10-gpm	Grundfos	61.5	16957	7.96	11.4	512
3-TDSS	96.8	37.5	5" pvc	93	1/2-hp, 10-gpm	Franklin	19	2280	7.75	11.3	1648
3-50	177.1	112.2	5" pvc	175	1/2-hp, 10-gpm	Franklin	18	2372	8.3	11.1	549
3-40	222.4	88.95	5" pvc	200	1/2-hp, 10-gpm	Franklin	70	18970	8.22	12.5	480
4-50	236	187.55	5" pvc	220	1/2-hp, 7-gpm	Sta-Rite	71	6958	8.02	12.4	708
4-40	294	173.22	5" pvc	200	3/4-hp, 10-gpm	Myers	86.2	21119	8.21	11.9	501
4-30	316.1	174.5	5" pvc	300	1/2-hp, 5-gpm	Sta-Rite	48	13797	7.85	14.4	538
5-50	220.3	195.8	5" pvc	220	1/2-hp, 5-gpm	Sta-Rite	176	8932	6.91	13.5	3.73
5-40	280	196.15	5"pvc	260	3/4-hp, 7-gpm	Sta-Rite	73	12410	7.06	11.7	3.04
5-30	314.2	195.75	5" pvc	300	1/2-hp, 5-gpm	Sta-Rite	51.4	12359	6.99	14.8	987
6-TDSS	255	233.73	5" pvc	240	3/4-hp, 5-gpm	Grundfos	20	864	7.51	10.7	2.69
6-50	324	255.81	5" pvc	300	3/4-hp, 10-gpm	Grundfos	60	8380	7.31	11.5	627
7-50	282	241.1	5" pvc	270	1/2-hp, 5-gpm	Franklin	86	7157	7.75	13.9	525
7-40	315	245	5" pvc	310	3/4-hp, 10-gpm	Franklin	19	2698	8.15	11.1	568
8-BP	298.3	264.17	5" pvc	285	1/2-hp, 5-gpm	Franklin	91	6315	6.81	11.2	4.04

NOTES

1-50	Pumped this well for three hours at 6-gpm the first day. Then pumped if for 24 hours at 5-gpm. Then pumped it for 49 minutes at 9 gpm
1-40	Pumped very thick, white chalky fluid for four days. Burned up a test pump. Replaced pump and cycled it on and off for 90 minutes each cycle for two days. Fluid cleaned up when the new test pump was installed. Due to fluctuating SWL, Rob Noble requested a video of the well. Ran a camera down the well on 10/7/2015 and everything looked fine. After, set dedicated pump in well and pumped for another 48 hours.
1-30	Pumped this well at 6-gpm for one day then increased the flow and pumped for an additional three days at 8.5-gpm from 300. This well has a 9-gpm dole valve. After problems with Well 1-40, Rob Noble requested a video of this well. Ran a camera down this well on 10/14/2015 and everything looked fine.
2-50	Pumped this well for 26 hours between 4-gpm and 6-gpm. This well has a 4-gpm dole valve.
2-40	Pumped this well for 28 hours between 5-gpm and 12-gpm.
2-30	Pumped this well for 24 hours between 5-gpm and 8.9-gpm.
3-TDSS	This well recovers the best at .22-gpm at 85'. Our present SOP is to pump it dry one day and go back and pump and sample the following day.
3-50	This well recovers at 0.49-gpm at 156'. Our present SOP is to pump it dry one day and go back and pump and sample the following day.
3-40	Pumped this well for 46 hours between 4-gpm and 7-gpm. This well has a 7-gpm dole valve.
4-50	Pumped this well for 21 hours between 3.5-gpm and 7-gpm. It produces 5-5gpm at 203'. This well has a 7-gpm dole valve.
4-40	Pumped this well for 20 hours between 7-gpm and 16-gpm. It produces 16-gpm at 198'.
4-30	This well only produces 2-gpm so during development it was pumped overnight to get 10 volumes in a 24-hour period. It takes 7 hours to get 3 volumes to sample. This well has a 2-gpm dole valve.
5-50	Pumped this well for 74 hours at 2-gpm. This well has a 2-gpm dole valve.
5-40	Pumped this well for 24 hours between 5.5-gpm and 9-gpm.
5-30	Pumped this well for 73 hours between 2.5-gpm and 4-gpm. This well has a 3-gpm dole valve.
6-TDSS	Pumped this well for 7 hours. This well won't sustain 2-gpm but are able to get 3 volumes before it runs dry. This well has a 2-gpm dole valve.
6-50	Pumped this well for 19 hours between 8-gpm and 11-gpm.
7-50	Pumped this well for 26 hours between 3-gpm and 6-gpm.
7-40	This well only produces 0.069-gpm at 306'. Our present SOP is to pump it dry one day and go back and pump and sample the following day.
8-BP	Pumped this well for 25 hours between 3-gpm and 6-gpm.

