

Platte River Power Authority Ash Monofill Annual Groundwater Monitoring and Corrective Action Report for 2019



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January 31, 2020

Platte River Power Authority Ash Monofill Annual Groundwater Monitoring and Corrective Action Report for 2019

A handwritten signature in black ink, appearing to read "Jeremy T. Hurshman", written over a horizontal line.

Prepared By
Jeremy Hurshman
Senior Hydrogeologist

A handwritten signature in black ink, appearing to read "Richard Henry", written over a horizontal line.

Reviewed By
Richard Henry, PhD
Principal Hydrogeologist

A handwritten signature in black ink, appearing to read "Vasanta Kalluri", written over a horizontal line.

Approved By
Vasanta Kalluri
Program Manager

Acronyms and Abbreviations

ACM	Assessment of Corrective Measure
AECOM	AECOM Technical Services, Inc.
bgs	below ground surface
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
EROP	Engineering Report and Operational Plan
GWPS	groundwater protection standard
i.d.	inner diameter
LCL	lower confidence limit
mg/L	milligrams per liter
PRPA	Platte River Power Authority
PVC	polyvinyl chloride
SSI	statistically significant increase
SSL	statistically significant level
TDS	total dissolved solids
UPL	upper prediction limit

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1.0 Introduction

This is the 2019 Annual Groundwater Monitoring and Corrective Action Report for the Coal Combustion Residuals (CCR) Ash Monofill at the Platte River Power Authority (PRPA) Rawhide Energy Station (Rawhide Station or Site) in Larimer County, Colorado. This report was developed by AECOM Technical Services, Inc. (AECOM) at the request of PRPA. The purpose of this report is to provide a summary of the groundwater monitoring activities performed at the Ash Monofill in 2019 to comply with the requirements of Title 40 of the Code of Federal Regulations (CFR) Part 257 Subpart D, known as the CCR Rule, which became effective on October 19, 2015. The rule provides standards for the disposal of CCR in landfills and surface impoundments (CCR units) and establishes groundwater monitoring requirements in 40 CFR 257.90 through 257.94. In accordance with 40 CFR 257.90(e), an annual report must document the status of the groundwater monitoring and correction action program (as applicable) for the CCR unit, summarize the key actions completed the previous year, describe any problems encountered, discuss actions taken to resolve the problems, and project key activities for the upcoming year. The annual report will be considered complete when it is placed in the facility operating record by January 31, 2020.

1.1 Report Organization

This Annual Report is divided into nine sections as outlined below and includes text, tables, figures, and appendices. The sections include:

- Section 1.0 includes this introduction and report organization;
- Section 2.0 provides a facility description that includes the facility location and operational history, a description of the CCR unit and a summary of the areal and site hydrogeology;
- Section 3.0 summarizes the results of the assessment of corrective measures (ACM);
- Section 4.0 summarizes the groundwater monitoring and corrective action activities performed in 2019, and references appendices to this report that contain detailed documentation of those activities;
- Section 5.0 summarizes the groundwater sampling and analysis results;
- Section 6.0 provides the statistical analyses and results;
- Section 7.0 provides a projection of the key activities anticipated in 2020;
- Section 8.0 provides a summary of findings; and
- Section 9.0 provides a list of references cited in the report.

The report also includes eight appendices that provide supporting documentation of the groundwater monitoring and related activities conducted in 2019 that include:

- Appendix A Monitoring Well Boring Logs and Well Completion Diagrams
- Appendix B Well Development Forms
- Appendix C Groundwater Sampling Forms
- Appendix D Laboratory Analytical Reports and Data Validation Reports
- Appendix E Slug Test Outputs and Field Forms
- Appendix F Statistical Analysis Results
- Appendix G Modified Groundwater Monitoring Well Network Certification
- Appendix H Ash Monofill Assessment of Corrective Measures

2.0 Facility Description

2.1 Facility Location and Operational History

The Rawhide Station encompasses approximately 4,560 acres north of Wellington in Larimer County, Colorado. In addition to the plant buildings, the major feature of the facility is an approximately 500-acre dry-land construction reservoir of reclaimed wastewater from the City of Fort Collins, also known as Hamilton Reservoir, which contains approximately 15,000 acre-feet of water and is used for cooling processes. The power block area contains the boiler and turbine buildings, the air quality control equipment, and the administrative offices. A rail spur along the northern edge of the Site connects the Rawhide Facility with the mainline of the Burlington Northern Santa Fe Railway Company Railway Company and is used to deliver coal and construction materials for plant operations. Six generating units are located at the Rawhide Station. Units A, B, C, D, and F are fueled by natural gas, and Unit 1 is fueled by coal from the Powder River Basin in Wyoming.

2.2 Ash Monofill Description

The Ash Monofill is located northwest of the main plant and north of Hamilton Reservoir. CCR solid waste from Unit 1 operations is disposed in the Ash Monofill which is comprised of two cells, Cell 1 and Cell 2, as shown on **Figure 1**. Cell 1 was operated from approximately 1980 to 2007 and is no longer in use. It is capped with cover soils but has not undergone final closure. Cell 2 is active, lies to the west of Cell 1, and is progressively advancing northwards as further ash material is placed within the cell.

2.3 Rawhide Station Hydrogeology

The hydrogeology of the Rawhide Station is discussed in the Engineering Report and Operational Plan (EROP) for the Solid Waste Disposal Facility (PRPA 1980), and in the Final Report Investigation of the Groundwater Monitoring Program for the Bottom Ash Disposal Site conducted by Lidstone and Anderson (1989). According to the 1980 EROP, hydrogeology of the Rawhide Station was originally investigated by drilling and installing 23 piezometers in conjunction with the original geotechnical investigation of the site prior to construction of the facility. Data from the piezometers indicated that a groundwater table exists within the weathered and fractured Pierre Shale bedrock beneath the Site, and in alluvial deposits along Coal Creek. The report indicated that the depth to groundwater varied across the Site from 11 to 67 feet below ground surface (bgs), with groundwater generally flowing to the south-southeast. The shallow water table, as explained in the 1980 EROP, was reported to be directly recharged by infiltration from precipitation and surface runoff.

Following construction and operation of the Rawhide Station, Lidstone and Anderson (1989) concluded that sufficient groundwater data were collected to determine that a mound had formed in the shallow, weathered, and fractured Pierre Shale in the vicinity of Hamilton Reservoir. After a review of available groundwater level information for Rawhide Station, AECOM concluded that the CCR units present at the Site are located hydraulically upgradient of any groundwater mound created by Hamilton Reservoir.

2.4 Ash Monofill Hydrogeology

The Ash Monofill is constructed within a narrow south-sloping valley with bedrock highs along both sides. The uppermost water-bearing stratum at the Ash Monofill was identified during groundwater monitoring well installation as the weathered and fractured Pierre Shale. Groundwater at the Ash Monofill is under water table conditions and, in 2019, lied at depths from approximately 3 to 64 feet bgs. Groundwater flow is generally from northwest to south-southeast, from the Ash Monofill towards Hamilton Reservoir, generally following the topographic slope of the valley.

3.0 Assessment of Corrective Measures

This section summarizes the actions completed regarding the Ash Monofill ACM which included:

- Completed a State of Colorado professional engineer certified Ash Monofill ACM extension justification and filed it in the facility's operating record on June 13, 2019.
- Completed, and posted to PRPA's publicly accessible CCR website, the Ash Monofill ACM on August 15, 2019. The Ash Monofill ACM is attached as **Appendix H**.
- Conducted a meeting on November 13, 2019, to discuss the Ash Monofill ACM with public and solicit comments.

4.0 Groundwater Monitoring Activities in 2019

This section summarizes groundwater monitoring activities conducted during 2019 to comply with the CCR Rule. Groundwater monitoring activities included:

- Installed one additional groundwater monitoring well, ASH-08, on April 24, 2019. The modified monitoring well network was certified by a professional engineer in accordance with 40 CFR 257.91(c). A copy of the certification is provided in **Appendix G**;
- Developed new monitoring well ASH-08 and redeveloped monitoring wells ASH-03, ASH-04, ASH-05, and ASH-07 to improve yield and reduce suspended particulates/turbidity;
- Performed slug tests at monitoring wells ASH-06, ASH-07, and ASH-08 to determine aquifer hydraulic properties;
- Measured groundwater levels at each monitoring well prior to purging and sampling to provide potentiometric data;
- Groundwater sampling and analysis of detection (Appendix III) and assessment (Appendix IV) monitoring constituents to identify potential releases from the Ash Monofill and to collect supplemental data to allow the background statistics to be updated; and
- Statistical analysis of the 2019 Appendix III detection and Appendix IV assessment monitoring data to determine if there were any statistically significant increases (SSIs) over background and whether any of the SSIs were above groundwater protection standards (GWPS) at a statistically significant level (SSL); and

4.1 Modified Groundwater Monitoring Well Network

One new groundwater monitoring well was installed at the Ash Monofill in April 24, 2019. Monitoring well ASH-08 was installed downgradient of the Ash Monofill to further characterize the extent of constituents in this area. The modified groundwater monitoring well network for the Ash Monofill is shown on **Figure 1**. The Ash Monofill network includes two upgradient wells, ASH-01 and ASH-06, that are used to establish background groundwater constituent concentrations, and six downgradient wells, ASH-02, ASH-03, ASH-04, ASH-05, ASH-07, and ASH-08, along the southern edge of the Ash Monofill that are designated downgradient compliance wells. Monitoring wells ASH-01 and ASH-02 were installed in 1980 as MW-1 and MW-2 for a site-wide monitoring well network. Monitoring wells ASH-03, ASH-04, and ASH-05 were installed in 2016 to comply with the CCR Rule. Monitoring wells ASH-06 and ASH-07 were installed in 2018 to comply with the CCR Rule.

Existing monitoring well ASH-02 was added to the Ash Monofill monitoring well network as an additional downgradient compliance well in 2019. The well was constructed by Black and Veatch in 1980 to monitor

sitewide groundwater quality changes. It was constructed with 4-inch i.d., Schedule 40 PVC well casing and screen. Bentonite clay was used as the annular sealant and pea gravel was used as the filter media around a 3-foot length of well screen set in the saturated zone. The well was completed with an above ground steel protective casings. The steel protective casing is surrounded by three wooden posts.

Monitoring well completion details are shown on **Table 1**. The boring log and well construction diagram for the monitoring wells are included in **Appendix A**.

4.2 Installation of Monitoring Well ASH-08

Monitoring well ASH-08 was installed at a location cleared by PRPA and One Call. Badger Daylighting performed hydrovac excavation to clear V-trenches at each boring location to a depth of 7 to 8 feet bgs to reduce the possibility of the drill rig encountering subsurface utilities. The soil boring was drilled by Drilling Engineers, Inc. of Fort Collins, Colorado (Drilling Engineers) using a hollow-stem auger rig equipped with 8.25-inch augers. Continuous soil cores were collected for logging and visual evaluation of lithology and water-bearing zones by AECOM's field geologist. Boring logs were completed in the field as the borings were advanced. The borings were logged by visual observation to lithologically classify the soils and note the presence or absence of moist soil core, free water in fractures, or groundwater seepage into the borings.

A permanent monitoring well was installed in the new soil boring. The well was constructed with 2-inch internal diameter (i.d.), Schedule 40 polyvinyl chloride (PVC) well casing, and 10 slot (0.010-inch factory-slotted) well screen. The monitoring well was screened across the water-bearing interval observed in the soil core. Monitoring well ASH-08 was equipped with a 10-foot-long screen. Filter pack, consisting of 10 to 20 silica sand, was placed in the well annulus from the bottom to a minimum of 2 feet above the well screen. A minimum 5-foot-thick 3/8-inch hydrated bentonite chip seal was placed on top of the sand filter pack using coated time-release bentonite chips. A Portland cement-bentonite (neat cement) grout was mixed and placed in the well annulus from the top of the hydrated bentonite seal to near ground surface. The well was completed with above ground steel protective casings (approximately 3 feet high) with a locking expansion plug. The steel protective casing was set within a 2-foot by 2-foot by 4 to 6-inch-thick concrete pad and surrounded by three steel bollards.

4.3 Monitoring Well Development

Following monitoring well installation, monitoring well ASH-08 was developed to improve yield and reduce turbidity. ASH-08 was developed by Drilling Engineers using a surge block, bailer, and submersible electric pump. Well development began no sooner than 24-hours after the well was completed and consisted of removing approximately 5 to 10 well casing volumes from the well. Four existing monitoring wells (ASH-03, ASH-04, ASH-5, and ASH-07) also were developed in April 2019 by AECOM personnel, in addition to ASH-08, to improve yield and reduce turbidity. During well development, AECOM personnel sampled the development water for pH, temperature, specific conductance, turbidity, and other observations (i.e., color and clarity) after each well casing volume was removed. Each well was developed to obtain water that was relatively clear (i.e., turbidity is less than 50 nephelometric turbidity units) and/or all field parameters stabilized (i.e., less than a 10 percent change between measurements). A well was considered developed when the field parameters stabilized, when 10 well casing volumes were removed, or when the well was pumped dry. Well development activities were documented on well development forms and are presented in **Appendix B**.

4.4 Surveying

The horizontal (x and y) and vertical (z) coordinates of the new monitoring well ASH-08 was measured by Northern Engineering, a Colorado-licensed surveyor, of Fort Collins, Colorado. Survey measurements were referenced to Universal Transverse Mercator Zone 13 North, North American Datum 1983 (NAD83), and North American Vertical Datum 1988 (NAVD88). For monitoring wells, the top of the well casing and the ground surface elevation were surveyed. The horizontal position was

reported in northing and easting coordinates to the nearest 0.10 foot relative to the survey control points, and vertical position was reported as elevation to the nearest 0.01 foot.

4.5 Well Hydraulic Testing

Following well development, slug tests were performed in each of the recently-installed monitoring wells (ASH-06, ASH-07, and ASH-08) to determine the aquifer transmissivity and conductivity. Slug tests were performed by AECOM geologists in accordance with Standard Operating Procedures (SOP-009 and SOP-010) provided in the Sitewide Monitoring Plan (AECOM 2019b). At least two slug tests were performed at each well, including falling (slug in) and rising (slug out) head tests. Slug tests were performed by displacing the water in a well using a sealed PVC slug, and measuring water level recovery using a submerged In-Situ Level Troll 700 automated pressure transducer. The slug test data were interpreted by an AECOM hydrogeologist using AQTESOLV Version 4.5 software. The slug test results are summarized in **Table 2**.

4.6 Water Level Measurements

During each monitoring event, groundwater levels were measured using an electronic water level meter. AECOM also measured the total depth of each monitoring well by lowering the meter sensor to the bottom of the well. Groundwater levels and total depth measurements were recorded to the nearest hundredth (0.01) of a foot. The water level meter cable and sensor were decontaminated at the start of field activities and after use at each well to limit the potential for cross-contamination between wells. Water level measurements were recorded on groundwater sampling forms, provided in **Appendix C**, and are tabulated in **Table 3** for the January, May, July, and October 2019 sampling events.

4.7 Groundwater Sample Collection

Two rounds of semi-annual Appendix III detection monitoring and Appendix IV assessment monitoring samples were collected at the Ash Monofill wells on May 1 to 6, 2019 and October 8 to 17, 2019. In addition, baseline detection and assessment monitoring also was conducted wells ASH-02, ASH-06, ASH-07, and ASH-08 on January 24 and July 17-22, 2019. Four rounds (January, May, July, and October) of baseline data were collected at wells ASH-06 and ASH-07, and three rounds (May, July, and October) of baseline data were collected at wells ASH-02 and ASH-08.

Groundwater samples were collected in general accordance with the CCR Ash Monofill Groundwater Detection Monitoring Plan (AECOM 2017). Each well was initially purged using a submersible bladder pump and dedicated polyethylene bonded tubing. Disposable bladder liners were replaced before sampling each monitoring well and the pump casing was decontaminated prior to purging and sampling each monitoring well to avoid cross contamination between wells. The bladder pump tubing was lowered into the well to a depth within the screen interval that was at least 1 to 2 feet off the bottom of the well to avoid disturbing accumulated sediment in the lower part of the well screen. Monitoring wells were purged using low flow sampling techniques until field parameter measurements of pH, temperature, dissolved oxygen, oxidation reduction potential, turbidity, and conductivity stabilized within ± 10 percent. Purge water volumes were recorded on groundwater sampling forms (**Appendix C**).

Groundwater samples were collected after purging each monitoring well. The samples were collected from the tubing outlet of the bladder pump directly into laboratory-supplied sample containers. Sample water was slowly pumped into each laboratory sample container until the containers were appropriately filled, taking care not to spill the laboratory preservative contained in sample bottles. The groundwater samples analyzed for dissolved metals were field-filtered. The sample containers were then labeled and placed on ice in a sample cooler. At the conclusion of the field day, the samples were either shipped or delivered by overnight carrier to Pace Analytical in Lenexa, Kansas, for analysis.