Table 3. Water Level Data

Well I.D.	Screened Stratigraphic Unit	Collar Elevation (ft amsl)	August 2015		September 2015			October 2015			November 2015			December 2015		
			Depth to Water (ft toc)	Groundwater Elevation (ft amsl)	Depth to Water (ft toc)	Groundwater Elevation (ft amsl)	Change From Previous Month	Depth to Water (ft toc)	Groundwater Elevation (ft amsl)	Change From Previous Month	Depth to Water (ft toc)	Groundwater Elevation (ft amsl)	Change From Previous Month	Depth to Water (ft toc)	Groundwater Elevation (ft amsl)	Change From Previous Month
133	TDSS	5263.49	No Reading		No Reading			177.81	5085.68		177.83	5085.66	-0.02	177.41	5086.08	0.42
134	TDSS	5163.69	No Reading		No Reading			33.39	5130.30		33.47	5130.22	-0.08	33.25	5130.44	0.22
177	TDSS	5268.36	Dry		Dry			Dry			Dry			Dry		
150	TDSS	5304.85	No Reading		No Reading			226.41	5078.44		225.75	5079.10	0.66	225.51	5079.34	0.24
183	TDSS	5305.81	199.40	5106.41	199.00	5106.81	-0.40	199.00	5106.81	0.00	199.29	-0.29	-0.29	198.81	5107.00	0.48
180	TDSS	5281.72	Dry		Dry			Dry			Dry			Dry		
1-50	50 Sand	5279.63	222.40	5057.23	222.83	5056.80	0.43	222.87	5056.76	-0.04	223.09	5056.54	-0.22	222.68	5056.95	0.41
1-40	40 Sand	5281.43	222.17	5059.26	78.40	5203.03	143.77	149.72	5131.71	-71.32	148.49	5132.94	1.23	148.02	5133.41	0.47
1-30	30 Sand	5283.64	224.15	5059.49	224.45	5059.19	-0.30	224.58	5059.06	-0.13	224.73	5058.91	-0.15	224.57	5059.07	0.16
2-50	50 Sand	5259.07	208.40	5050.67	208.50	5050.57	-0.10	208.26	5050.81	0.24	208.53	5050.54	-0.27	208.08	5050.99	0.45
2-40	40 Sand	5259.08	204.78	5054.30	205.04	5054.04	-0.26	204.74	5054.34	0.30	205.01	5054.07	-0.27	204.72	5054.36	0.29
2-30	30 Sand	5260.00	198.92	5061.08	199.15	5060.85	-0.23	199.12	5060.88	0.03	199.13	5060.87	-0.01	199.12	5060.88	0.01
3-TDSS	TDSS	5163.74	37.45	5126.29	32.96	5130.78	4.49	38.10	5125.64	-5.14	38.12	5125.62	-0.02	37.93	5125.81	0.19
3-50	50 Sand	5165.20	111.73	5053.47	106.47	5058.73	5.26	112.2	5053.00	-5.73	112.35	5052.85	-0.15	112.02	5053.18	0.33
3-40	40 Sand	5166.28	86.35	5079.93	87.32	5078.96	-0.97	87.66	5078.62	-0.34	87.29	5078.99	0.37	87.04	5079.24	0.25
4-50	50 Sand	5243.33	187.70	5055.63	187.90	5055.43	-0.20	187.59	5055.74	0.31	187.79	5055.54	-0.20	187.36	5055.97	0.43
4-40	40 Sand	5245.23	173.26	5071.97	173.60	5071.63	-0.34	174.82	5070.41	-1.22	173.56	5071.67	1.26	173.38	5071.85	0.18
4-30	30 Sand	5246.55	174.60	5071.95	174.80	5071.75	-0.20	174.95	5071.60	-0.15	174.38	5072.17	0.57	174.60	5071.95	-0.22
5-50	50 Sand	5266.69	196.21	5070.48	196.25	5070.44	-0.04	195.85	5070.84	0.40	196.10	5070.59	-0.25	195.52	5071.17	0.58
5-40	40 Sand	5267.09	196.95	5070.14	196.78	5070.31	0.17	196.24	5070.85	0.54	196.50	5070.59	-0.26	196.01	5071.08	0.49
5-30	30 Sand	5266.34	195.95	5070.39	195.95	5070.39	0.00	195.85	5070.49	0.10	195.54	5070.80	0.31	195.15	5071.19	0.39
6-TDSS	TDSS	5306.69	234.15	5072.54	234.20	5072.49	-0.05	233.91	5072.78	0.29	234.04	5072.65	-0.13	233.78	5072.91	0.26
6-50	50 Sand	5306.45	254.58	5051.87	254.80	5051.65	-0.22	254.42	5052.03	0.38	254.76	5051.69	-0.34	254.27	5052.18	0.49
7-50	50 Sand	5307.16	242.35	5064.81	242.28	5064.88	0.07	242.12	5065.04	0.16	242.28	5064.88	-0.16	241.83	5065.33	0.45
7-40	40 Sand	5308.19	246.15	5062.04	245.11	5063.08	1.04	247.20	5060.99	-2.09	244.48	5063.71	2.72	243.95	5064.24	0.53
8-BP	Backfilled Pit	5329.17	No Reading		264.49	5064.68		264.33	5064.84	0.16	264.48	5064.69	-0.15	263.93	5065.24	0.55

ft = feet
amsl = above mean sea level
bgs = below ground surface
toc = top of collar

Table 4. Regolith Sampling Collection Data

Sample ID	Location	Boring Depth	Depth to Bedrock	Depth to Water Table	A Sample	B Sample	B Sample	Notes
B-1	North	39'	32'	>39'	14'-19'	24'-29'	Dry	Hit bedrock before water table
B-2	North	27'	24'	>27'	9'-14'	19'-23'	Dry	Hit bedrock before water table
B-3	East Drainage	44'	37'	34'	25'-29'	34'-37'	Wet	
B-4	East Drainage	39'	34'	29'	14'-24'	29'-34'	Wet	
B-5	East Drainage	39'	34'	29'	19'-29'	29'-34'	Wet	
B-6	East Drainage	69'	69'	64'	34'-44'	65'-69'	Wet	
B-7	East Drainage	59'	55'	50'	30'-45'	50'-55'	Wet	
B-8	Southeast Drainage	44'	44'	39'	19'-24'	39'-44'	Wet	
B-9	Southeast Drainage	49'	47'	44'	34'-39'	44'-47'	Wet	
B-10	Southeast Drainage	39'	>39'	29'	19'-24'	33'-39'	Wet	
B-11	Southeast Drainage	34'	>34'	24'	14'-24'	29'-34'	Wet	
B-12	Southeast Drainage	32'	29'	>32'	9'-19'	24'-29'	Dry	Hit bedrock before water table
B-13	Southeast Drainage	29'	24'	22'	9'-14'	22'-24'	Wet	
B-14	Southeast Drainage	22'	22'	>22'	9'-11'	20'-22'	Dry	Hit bedrock before water table
B-15	Southeast Drainage	19'	>19'	14'	4'-9'	14'-19'	Wet	