4.8 Analytical Program

Groundwater samples collected from the Ash Monofill wells were analyzed using U.S. Environmental Protection Agency SW-846 methods for Appendix III and Appendix IV constituents. All analytical results are reported as totals (unfiltered). **Table 4** (January), **Table 5** (May), **Table 6** (July), and **Table 7** (October) summarize the groundwater analytical results for each sampling event. The laboratory analytical reports are provided in **Appendix D**.

Appendix III constituents included: boron (Method 6010C), chloride (Method 9056A), calcium (Method 6010C), fluoride (Method 9056A), pH (field), sulfate (Method 9056A), and total dissolved solids (TDS) (American Public Health Association et al. [1998] Standard Method 2540C). The analytical method used for each constituent is shown in parenthesis following the analyte name.

Appendix IV constituents included: antimony (Method 6020A), arsenic (Method 6020A), barium (Method 6020A), beryllium (Method 6020A), cadmium (Method 6020A), chromium (Method 6020A), cobalt (Method 6020A), fluoride (Method 9056A), lead (Method 6020A), lithium (Method 6010C), mercury (Method 7470A), molybdenum (Method 6020A), radium 226/228 combined (Method 9315), selenium (Method 6020A), and thallium (Method 6020A).

4.9 Quality Control/Quality Assurance

Quality assurance and quality control samples collected during sampling activities included one field duplicate for each round of assessment monitoring, one equipment rinse blank, and one matrix spike/matrix spike duplicate sample. The field duplicate samples were collected immediately following collection of the primary samples using the same sampling procedures. The equipment rinse blank samples were collected after decontaminating the bladder pump casing using techniques outlined in the sampling and analysis plan.

4.10 Data Validation

The laboratory data were validated by AECOM chemists using U.S. Environmental Protection Agency guidance. Data validation reports are provided in **Appendix D**.

5.0 Monitoring Results and Evaluation

This section discusses potentiometric surface elevations, groundwater flow directions, and analytical sampling results for the samples collected during the two assessment monitoring events conducted in May and October 2019 and the baseline detection and assessment monitoring conducted in July 2019 at the Ash Monofill.

5.1 Well Hydraulic Testing

Slug tests were performed to determine aquifer hydraulic conductivities for the new monitoring wells ASH-06, ASH-07, and ASH-08. The slug tests were performed on May 2, 2019 (ASH-06 and ASH-08) and on May 8, 2019 (ASH-07) by AECOM geologists. Water level data were collected using automated transducers installed in each monitoring well prior to the start of slug tests. These data were analyzed to determine the aquifer hydraulic conductivity values and transmissivity values for each well. Manual water level measurements also were collected to verify electronic transducer data and are provided in **Appendix E**. The aquifer hydraulic conductivities determined from the slug test results ranged from 0.085 to 1.44 feet per day, with a geometric mean of 0.935 foot per day. These values are consistent with previously determined hydraulic conductivities (0.48 to 1.23 ft/d) at the Ash Monofill (AECOM 2018 and 2019a). The slug test results are summarized in **Table 2**. Slug test analysis output is provided in **Appendix E**.

5.2 Groundwater Potentiometric Surface

As required by 40 CFR 257.93(c), the static depth to groundwater was measured at each well during each sampling round prior to purging. The depth to groundwater measurements (**Table 3**) were used with the top of casing elevations (**Table 1**) to calculate the groundwater elevations and prepare potentiometric surface maps for May, July, and October sampling events (**Figure 2**, **Figure 3**, and **Figure 4**). These maps were used to determine that groundwater in the uppermost aquifer beneath the Ash Monofill flows from northwest to southeast at an average hydraulic gradient of 0.014 feet per foot. This gradient is consistent with the average gradients previously reported in past annual reports (AECOM 2018 and 2019a).

5.3 Groundwater Flow

An average flow rate was calculated for groundwater in the uppermost aquifer beneath the Ash Monofill using the historic average hydraulic gradient (0.016 foot per foot) determined between monitoring wells ASH-01 and ASH-06, the minimum and maximum hydraulic conductivities determined from aquifer slug tests, and an assumed effective porosity of 15 percent. The results indicate that groundwater in the uppermost aquifer beneath the Ash Monofill flows at a rate ranging from approximately 0.051 to 0.131 foot per day, with a geometric mean of 0.073 foot per day.

5.4 Groundwater Analytical Results

Groundwater samples were collected and analyzed for Appendix III and IV parameters specified in Section 4.7 in January, May, July, and October 2019. The samples were analyzed by Pace Analytical in Lenexa, Kansas. These laboratory analytical reports are provided in **Appendix D** and included in the facility operating record. The laboratory results were reviewed for completeness against the project-required analytical methods and the chain-of-custody forms and subsequently validated by AECOM. The data were found to be valid and useable with qualification as outlined in the data verification reports found in **Appendix D**. **Table 4** (January), **Table 5** (May), **Table 6** (July), and **Table 7** (October) summarize the groundwater analytical results for each sampling round. Monitoring wells ASH-01, ASH-02, ASH-03, ASH-04, ASH-05, ASH-06, ASH-07, and ASH-08 were sampled during the May and October events to comply with assessment monitoring requirements. Monitoring wells ASH-02, ASH-06, ASH-07, and ASH-08 also were sampled during the January and July 2019 events to collect quarterly baseline detection and assessment monitoring data.

5.5 Groundwater Monitoring System Evaluation

As described in **Section 4**, drilling equipment and procedures were employed to identify the uppermost aquifer and determine that each new monitoring well was installed with appropriate total depth and placement of well screen to: (1) facilitate collection of representative samples of groundwater in the uppermost aquifer, and (2) to accurately measure water-table elevations to determine the groundwater hydraulic gradient and flow direction. All monitoring wells comprising the Ash Monofill groundwater monitoring system were inspected during each sampling round and were found to be in good condition and capable of supplying a representative sample.

Analysis of potentiometric surface maps constructed using the depth to groundwater measurements obtained during each sampling round (**Figure 2**, **Figure 3**, and **Figure 4**) indicate that groundwater beneath the Ash Monofill generally flows from northwest to southeast at average gradient in 2019 of 0.014 foot per foot and a historic mean flow rate of approximately 0.073 foot per day. This flow direction is consistent with the groundwater flow directions observed during 2016, 2017, and 2018. These data confirm that monitoring well ASH-01 and ASH-06 are located upgradient of the Ash Monofill and represents background ground water quality and that monitoring wells ASH-02, ASH-03, ASH-04, ASH-05, ASH-07, and ASH-08 are located downgradient of the Ash Monofill and represent downgradient groundwater quality.

5.6 Problems Encountered and Actions Taken

There were no problems encountered or actions taken during 2019.

6.0 Statistical Analysis Results

The Ash Monofill groundwater quality data were evaluated using the certified statistical approach presented in the CCR Ash Monofill Groundwater Detection Monitoring Plan (AECOM 2017). Groundwater quality data were evaluated using an interwell approach that statistically compared constituent concentrations at downgradient monitoring wells to those present at background monitoring wells. For the PRPA Ash Landfill, monitoring well ASH-01 and ASH-06 are designated as the background wells because they are located upgradient of the northern landfill boundary, whereas monitoring wells ASH-02, ASH-03, ASH-04, ASH-05, ASH-07, and ASH-08 are designated as compliance wells because they are located downgradient of the southern monofill boundary.

The statistical analyses were performed in accordance with 40 CFR Parts 257.93(f), 257.93(g), and 257.93(h) and the Statistical Method Certification (AECOM 2017). Prediction limits (i.e., parametric or nonparametric) with 1 of 2 retesting were developed for each constituent based on the frequency of non-detect values and whether the background data for that constituent exhibited a normal, lognormal, or nonparametric distribution. For the statistical analysis, non-detect values were represented as one-half the detection limit. No outliers were identified in the data. Analytical data from the background monitoring wells collected between March 2016 and October 2019 were used to develop an upper prediction limit (UPL) for the background data at 95 percent confidence. Data from the downgradient monitoring wells for the same time period were compared to the UPL to identify SSIs over background. Mann-Kendall trend analysis was used to identify statistically significant increasing trends for constituents with SSIs. ProUCL Version 5.1 was used to store the data and run the statistical analyses. The results of the statistical analyses, including the Appendix III and IV UPLs, are provided in **Table 8** and **Table 9**, respectively. The statistical analysis output is provided in **Appendix F**.