Table 5. Regolith Samples – Total Extractable Metals

Sample ID	Date	Arsenic	Cadmium	Chromium	Lead	Nickel	Selenium	Uranium	TOC Solids/ Sludges Combustion	CEC (mequif/100g)
		mg/kg								
B1-A-01	02/07/15	3.69	0.138	22.7	12	15.3	0.307	1.9	1270	36
B1-B-01	02/07/15	1.4	0.065	30.8	8.61	24.9	0.119	1.53	<112	44.8
B2-A-01	02/07/15	3.95	0.116	22.4	11.8	15.6	0.376	1.72	670	34.7
B2-B-01	02/07/15	2.96	0.121	27	10.7	19.3	<0.113	1.54	774	50.1
B3-A-01	02/03/15	11.5	0.0881	23	7.75	13.7	0.122	1.26	<117	43.4
B3-B-01	02/03/15	2.81	0.131	27.9	10.1	19	0.312	1.7	326	42.1
B4-A-01	02/06/15	4.04	0.124	20.7	11.4	13.1	0.205	1.69	689	53.8
B4-B-01	02/06/15	3.46	0.101	20.3	10.7	13.8	0.113	1.65	<114	45.9
B5-A-01	02/06/15	4.04	0.122	24.7	13.3	18.4	0.286	1.64	1070	48.2
B5-B-01	02/06/15	6.56	0.126	18.1	9.58	12.5	0.172	1.54	551	57.5
B6-A-01	02/05/15	3.38	0.0564	13.7	3.9	12.5	0.404	0.612	<113	25.9
B6-B-01	02/05/15	3.96	0.154	27.5	14.5	18.4	0.203	2.18	587	50.1
B7-A-01	02/05/15	3.41	0.0375	14.5	4.27	7.43	<0.104	0.757	<107	34.8
B7-B-01	02/05/15	2.06	<0.022	16	4.2	6.84	0.166	2.21	<109	37.4
B8-A-01	02/04/15	3.38	0.0329	12.3	3.29	4.68	0.694	0.986	<107	27.5
B8-B-01	02/04/15	2.92	0.0345	12.3	3.51	11.1	1.22	0.685	<122	29.8
B9-A-01	02/04/15	1.42	0.0359	11.2	3.44	7.44	<0.106	0.619	<107	36.1
B9-B-01	02/04/15	3.97	0.0272	12.2	3.4	7.4	1.77	0.639	<120	27
B10-A-01	02/06/15	4.31	0.119	26.7	11.3	16.9	0.23	1.48	336	57.1
B10-B-01	02/06/15	6.66	0.103	16.8	8.63	14.4	1.23	1.28	334	42.9
B11-A-01	02/06/15	5.46	0.157	39.6	19.6	25.9	0.27	2.62	2140	60.1
B11-B-01	02/06/15	6.53	0.0645	25.4	12	18.5	0.209	1.61	1790	55
B12-A-01	02/07/15	3.55	0.0715	15.9	7.98	10.8	0.229	1.17	<110	49
B12-B-01	02/07/15	1.73	0.0624	17.9	6.34	15.9	0.183	0.905	202	34.3
B13-A-01	02/03/15	2.36	0.0404	8.7	4.35	7.61	0.113	0.647	793	38
B13-B-01	02/03/15	3.23	0.327	25.8	12.3	14.7	0.185	2	<127	55.2
B14-A-01	02/03/15	2.61	0.119	12.9	6.55	11	0.151	1.07	<112	40.7
B14-B-01	02/03/15	2.08	0.126	19.1	5.95	12.1	0.609	0.995	1300	41.3
B15-A-01	02/03/15	3.98	0.0379	11.4	5.93	5.96	0.205	0.825	201	23.2
B15-B-01	02/03/15	2.71	0.0382	2.6	3.49	2.36	<0.105	0.292	<106	9.4
OUTCROP-01	02/03/15	4.63	<0.0205	8.04	3.58	2.55	<0.101	0.892	136	36.9
field dups:										
B6-A-02	02/05/15	3.14	0.0543	8.6	3.34	10.6	0.438	0.539	131	2
B6-B-02	02/05/15	4.52	0.141	29.7	14.8	18.2	0.228	2.34	1340	57.6

Table 6. Regolith Samples – MWMP

Sample ID	U (mg/kg)		As (mg/kg)		Se (mg/kg)		Th-230 (pCi/g)		Ra-226+228 (pCi/g)	
	Total U	MWMP-extractable U	Total As	MWMP-extractable As	Total Se	MWMP-extractable Se	Total Th-230	MWMP-extractable Th-230	Total Ra-226+228	MWMP-extractable Ra-226+228
B1-A-01	1.9	0.0065	3.69	0.0008	0.31	0.0071	0.5	0.0E+00	1.6	0.0034
B2-A-01	1.72	0.0055	3.95	0.0006	0.38	0.0358	0.8	1.8E-04	1.3	0.0015
B3-A-01	1.26	0.0010	11.5	0.0009	0.12	0.0007	0.9	7.3E-04	1.2	0.0002
B4-A-01	1.69	0.0003	4.04	0.0005	0.21	0.0003	0.9	0.0E+00	1.6	0.0006
B5-A-01	1.64	0.0009	4.04	0.0004	0.29	0.0005	0.9	9.0E-05	1.3	0.0001
B6-A-01	0.612	0.0014	3.38	0.0009	0.40	0.0047	<0.2	3.4E-04	1.1	0.0001
B7-A-01	0.757	0.0001	3.41	0.0003	0.10	0.0027	0.3	0.0E+00	0.7	0.0034
B8-A-01	0.986	0.0026	3.38	0.0004	0.69	0.5424	1.0	4.0E-05	0.9	0.0001
B9-A-01	0.619	0.0007	1.42	0.0006	0.20	0.0011	0.3	6.9E-04	1.8	0.0001
B10-A-01	1.48	0.0011	4.31	0.0003	0.106	0.0229	0.6	2.4E-04	1.2	0.0002
B11-A-01	2.62	0.0037	5.46	0.0003	0.27	0.0165	0.9	0.0E+00	1.9	0.0024
B12-A-01	1.17	0.0006	3.55	0.0005	0.23	0.0306	0.5	5.1E-05	1.1	0.0003
B13-A-01	0.647	0.0023	2.36	0.0005	0.11	0.0091	0.3	9.0E-05	1.1	0.0004
B14-A-01	1.07	0.0034	2.61	0.0005	0.15	0.0119	18	3.1E-04	1.6	0.0029
B15-A-01	0.825	0.0011	3.98	0.0010	0.21	0.0019	0.2	1.4E-04	1.2	0.0003
B1-B-01	1.53	1	1.4		0.119		0.4		1.0	
B2-B-01	1.54		2.96		<0.113		0.6		1.4	
B3-B-01	1.7		2.81		0.312		0.6		1.9	
B4-B-01	1.65		3.46		0.113		0.5		1.3	
B5-B-01	1.54		6.56		0.172		0.6		1.4	
B6-B-01	2.18		3.96		0.203		0.5		2.0	
B7-B-01	2.21		2.06		0.166		0.2		1.0	
B8-B-01	0.685		2.92		1.22		0.4		1.2	
B9-B-01	0.639		3.97		1.77		0.2		0.6	
B10-B-01	1.28		6.66		1.23		0.4		1.2	
B11-B-01	1.61		6.53		0.209		0.9		1.4	
B12-B-01	0.905		1.73		0.183		0.4		0.8	
B13-B-01	2		3.23		0.185		0.5		1.5	
B14-B-01	0.995		2.08		0.609		0.4		1.2	
B15-B-01	0.292		2.71		<0.105		0.2		0.8	
OUTCROP-01	0.892		4.63		<0.101		0.2		1.1	