6.1 Appendix III SSI Determination

The Appendix III detection monitoring results were compared against their respective background UPLs to determine if they exhibited SSIs above background. This comparison indicates that some of the boron, calcium, chloride, sulfate, and TDS concentrations at monitoring wells ASH-02, ASH-03, ASH-04, ASH-05, ASH-07, and ASH-08 have confirmed SSIs above the background UPLs as shown in the table below. Fluoride and pH did not show any SSIs above background at any of the downgradient compliance wells. None of the SSIs had statistically significant increasing trends. The Appendix III SSIs found during 2019 are consistent with those identified during 2018.

Well	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	TDS
ASH-02	SSI	----	----	----	----	SSI	----
ASH-03	SSI	SSI	SSI	----	----	SSI	SSI
ASH-04	----	SSI	SSI	----	----	SSI	SSI
ASH-05	SSI	SSI	SSI	----	----	SSI	SSI
ASH-07	SSI	SSI	SSI	----	----	SSI	SSI
ASH-08	SSI	SSI	----	----	----	SSI	SSI

6.2 Appendix IV SSI Determination

The Appendix IV assessment monitoring results were compared against their respective background UPLs to determine if they exhibited SSIs above background. This comparison indicates that selenium at monitoring wells ASH-03, ASH-04, ASH-05, and ASH-07 have SSIs over background that were confirmed by subsequent monitoring events (**Table 10**). None of the SSIs, including selenium at ASH-03, ASH-05,

or ASH-07, had statistically significant increasing trends. No other Appendix IV constituents exhibited verified SSIs.

6.3 Establishment of Groundwater Protection Standards

GWPS were selected for the Ash Monofill Appendix IV constituents using the criteria specified in 40 CFR 257.95(h). The GWPS listed on **Table 9** were selected from the U.S. Environmental Protection Agency drinking water maximum contaminant limits, groundwater standards provided in 40 CFR 257.95(3)(h)(2), or the background UPLs where they exceed either of the other standards.

6.4 Appendix IV SSL Determination

Constituents exhibiting an SSI over the background UPL were further evaluated to determine whether they are present at SSLs relative to GWPS established under the CCR Rule (40 CFR 257.95(d)(2)). SSLs were identified by calculating the 95 percent lower confidence limit (95 LCL) for the detection and assessment monitoring data at the downgradient compliance wells at the Ash Monofill and comparing the 95 LCL to the GWPS. A constituent is present at a SSL over the GWPS if the 95 LCL is greater than the GWPS. Selenium concentrations at monitoring wells ASH-03, ASH-05, and ASH-07 were found at a SSL above the GWPS because their 95 LCLs were greater than the selenium GWPS (0.05 milligram per liter [mg/L]) as shown in the table below.

Well No.	Parameter	95% LCL (mg/L)	GWPS (mg/L)
ASH-03	Selenium	0.0528	0.05
ASH-04	Selenium	0.0336	0.05
ASH-05	Selenium	0.0857	0.05
ASH-07	Selenium	0.0616	0.05

Yellow highlighted value exceeds GWPS.

7.0 Projected Activities in 2020

The following activities are anticipated to be performed at the Ash Monofill during calendar year 2020:

- PRPA will continue groundwater monitoring on a semiannual basis for the Appendix III detection monitoring constituents and Appendix IV assessment monitoring constituents that were detected as specified in 40 CFR 257.95(d)(1) or 40 CFR 257.95(f). The full list of Appendix IV constituents also will be sampled annually.
- Wells ASH-02, ASH-06, ASH-07, and ASH-08 were added to the monitoring network. Baseline data will continue to be collected at these wells for Appendix III and IV constituents on a quarterly basis until eight samples have been collected at each well. Four rounds of baseline data were collected at wells ASH-06 and ASH-07, and three rounds of baseline data were collected at wells ASH-02 and ASH-08 in 2019. Four additional baseline samples will be collected at ASH-06 and ASH-07 in 2020 to complete the eight rounds of quarterly sampling. Four additional baseline samples will be collected at ASH-02 and ASH-08 in 2020 and one additional sample at these wells in 2021 to complete the eight rounds of quarterly sampling. Sampling and analysis will be performed in accordance with the Ash Monofill Groundwater Monitoring Plan (AECOM 2017). Laboratory analyses will be performed by Pace Analytical. The new data will be incorporated into the statistical analyses as appropriate.
- An ACM was prepared in August 2019 to identify potential remedial alternatives for selenium in groundwater at the Ash Monofill. The ACM included a range of cleanup options that included monitored natural attenuation, groundwater pump and treat, and a permeable reactive barrier. The ACM options were presented at a public meeting in November 2019. In 2020, the corrective actions presented in ACM will be evaluated for a final remedy selection and implementation.

8.0 Summary and Findings

AECOM, on behalf of PRPA, oversaw groundwater sampling and analysis of detection (Appendix III) and assessment (Appendix IV) monitoring, installed a new monitoring well (ASH-08), and prepared an ACM for the Ash Monofill during 2019. Monitoring data and analytical results collected as part of the detection and assessment monitoring programs were evaluated to determine the aquifer hydraulic conductivities at the new monitoring wells, potentiometric surface elevations, groundwater flow directions and rates, and whether any constituents are present at a SSI above background UPLs or exceeded GWPS at a SSL.

The existing Ash Monofill monitoring well network was modified by the installation of one new monitoring well (ASH-08) in 2019. Monitoring well ASH-08 was installed downgradient of the Ash Monofill to further characterize constituent extents. Quarterly baseline sampling was conducted at monitoring wells ASH-06, ASH-07 (installed in 2018) and ASH-08. Additional baseline sampling will be conducted in 2020 until 8 quarterly rounds have been collected at these wells. These data will be incorporated into the monitoring program as collected.

Selenium concentrations in groundwater at monitoring wells ASH-03, ASH-04, ASH-05, and ASH-07 were found to have SSIs above background UPLs. Additional statistical analysis found that selenium exceeds the GWPS at a SSL at wells ASH-03, ASH-05, and ASH-07. These results require continued assessment monitoring at the Ash Monofill and corrective action.

An ACM was prepared in August 2019 to identify potential remedial alternatives for selenium in groundwater at the Ash Monofill. The ACM included a range of cleanup options that included monitored natural attenuation, groundwater pump and treat, and a permeable reactive barrier. The ACM options were presented at a public meeting in November 2019. Assessment monitoring results indicate that selenium exceeds the GWPS at a SSL at monitoring wells ASH-03, ASH-05, and ASH-07 and will require correction action.

9.0 References

- AECOM Technical Services, Inc. (AECOM). 2017. Coal Combustion Residuals (CCR) Ash Monofill Groundwater Detection Monitoring Plan Revision 0. Prepared for Platte River Power Authority Rawhide Energy Station Larimer County, Colorado. October 10, 2017.
- AECOM Technical Services, Inc. (AECOM). 2018. Bottom Ash Transfer (BAT) Impoundments Annual Groundwater Monitoring and Corrective Action Report 2016 – 2017. Prepared for Platte River Power Authority. January 31.
- AECOM Technical Services, Inc. (AECOM). 2019a. Bottom Ash Transfer (BAT) Impoundments Annual Groundwater Monitoring and Corrective Action Report For 2018. Prepared for Platte River Power Authority. January 31.
- AECOM Technical Services, Inc. (AECOM). 2019b. Sitewide Monitoring Plan, Revision 4. Rawhide Energy Station, Platte River Lower Authority, Fort Collins, Colorado. June 2019.
- American Public Health Association, American Water Works Association, and Water Environment Federation. 1998. Standard Methods for the Examination of Water and Wastewater, 20th Edition.
- Lidstone and Anderson, Inc. 1989. Investigation of the Ground-Water Monitoring Program for the Bottom Ash Disposal Site. March 1989.
- Platte River Power Authority (PRPA). 1980. Engineering Report and Operational Plan for the Solid Waste Disposal Facility, Rawhide Energy Project, December 1980.
- Title 40 of the Code of Federal Regulations (CFR) Part 257 Subpart D.