Table 7. Regolith Samples – Radiological Analysis

Sample ID	Date	Gross Alpha minus Rn & U	Radium 226	Radium 228	Thorium 230
		pCi/g			
B1-A-01	2/7/2015	4.5	0.7	0.9	0.5
B1-B-01	2/7/2015	3.6	0.5	0.5	0.4
B2-A-01	2/7/2015	4.2	0.7	0.6	0.8
B2-B-01	2/7/2015	3.6	0.7	0.7	0.6
B3-A-01	2/3/2015	4.1	0.6	0.6	0.9
B3-B-01	2/5/2015	4.8	0.9	1.0	0.6
B4-A-01	2/6/2015	4.8	0.7	0.9	0.9
B4-B-01	2/6/2015	3.4	0.6	0.7	0.5
B5-A-01	2/6/2015	4.8	0.6	0.7	0.9
B5-B-01	2/6/2015	5.0	0.8	0.6	0.6
B6-A-01	2/5/2015	3.2	0.4	0.7	<0.2
B6-B-01	2/5/2015	5.1	0.8	1.2	0.5
B7-A-01	2/5/2015	2.6	0.4	0.3	0.3
B7-B-01	2/5/2015	3.0	0.3	0.7	0.2
B8-A-01	2/4/2015	3.4	0.4	0.5	1.0
B8-B-01	2/4/2015	2.9	0.6	0.6	0.4
B9-A-01	2/4/2015	2.3	1.0	0.8	0.3
B9-B-01	2/4/2015	2.2	0.3	0.3	0.2
B10-A-01	2/6/2015	4.5	0.7	0.5	0.6
B10-B-01	2/6/2015	3.0	0.5	0.7	0.4
B11-A-01	2/6/2015	4.9	1.1	0.8	0.9
B11-B-01	2/6/2015	3.5	0.8	0.6	0.9
B12-A-01	2/7/2015	3.5	0.6	0.5	0.5
B12-B-01	2/7/2015	2.5	0.5	0.3	0.4
B13-A-01	2/3/2015	3.1	0.6	0.5	0.3
B13-B-01	2/3/2015	4.3	0.7	0.8	0.5
B14-A-01	2/3/2015	7.4	0.8	0.8	18
B14-B-01	2/3/2015	2.6	0.5	0.7	0.4
B15-A-01	2/3/2015	3.2	0.5	0.7	0.2
B15-B-01	2/3/2015	2.1	0.3	0.5	0.2
OutCrop-01	2/3/2015	2.0	0.5	0.6	0.2
Field Duplicates:					
B6-A-02	2/5/2015	2.7	0.4	0.7	0.2
B6-B-02	2/5/2015	4.6	0.8	1.3	0.6

Energy Laboratories 2015 Soils Results

Table 8. Regolith Samples – Mineralogy

Sample ID	MI Lab ID	Quartz	K-Feldspar	Plagioclase	Calcite	Dolomite	Siderite	Pyrite	Hydroxyl-Apatite	Illite	I/S Mixed Layer Clay	Smectite	Kaolinite	Amphibole Group	Pyroxene Group	Total
		(Wt %)														
B15-A-01	15043-01	59	12	14						3.0	0.9	6.7	2.8	1.3		100
B14-A-01	15043-02	59	10	6.4						5.1	1.9	14	3.2	0.6		100
B4-A-01	15043-03	52	9.4	7.8						5.7	4.8	16	3.6	0.9		100
B1-A-01	15043-04	48	7.3	7.6						6.5	4.9	20	4.8	1.2		100
B2-A-01	15043-05	54	8.5	5.8						7.5	6.4	13	4.0	0.3		100
B15-B-01	15043-06	60	17	16						2.1	0.3	2.6	2.1			100
B6-A-02	15043-07	57	17	16						2.2	0.0	3.9	3.3	0.5		100
B6-A-01	15043-08	60	15	15						2.3	0.9	3.3	3.3	0.5		100
B6-B-01	15043-09	40	8.2	10						7.2	5.1	24	5.1	0.3		100
B7-B-01	15043-10	56	15	15						2.6	0.5	5.5	4.3	0.8		100
B6-B-02	15043-11	39	8.8	5.9						7.7	4.9	25	7.0		2.1	100
B5-A-01	15043-12	50	8.9	7.0						7.0	5.6	17	4.4	0.3		100
B5-B-01	15043-13	37	8.6	5.0						8.3	3.6	31	6.8	0.2		100
B9-B-01	15043-14	57	18	16						2.4	0.8	2.3	3.5	0.8		100
B10-A-01	15043-15	39	7.2	8.7						7.3	5.8	25	7.2	0.2		100
B13-B-01	15043-16	48	12	11	3.5			0.2		4.4	3.7	14	3.5	0.3		100
B12-A-01	15043-17	48	9.6	6.7						5.2	4.4	21	4.7	1.0		100
B1-B-01	15043-18	47	8.2	5.5						6.6	3.4	22	6.6			100
OUTCROP-01	15043-19	53	20	16						2.1	0.4	4.7	3.3	0.2		100
B14-B-01	15043-20	68	10	11						3.0	0.7	3.8	3.2	0.2		100
B10-B-01	15043-21	46	11	6.6	1.2				12	4.8	2.7	11	4.3			100
B8-A-01	15043-22	51	21	17						2.1	0.0	5.1	2.9	0.7		100
B9-A-01	15043-23	55	15	16						3.0	1.1	5.4	4.9	0.5		100
B3-B-01	15043-24	51	10	7.4						6.3	2.8	17	5.5			100
B3-A-01	15043-25	51	13	14				0.2		4.3	1.5	11	3.6	1.3		100
B8-B-01	15043-26	60	16	16						2.1	0.0	2.7	2.4	0.7		100
B13-A-01	15043-27	54	11	8.6						5.2	2.9	14	3.2	0.9		100
B11-B-01	15043-28	58	14	8.7				0.2		6.0	2.7	6.9	3.2	0.5		100
B4-B-01	15043-29	39	11	8.4						6.1	3.7	26	5.9			100
B2-B-01	15043-30	51	10	8.3						5.9	2.8	17	4.8	0.5		100
B11-A-01	15043-31	27	5.7	4.1	1.0	0.3	0.3			8.6	8.8	35	8.8	0.2		100
B12-B-01	15043-32	49	7.4	3.5						6.8	2.9	26	5.0			100
B7-A-01	15043-33	47	13	12						4.6	2.4	14	7.0			100

Table 9. Highland Dewatering Wells for Proposed Abandonment

Well Group	Well No.	Well Name[1]	Northing[2]	Easting[2]	Screened Hydrogeologic Unit	Ground Elevation (ft msl)	Depth of Completed Well (ft bgs)	Depth of Completed Well (msl)	Screen top (ft bgs)	Screen bottom (ft bgs)	Screen top (ft msl)	Screen Bottom (ft msl)	Screen diameter (in)	Water Level (ft msl)	Date of Water Level	Sample Collection (WDEQ)
6	47	DW-18	77474.1	106659.5	OSS/SH	5273.1	420	4853.1	258	490	5015.1	4783.1	10	5055.3	7/30/2010	Q1, Q3
4	136	DW-41	72348.0	107537.9	TDSS/OSS/SH	5227.1	364	4863.1	102	470	5125.1	4757.1	8	5063.58	8/3/2010	Q1, Q3
2	141	DW-46	73583.8	104714.6	OSS/SH	5235.5	368	4867.5	211	460	5024.5	4775.5	8	5069.6	8/12/2010	Q1, Q3
2	142	DW-47	73886.1	103399.0	TDSS/OSS/SH	5238.6	357	4881.6	51	424	5187.6	4814.6	8	5114.85	8/2/2010	Q1, Q3
1	144	DW-35	76693.8	103409.5	TDSS/OSS/SH	5311.3	500	4811.3	200	500	5111.3	4811.3	8	5069.8	8/13/2010	Q1, Q3

Notes:

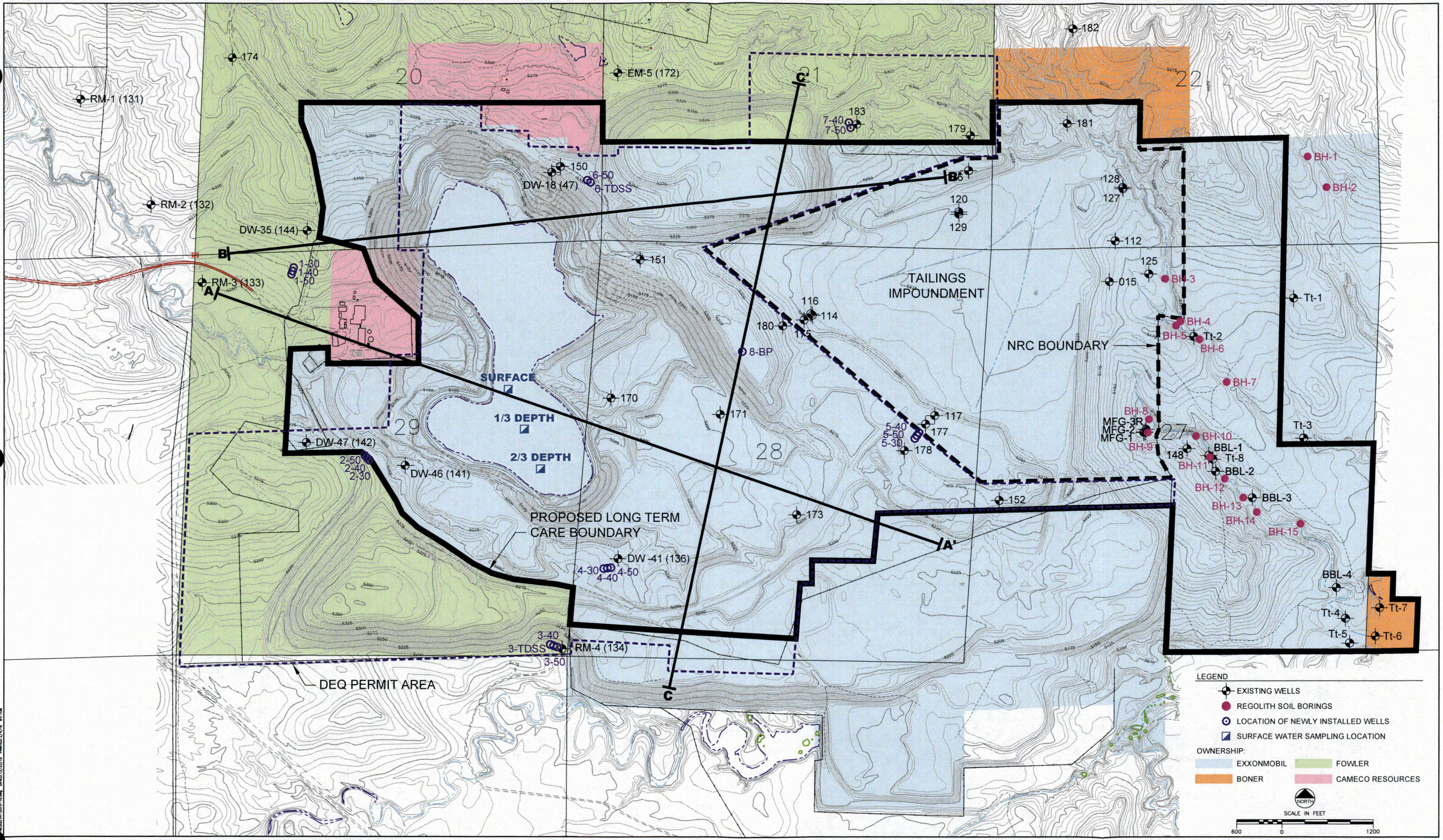
(1) The legal location of the wells is unknown.

(2) The datum for the MFG wells is WGS 84; the datum for the BBL wells is NAD83. The datum for the other wells is unknown.

-- Data unknown

Acronyms bgs - below ground surface; ft – feet; in – inch; msl - mean sea level; NA - not assigned; OSS - Ore Body Sandstone; PVC - Polyvinyl chloride; SH – Shale; TDSS -Tailings Dam Sandstone

Figures



No.	DESCRIPTION	BY	CHKD.	APPROVED	DATE

REVISIONS

DWG No.	DRAWING TITLE

REFERENCES

ENGINEERING RECORD	BY	DATE

DESIGNERS

PREPARED BY

WORTHINGTON MILLER ENVIRONMENTAL, LLC.

PREPARED FOR

ExxonMobil

TITLE

FIGURE 1 SAMPLING LOCATIONS, NEW WELLS & BORINGS

PROJECT: HIGHLAND | DATE: FEBRUARY 2016 | DRAWING | REVISION

SCALE: AS SHOWN | FILE: WELLS-REGOLITH-2015-10

SYSTEM	EPOCH	FORMATION	LITHOLOGY	DESCRIPTION
TERTIARY	EOCENE	WASATCH		SOIL AND WEATHERED ZONE
				Undifferentiated Sandstones and Shales (Fowler Sands). 0-350 feet in thickness.
				Sandstone: grain size varies from medium-grained sand to gravel, most commonly medium to very coarse-grained sand; beds vary from loose friable sand to well-cemented (carbonate) sandstones (Does not contain uranium mineralization).
				Siltstone and Claystone (shale): Color varies from olive orange to gray green; may contain thin interbedded sandstones and lignite beds.
	PALEOCENE	FORT UNION		
				Tailings Dam Sandstone (TDSS): Sandstone description same as Wasatch Sandstone (Does not contain uranium mineralization in Highland area). 30-50 feet in thickness.
				Tailings Dam Shale (TDSH): generally gray green with thin beds of sandstone. 20-50 feet in thickness.
				50-Sand (50SS- Upper Ore Body Sandstone): Sandstone description same as Wasatch Sandstone (Ore bearing unit in Highland area). 20-50 feet in thickness.
				45-Shale Siltstone and Claystone (45SH): generally gray green. 9-35 feet in thickness.
				40-Sand (40SS- Middle Ore Body Sandstone): Sandstone description same as Wasatch Sandstone (Major ore bearing unit in Highland area). 20-50 feet in thickness.
				35-Shale Siltstone and Claystone (35SH) (shale): generally gray green; may contain thinbedded sandstone units). 9-35 feet in thickness.
				30-Sand (30SS- Lower Ore Body Sandstone): Sandstone description same as Wasatch Sandstone (Major ore bearing unit in Highland area). 20-50 feet in thickness.
				25-Shale Siltstone and Claystone (25SH) (shale): generally gray green. 9-35 feet in thickness.
				20-Sand (20SS): Sandstone description same as Wasatch Sandstone. Does not contain economic amounts of uranium in Highland area). 20-50 feet in thickness.
				Siltstone and Claystone (shale): same as above. Variable thickness.