Tables

Table 1**Ash Monofill Monitoring Well Construction Details****PRPA Ash Monofill Annual Report for 2019****PRPA Rawhide Facility, Colorado**

Well Name	Location Relative to Waste Unit	Easting (ft)	Northing (ft)	Ground Surface Elevation (ft amsl)	Top of Casing Elevation (ft amsl)	Total Depth (ft bgs)	Well Screen Interval (ft bgs)	Well Screen Lithology
ASH-01	Upgradient Well	3124781.307	1562659.296	5759.29	5760.15	31	26-29	Shale
ASH-02	Downgradient Well	3127250.213	1558450.627	5679.25	5679.87	55	51-54	Shale
ASH-03	Downgradient Well	3126904.393	1558820.854	5714.21	5717.18	49	39-49	Shale
ASH-04	Downgradient Well	3126544.377	1558803.996	5689.58	5692.57	29	19-29	Shale
ASH-05	Downgradient Well	3126255.648	1558603.939	5696.68	5698.71	29	19-29	Shale
ASH-06	Upgradient Well	3126039.957	1562657.603	5783.23	5786.41	65	50-65	Shale
ASH-07	Downgradient Well	3127068.621	1558643.688	5687.58	5690.56	25	15-25	Shale
ASH-08	Downgradient Well	3126672.477	1558046.977	5681.22	5684.41	29	19-29	Shale

Notes:

ft amsl = feet above mean sea level; ft bgs = feet below ground surface

ASH-01 was installed in December 1980 as MW-1 by Black & Veatch.

ASH-02 was installed in December 1980 as MW-2 by Black & Veatch.

Wells surveyed in North American Datum 1983 (NAD83)

Table 2
Ash Monofill Slug Test Summary 2019
PRPA Ash Monofill Annual Report for 2019
PRPA Rawhide Facility, Colorado

Well ID	Geomean of K Value (cm/sec)	Geomean of K Value (ft/day)
ASH-06	5.07E-04	1.44
ASH-07	4.53E-04	1.28
ASH-08	3.01E-05	0.09

Notes:

cm/sec = centimeter per second

ft/day = feet per day

k = hydraulic conductivity

Table 3
Ash Monofill Groundwater Level Measurements 2019
PRPA Ash Monofill Annual Report for 2019
PRPA Rawhide Facility, Colorado

Well ID	Sampling Event	Measurement Date	Measuring Point Elevation (ft amsl)	Depth to Water (ft)	Groundwater Elevation (ft amsl)
ASH-01	May 2019	5/29/2019	5760.145	13.92	5746.23
ASH-01	July 2019	7/10/2019	5760.145	12.91	5747.23
ASH-01	October 2019	10/8/2019	5760.145	12.88	5747.27
ASH-02	May 2019	5/29/2019	5679.87	2.90	5676.97
ASH-02	July 2019	7/8/2019	5679.87	2.69	5677.18
ASH-02	October 2019	9/30/2019	5679.87	4.09	5675.78
ASH-03	May 2019	5/29/2019	5717.18	38.27	5678.91
ASH-03	July 2019	7/8/2019	5717.18	37.68	5679.50
ASH-03	October 2019	9/30/2019	5717.18	37.81	5679.37
ASH-04	May 2019	5/29/2019	5692.57	14.35	5678.22
ASH-04	July 2019	7/8/2019	5692.57	13.47	5679.10
ASH-04	October 2019	9/30/2019	5692.57	13.30	5679.27
ASH-05	May 2019	5/29/2019	5698.71	22.25	5676.46
ASH-05	July 2019	7/8/2019	5698.71	21.63	5677.08
ASH-05	October 2019	9/30/2019	5698.71	21.17	5677.54
ASH-06	January 2019	1/24/2019	5786.41	63.68	5722.73
ASH-06	May 2019	5/29/2019	5786.41	62.92	5723.49
ASH-06	July 2019	7/8/2019	5786.41	62.68	5723.73
ASH-06	October 2019	9/30/2019	5786.41	62.73	5723.68
ASH-07	January 2019	1/24/2019	5690.56	16.55	5674.01
ASH-07	May 2019	5/29/2019	5690.56	14.37	5676.19
ASH-07	July 2019	7/8/2019	5690.56	14.00	5676.56
ASH-07	October 2019	9/30/2019	5690.56	15.35	5675.21
ASH-08	May 2019	5/29/2019	5684.41	10.50	5673.91
ASH-08	July 2019	7/8/2019	5684.41	10.05	5674.36
ASH-08	October 2019	9/30/2019	5684.41	11.37	5673.04

Notes:

ft = feet

ft amsl = feet above mean sea level

Table 4
Ash Monofill Groundwater Analytical Results January 2019
PRPA Ash Monofill Annual Report for 2019
PRPA Rawhide Facility, Colorado

Sample Location			ASH-06	ASH-07	ASH-07
Sample Type				Duplicate	
Sample Date			1/24/2019	1/24/2019	1/24/2019
Chemical Name	Analytical Method	Unit			
Appendix III Parameters					
Boron	SW6010	mg/L	0.288	0.701	0.689
Calcium	SW6010	mg/L	27.5	453	448
Chloride	EPA9056	mg/L	7.8	79.9	66.6
Fluoride	EPA9056	mg/L	0.84	< 0.20	< 0.20
pH	Field Measure	SU	9.25	6.89	6.89
Sulfate	EPA9056	mg/L	104	5050	3760
Total Dissolved Solids	SM2540C	mg/L	487	6300	5890
Appendix IV Parameters					
Antimony	SW6020	ug/L	< 1.0	< 1.0	< 1.0
Arsenic	SW6020	ug/L	1.3	< 1.0	< 1.0
Barium	SW6020	ug/L	72.2	28.4	28
Beryllium	SW6020	ug/L	< 0.50	< 0.50	< 0.50
Cadmium	SW6020	ug/L	< 0.50	< 0.50	< 0.50
Chromium	SW6020	ug/L	42.2	< 1.0	< 1.0
Cobalt	SW6020	ug/L	< 1.0	3.2	3.1
Lead	SW6020	ug/L	< 1.0	< 1.0	< 1.0
Lithium	SW6010	ug/L	89.5	575	562
Mercury	EPA7470	ug/L	< 0.20	< 0.20	< 0.20
Molybdenum	SW6020	ug/L	41	4.5	4.5
Selenium	SW6020	ug/L	20.6	76.5	91.9
Thallium	SW6020	ug/L	< 1.0	< 1.0	< 1.0
Field Parameters					
Dissolved Oxygen	Field Measure	mg/L	7.06	0.77	0.77
Oxidation Reduction Potential	Field Measure	mv	160.5	125.6	125.6
Specific Conductivity	Field Measure	us/cm	980	6219	6219
Temperature	Field Measure	degC	9.6	10.64	10.64
Turbidity	Field Measure	NTU	9.04	22.4	22.4

Notes:

mg/L = milligram per liter

mv =millivolts

SU = standard units

uS/cm = microSiemens per centimeter

NTU = nephelometric turbidity units

ug/L = microgram per liter

pCi/L = picocuries per liter

< = not detected above indicated reporting limit

degC = degrees Centigrade

Table 5
Ash Monofill Groundwater Analytical Results May 2019
PRPA Ash Monofill Annual Report for 2019
PRPA Rawhide Facility, Colorado

Sample Location Sample Type Sample Date			ASH-01 Duplicate 5/2/2019	ASH-01 5/2/2019	ASH-02 5/6/2019	ASH-03 5/2/2019	ASH-04 5/2/2019	ASH-05 5/2/2019	ASH-06 5/6/2019	ASH-07 5/2/2019	ASH-08 5/6/2019
Chemical Name	Analytical Method	Unit									
Appendix III Parameters											
Boron	SW6010	mg/L	0.791	0.489	1.96	0.811 J-	0.623	0.784	0.283	0.686	0.856
Calcium	SW6010	mg/L	416	363	167	431	441	503	26.7	421	429
Chloride	EPA9056	mg/L	87.4	20.2	7.8	86.8	190	219	7.8	67.7	22.3
Flouride	EPA9056	mg/L	< 0.2	< 0.2	0.77	< 0.2	0.29	< 0.2	0.79	< 0.2	< 0.2
Sulfate	EPA9056	mg/L	3680	< 1	--	3400	3320	2680	75.7	3850	2730
Total Dissolved Solids	SM2540C	mg/L	5110	3250	3050	4230	5380	4620	384	5740	4010
Appendix IV Parameters											
Antimony	SW6020	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	SW6020	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	1.2	< 1	< 1
Barium	SW6020	ug/L	11.9	8.3	15.5	13.3 J+	11.3	14.8	67	20.4	39.9
Beryllium	SW6020	ug/L	< 0.5	< 0.5	< 0.5	< 0.5 UJ-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cadmium	SW6020	ug/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium	SW6020	ug/L	< 1	< 1	< 1	1.8	1.2	< 1	3.4	1.5	1.6
Cobalt	SW6020	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1.8	2.8
Lead	SW6020	ug/L	< 2	< 1	< 1	< 1	< 1	< 1	< 1	< 2	< 1
Lithium	SW6010	ug/L	384	398	304	390	346	289	56	549	304
Mercury	EPA7470	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	SW6020	ug/L	1.1	< 1	8.4	1.2	1.4	< 1	29.1	2	10.1
Radium, total	TRC	pCi/L	2.04	1.62	0.357	1.39	1.98	1.89	0.873	2.62	1.29
Radium-226	E903.1	pCi/L	0.912 J+	0.947 J+	0.346 J+	0.886 J+	0.894 J+	0.897 J+	0.639 J+	1.35 J+	0.607 J+
Radium-228	E904.0	pCi/L	1.13	0.676	0.0106	0.505	1.09	0.991	0.234	1.27	0.684
Selenium	SW6020	ug/L	99	< 1	< 1	96.6 J-	62.8	81.5	22.8	68.8	7.3
Thallium	SW6020	ug/L	< 2	< 1	< 1	< 1	< 1	< 1	< 1	< 2	< 1
Field Parameters											
Dissolved Oxygen	Field Measure	mg/L	4.07	4.07	2.89	0.6	0.2	0.28	5.02	2.36	3.96
Oxidation Reduction Potential	Field Measure	mv	72.2	72.2	94.9	40.6	82	87.7	54.1	98.6	115.3
pH	Field Measure	SU	7.31	7.31	7.64	6.97	7.31	6.98	8	6.92	7.17
Specific Conductivity	Field Measure	us/cm	2671	2671	3035	3966	4172	3692	510	4469	3362
Temperature	Field Measure	degC	10.8	10.8	11.4	11.1	11.4	12.5	12.3	11.8	12.1
Turbidity	Field Measure	NTU	2.63	2.63	4.33	13.6	10.85	14.4	4.56	20.1	7.98