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FIGURE 2
GENERALIZED STRATIGRAPHIC
COLUMN, HIGHLAND AREA

Date:	DECEMBER 2015
Project:	HIGHLAND
File:	STRAT-COLUMN

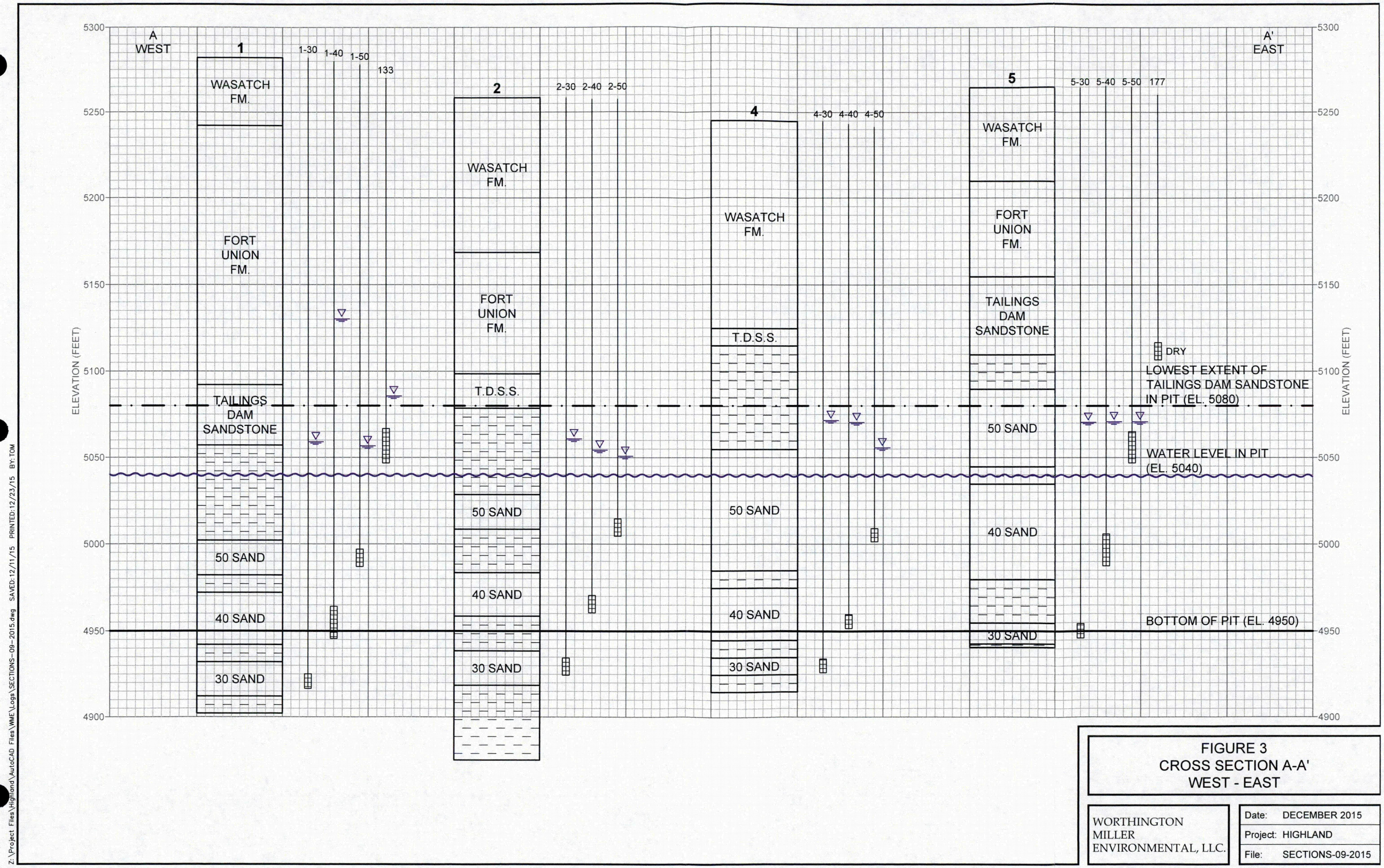

FIGURE 3
CROSS SECTION A-A'
WEST - EAST

WORTHINGTON MILLER ENVIRONMENTAL, LLC.

Date: DECEMBER 2015
Project: HIGHLAND
File: SECTIONS-09-2015

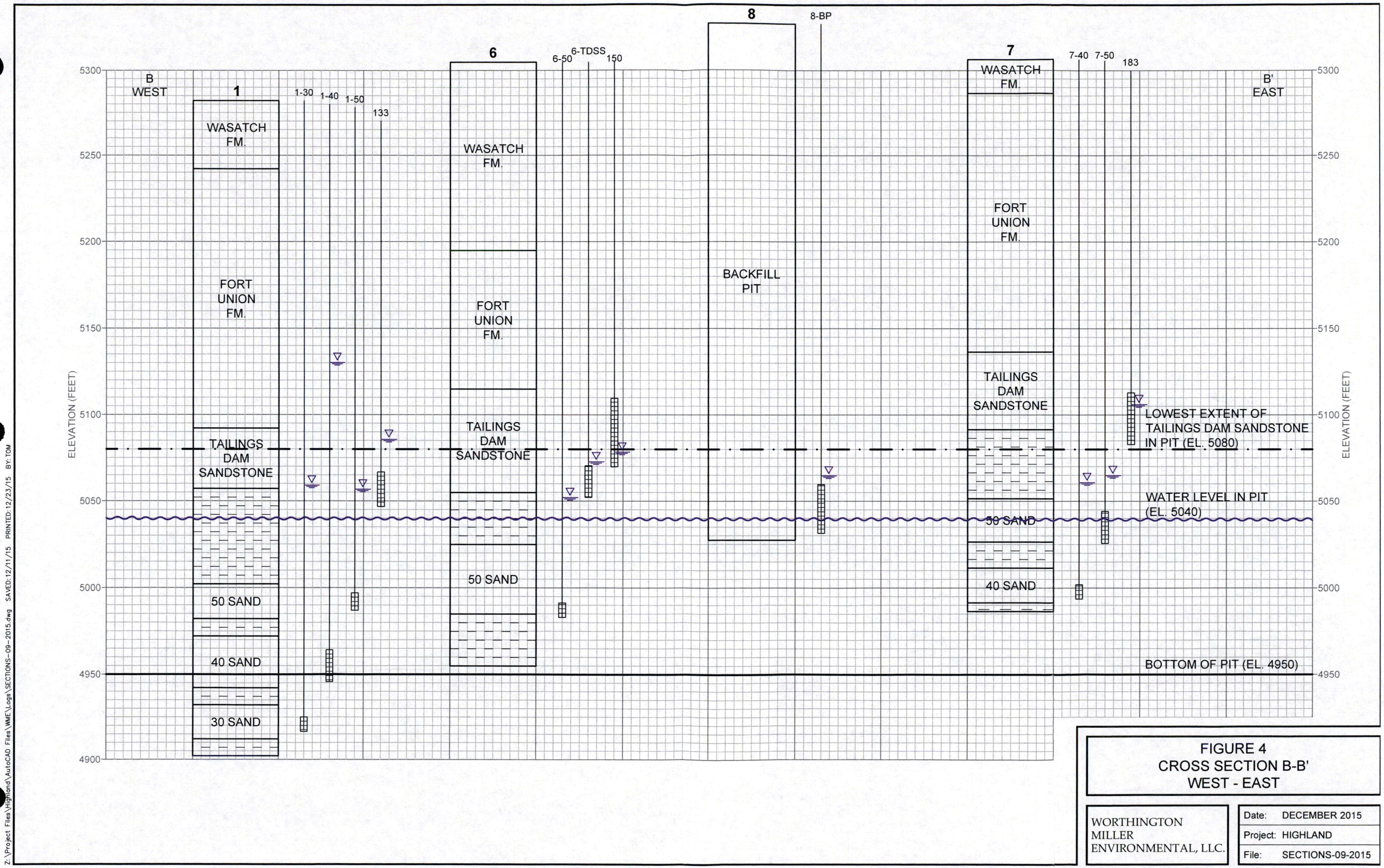

FIGURE 4
CROSS SECTION B-B'
WEST - EAST

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ENVIRONMENTAL, LLC.

Date:	DECEMBER 2015
Project:	HIGHLAND
File:	SECTIONS-09-2015

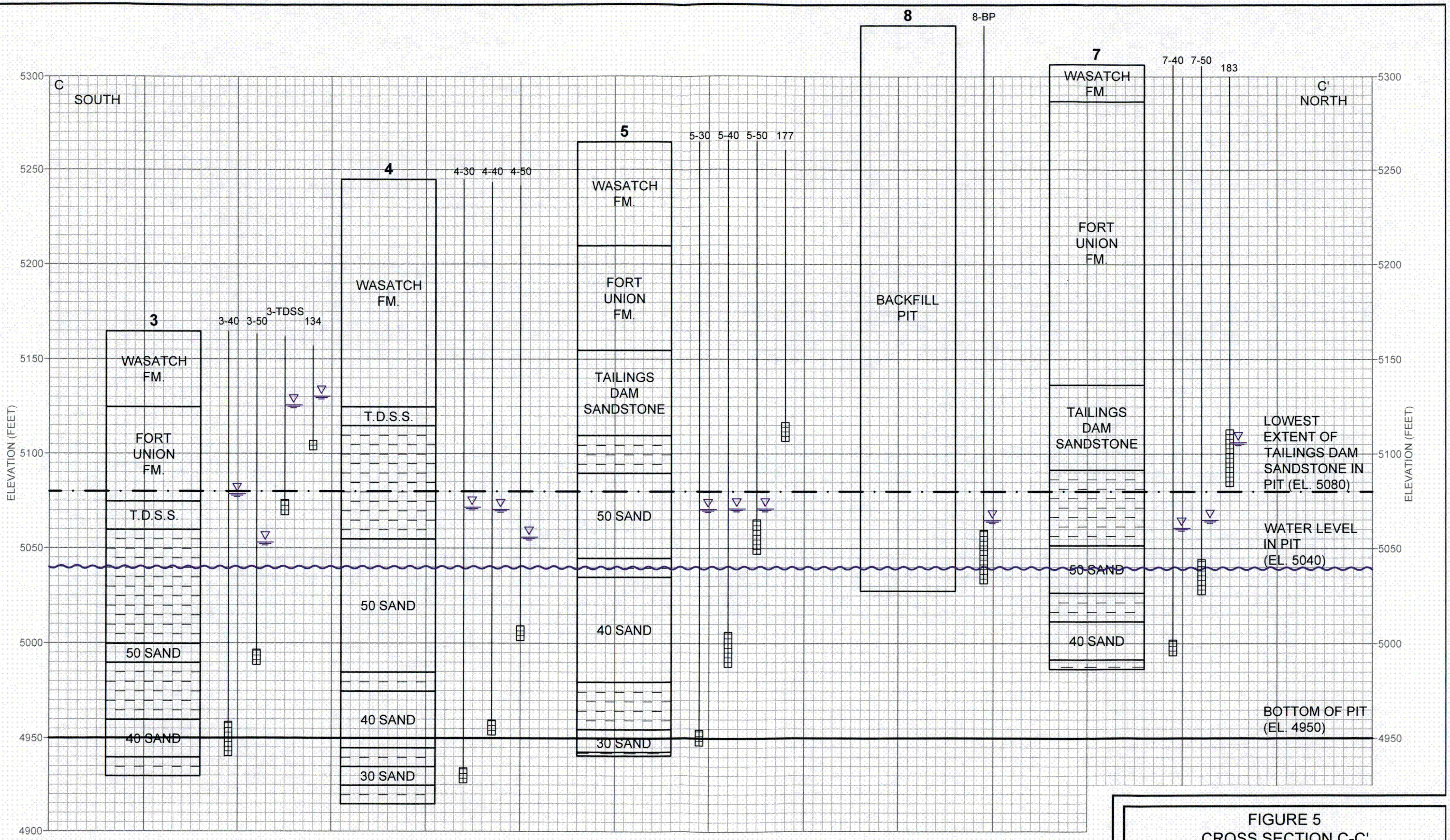

FIGURE 5
CROSS SECTION C-C'
SOUTH - NORTH

WORTHINGTON MILLER ENVIRONMENTAL, LLC.