Notes:
mg/L = milligram per liter
mv =millivolts
SU = standard units
uS/cm = microSiemens per centimeter
NTU = nephelometric turbidity units
ug/L = microgram per liter
pCi/L = picocuries per liter
< = not detected above indicated reporting limit
degC = degrees Centigrade
J + = estimated concentration, biased high
TRC = total radium calculation

Table 6
Ash Monofill Groundwater Analytical Results July 2019
PRPA Ash Monofill Annual Report for 2019
PRPA Rawhide Facility, Colorado

Sample Location Sample Type Sample Date			ASH-02 7/17/2019	ASH-06 7/18/2019	ASH-07 7/18/2019	ASH-08 7/17/2019
Chemical Name	Analytical Method	Unit				
Appendix III Parameters						
Boron	SW6010	mg/L	2	0.326	0.602	0.914
Calcium	SW6010	mg/L	174	28.9	431	430
Chloride	EPA9056	mg/L	22.4	9.7	106	19
Flouride	EPA9056	mg/L	< 0.20	0.69	< 0.20 UJ-	< 0.20
Sulfate	EPA9056	mg/L	2330	197	3850 J+	2980
Total Dissolved Solids	SM2540C	mg/L	3390	634	6380	4190
Appendix IV Parameters						
Antimony	SW6020	ug/L	< 1.0	< 1.0	< 1.0	< 2.0
Arsenic	SW6020	ug/L	< 1.0	< 1.0	< 1.0	< 1.0
Barium	SW6020	ug/L	18.4	66.6	13.3	22.1
Beryllium	SW6020	ug/L	< 0.50	< 0.50	< 0.50	< 0.50
Cadmium	SW6020	ug/L	< 0.50	< 0.50	< 0.50	< 0.50
Chromium	SW6020	ug/L	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	SW6020	ug/L	< 1.0	< 1.0	< 1.0	1.7
Lead	SW6020	ug/L	< 1.0	< 1.0	< 2.0	< 2.0
Lithium	SW6010	ug/L	300	63.9	510	294
Mercury	EPA7470	ug/L	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	SW6020	ug/L	6.9	55.8	1.4	2.6
Radium, total	TRC	pCi/L	0.746 J+	2.74 J+	1.01 J+	0.750 J+
Radium-226	E903.1	pCi/L	0.381 J+	1.71 J+	0.812 J+	0.193 J+
Radium-228	E904.0	pCi/L	0.365 J+	1.03 J+	0.202 J+	0.557 J+
Selenium	SW6020	ug/L	< 1.0	24.2	153 J+	< 1.0
Thallium	SW6020	ug/L	< 1.0	< 1.0	< 2.0	< 2.0
Field Parameters						
Dissolved Oxygen	Field Measure	mg/L	1.89	2.38	0.35	0.17
Oxidation Reduction Potential	Field Measure	mv	130.2	117.8	162.7	64.8
pH	Field Measure	SU	7.38	8.28	6.32	6.92
Specific Conductivity	Field Measure	us/cm	3394	687	4922	3684
Temperature	Field Measure	degC	15.07	17.49	12.51	14.36
Turbidity	Field Measure	NTU	9.29	11.8	20.4	15.2

Notes:

mg/L = milligram per liter

mv =millivolts

SU = standard units

uS/cm = microSiemens per centimeter

NTU = nephelometric turbidity units

ug/L = microgram per liter

pCi/L = picocuries per liter

< = not detected above indicated reporting limit

degC = degrees Centigrade

J+ = estimated concentration, biased high

TRC = total radium calculation

Table 7
Ash Monofill Groundwater Analytical Results October 2019
PRPA Ash Monofill Annual Report for 2019
PRPA Rawhide Facility, Colorado

Sample Location Sample Type Sample Date			ASH-01 10/8/2019	ASH-02 Duplicate 10/8/2019	ASH-02 10/8/2019	ASH-03 10/9/2019	ASH-04 10/8/2019	ASH-05 10/9/2019	ASH-06 10/8/2019	ASH-07 10/9/2019	ASH-08 10/9/2019
Chemical Name	Analytical Method	Unit									
Appendix III Parameters											
Boron	SW6010	mg/L	0.462	1.95	1.87	0.738	0.611	0.718	0.324	0.732	0.891
Calcium	SW6010	mg/L	346	155	154	415	420	466	26.7	426	401
Chloride	EPA9056	mg/L	--	--	--	71.5	--	199	--	113	17.8
Fluoride	EPA9056	mg/L	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	0.81	< 0.20	< 0.20
pH	Field Measure	SU	7.24	7.24	7.76	6.78	7.55	7.07	8.26	6.92	7.04
Sulfate	EPA9056	mg/L	--	--	--	3180	--	2710	--	3970	2710
Total Dissolved Solids	SM2540C	mg/L	3290	3380	3470	5190	5350	6390	515	4410	4710 J
Appendix IV Parameters											
Antimony	SW6020	ug/L	< 4.0	< 10.0	< 10.0	< 2.0	< 5.0	< 1.0	< 1.0	< 2.0	< 1.0
Arsenic	SW6020	ug/L	< 4.0	< 10.0	< 10.0	< 2.0	< 5.0	< 1.0	< 1.0	< 2.0	1.4
Barium	SW6020	ug/L	9.7	20	20	8.5	9.2	15.1	60.5	13	18.6
Beryllium	SW6020	ug/L	< 2.0	< 5.0	< 5.0	< 1.0	< 2.5	< 0.50	< 0.50	< 1.0	< 0.50
Cadmium	SW6020	ug/L	< 2.0	< 5.0	< 5.0	< 1.0	< 2.5	< 0.50	< 0.50	< 1.0	< 0.50
Chromium	SW6020	ug/L	< 4.0	< 10.0	< 10.0	< 2.0	< 5.0	< 1.0	1.6	< 2.0	< 1.0
Cobalt	SW6020	ug/L	< 4.0	< 10.0	< 10.0	< 2.0	< 5.0	< 1.0	< 1.0	< 2.0	2.4
Lead	SW6020	ug/L	< 4.0	< 10.0	< 10.0	< 2.0	< 5.0	< 2.0	< 1.0	< 2.0	< 2.0
Lithium	SW6010	ug/L	387	280	281	373	337	279	51.9	542	288
Mercury	EPA7470	ug/L	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	SW6020	ug/L	< 4.0	< 10.0	< 10.0	< 2.0	< 5.0	< 1.0	48.2	< 2.0	2.5
Radium, total	TRC	pCi/L	0.282 J+	1.25 J+	1.22 J+	0.979 J+	1.65 J+	0.255 J+	0.901 J+	0.292 J+	1.13 J+
Radium-226	E903.1	pCi/L	0.187 J+	0.179 J+	0	0.460 J+	0	0.100 J+	-0.0627	0.292 J+	0.150 J+
Radium-228	E904.0	pCi/L	1.08 J+	1.06 J+	0.607 J+	0.519 J+	1.09 J+	0.155 J+	0.969 J+	-0.0622	0.976 J+
Selenium	SW6020	ug/L	< 4.0	< 10.0	< 10.0	102	70.3	78.4	33.7	122	< 1.0
Thallium	SW6020	ug/L	< 4.0	< 10.0	< 10.0	< 2.0	< 5.0	< 2.0	< 1.0	< 2.0	< 2.0
Field Parameters											
Dissolved Oxygen	Field Measure	mg/L	0.59	0.59	0.33	0.73	0.36	0.45	5.56	0.48	0.54
Oxidation Reduction Potential	Field Measure	mv	149.3	149.3	152.3	164.3	132.7	124.2	139.1	135.9	86.3
Specific Conductivity	Field Measure	us/cm	3717	3717	4175	5136	5705	4579	663	5656	4187
Temperature	Field Measure	degC	11.93	11.93	16.01	11.91	16.7	15.59	14.83	14.17	11.67
Turbidity	Field Measure	NTU	NM*	NM*	NM*	3.67	NM*	24.8	NM*	14.3	7.74