Date: DECEMBER 2015
Project: HIGHLAND
File: SECTIONS-09-2015

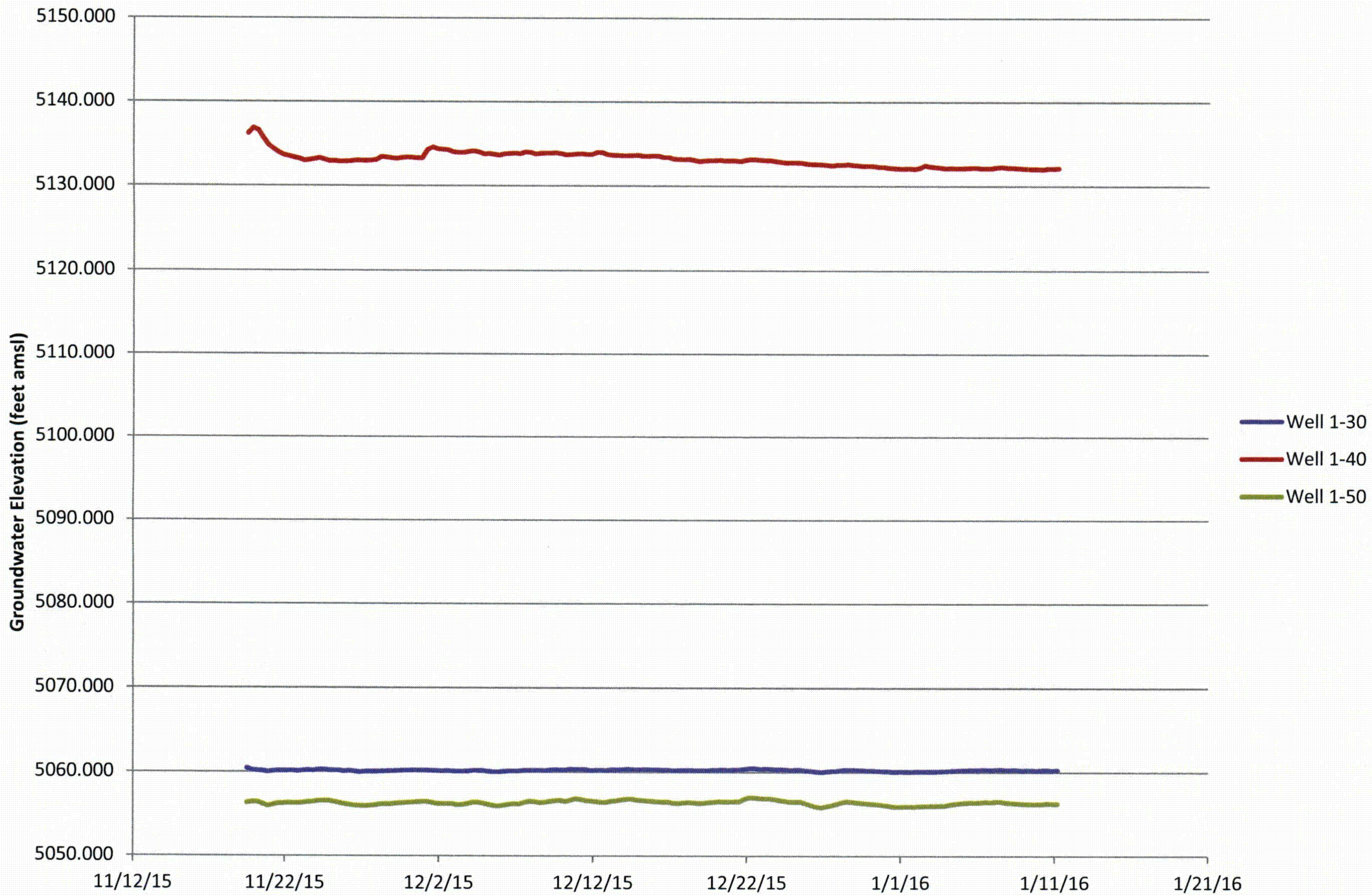

Figure 6. Cluster #1 Groundwater Elevations

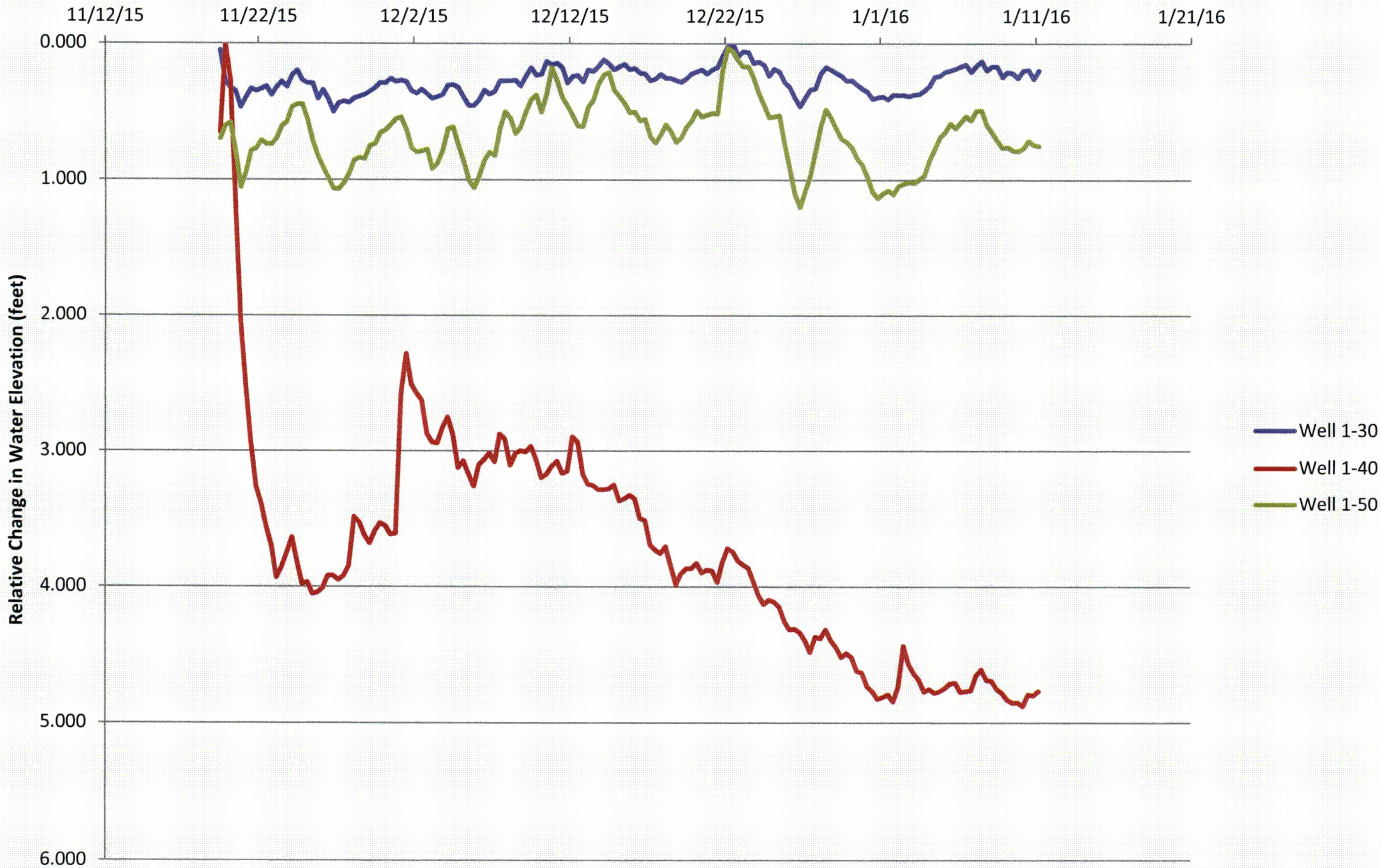

Figure 7. Cluster #1 Relative Change in Depth to Groundwater