Notes:
mg/L = milligram per liter
mv =millivolts
SU = standard units
uS/cm = microSiemens per centimeter
NTU = nephelometric turbidity units
ug/L = microgram per liter
pCi/L = picocuries per liter
< = not detected above indicated reporting limit
degC = degrees Centigrade
NM* = not measured due to turbidty meter not working
J+ = estimated concentration, biased high
TRC = total radium calculation

Table 7
Ash Monofill Appendix III Background Upper Prediction Limits
PRPA Ash Monofill Annual Report for 2019
PRPA Rawhide Facility, Colorado

Parameter (Units)	Number of Samples	Percent Nondetects	Normal or Lognormal Distribution?	Statistical Test	Background UPL
Boron (mg/L)	17	0	Yes/No	Parametric	0.63
Calcium (mg/L)	17	0	No/No	Nonparametric	380
Chloride (mg/L)	15	0	No/No	Nonparametric	29
Fluoride (mg/L)	17	29	Yes/Yes	Parametric	1.17
pH (standard units)	15	0	No/Yes	Parametric	9.28
Sulfate (mg/L)	15	7	No/No	Nonparametric	2,740
Total Dissolved Solids (mg/L)	17	0	No/No	Nonparametric	3,900

Notes:

mg/L = milligrams per liter

Table 8
Ash Monofill Appendix IV Background Upper Prediction Limits
PRPA Ash Monofill Annual Report for 2019
PRPA Rawhide Facility, Colorado

Parameter (Units)	Number of Samples	Percent Nondetects	Normal or Lognormal Distribution?	Statistical Test	Background Limit	GWPS
Antimony (mg/L)	17	100	No/No	MDL	0.004	0.006
Arsenic (mg/L)	17	82	No/No	MDL	0.004	0.05
Barium (mg/L)	17	0	No/No	Nonparametric	0.072	2.0
Beryllium (mg/L)	17	100	No/No	MDL	0.002	0.004
Cadmium (mg/L)	17	100	No/No	MDL	0.002	0.005
Chromium (mg/L)	17	100	No/No	MDL	0.004	0.1
Cobalt (mg/L)	17	76	No/No	Nonparametric	0.042	0.042
Fluoride (mg/L)	17	29	Yes/Yes	Parametric	1.17	4.0
Lead (mg/L)	17	88	No/No	MDL	0.004	0.015
Lithium (mg/L)	17	0	No/No	Nonparametric	0.57	0.57
Mercury (mg/L)	17	100	No/No	MDL	0.0002	0.002
Molybdenum (mg/L)	17	71	No/No	Nonparametric	0.056	0.1
Selenium (mg/L)	17	35	No/No	Nonparametric	0.034	0.05
Thallium (mg/L)	17	100	No/No	MDL	0.004	0.004
Radium-226+228 Combined (pCi/L)	15	20	Yes/Yes	Parametric	2.63	5

Notes:

mg/L = milligrams per liter

pCi/L = picoCuries per liter

MDL = background limit set at maximum detection or reporting limit

All of the antimony, beryllium, cadmium, chromium, cobalt, mercury, molybdenum, and thallium results in the background monitoring wells were reported as not detected or detected less than 5 percent. For these constituents, the maximum detection or reporting limit was selected as the UPL per the double quantification rule in the U.S.

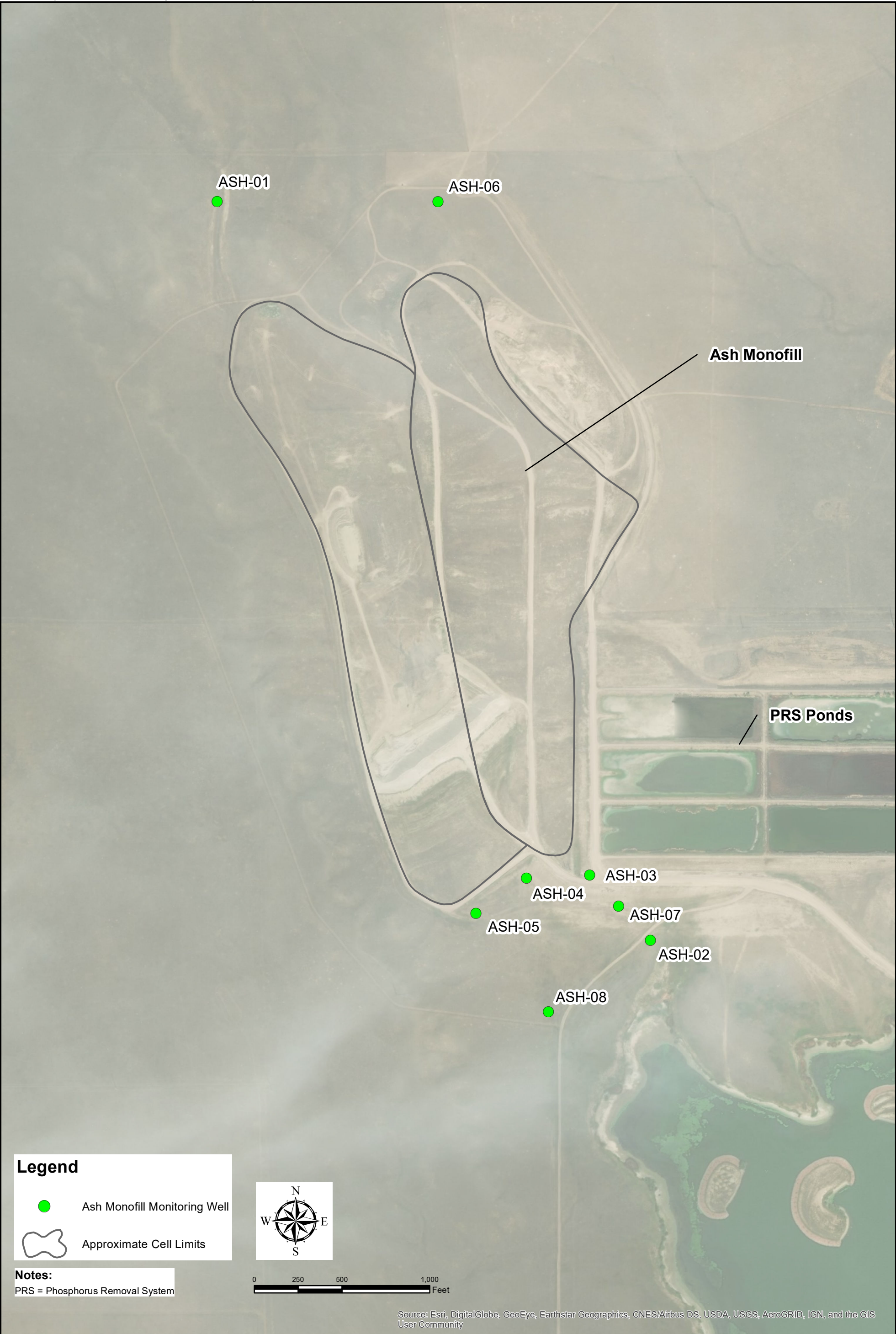
Environmental Protection Agency's Unified Statistical Guidance (2009).

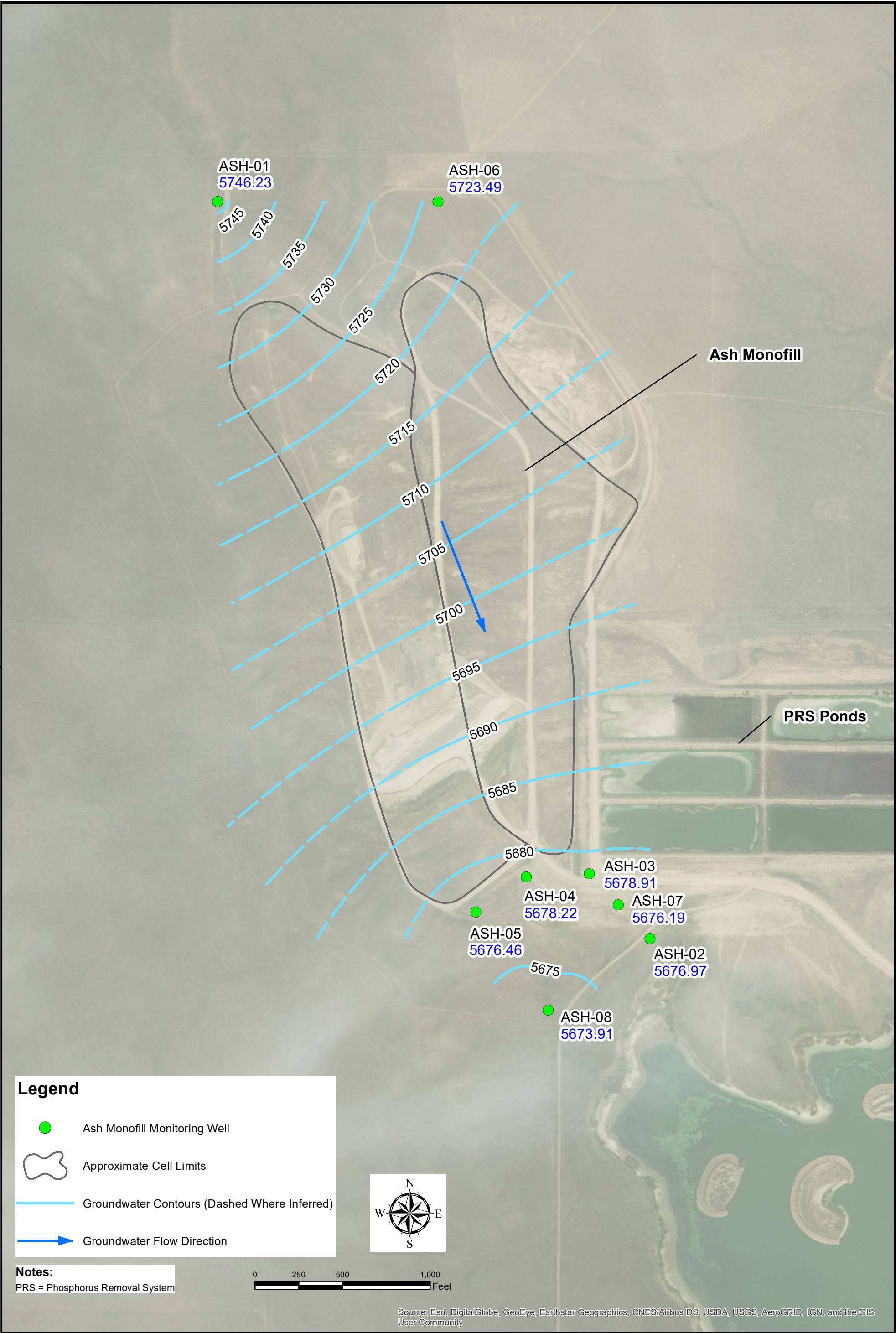
Table 9
Ash Monofill Appendix IV Statistical Results
PRPA Ash Monofill Annual Report for 2019
PRPA Rawhide Facility, Colorado

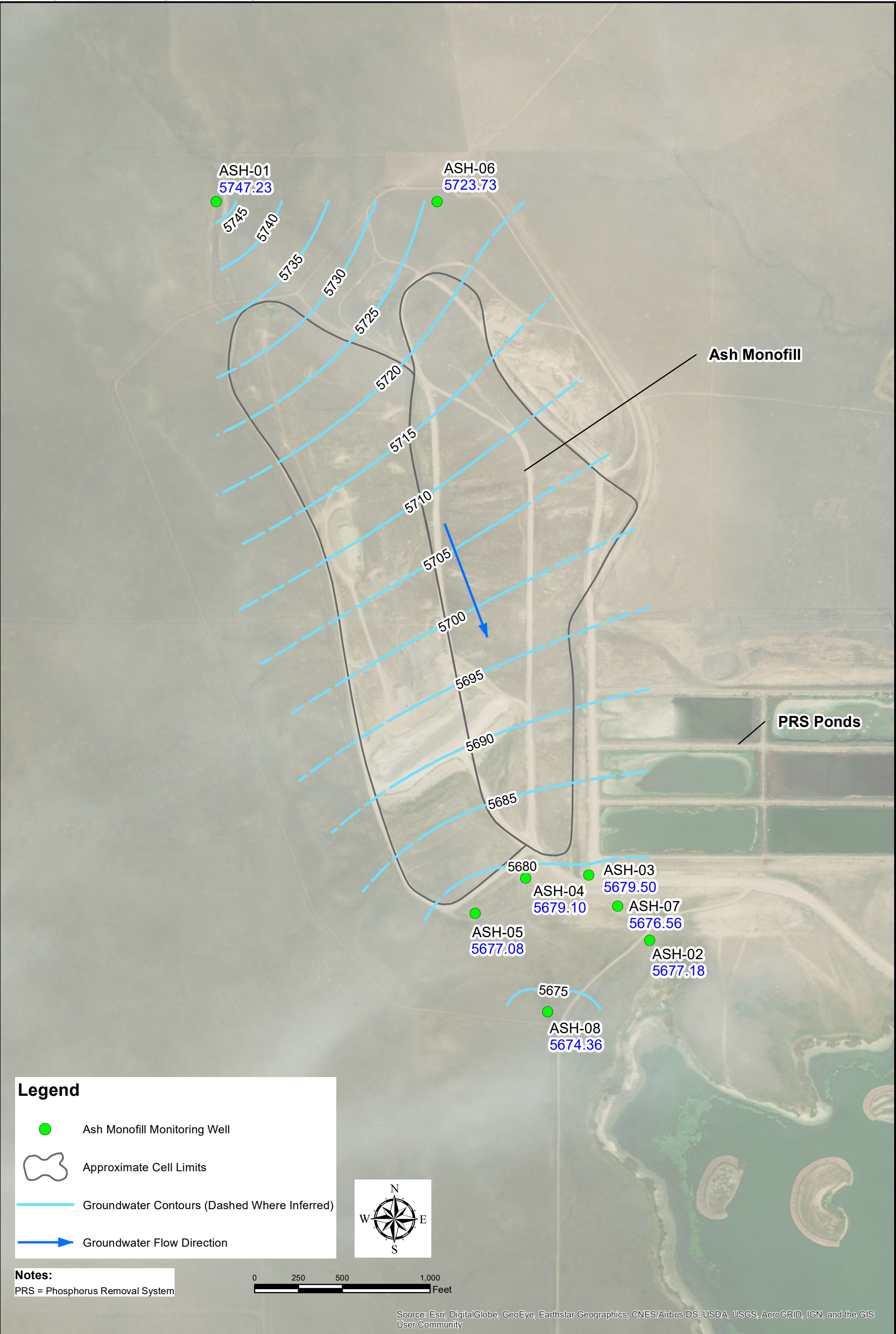
				Well Number	ASH-02	ASH-02	ASH-02	ASH-02	ASH-03	ASH-03	ASH-04	ASH-04	ASH-05	ASH-05	ASH-07	ASH-07	ASH-07	ASH-08	ASH-08	ASH-08
				Sample Date	5/6/2019	7/17/2019	10/8/2019	10/8/2019	5/2/2019	10/9/2019	5/2/2019	10/8/2019	5/2/2019	10/9/2019	5/2/2019	7/18/2019	10/9/2019	5/6/2019	7/17/2019	10/9/2019
				Sample Type	N	N	FD	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	Unit	Background UPL	GWPS																	
Antimony	mg/L	0.004	0.006	< 0.001	< 0.001	< 0.010	< 0.010	< 0.001	< 0.002	< 0.001	< 0.005	< 0.001	< 0.001	< 0.001	< 0.001	< 0.002	< 0.001	< 0.002	< 0.001	< 0.001
Arsenic	mg/L	0.004	0.05	< 0.001	< 0.001	< 0.010	< 0.010	< 0.001	< 0.002	< 0.001	< 0.005	< 0.001	< 0.001	< 0.001	< 0.001	< 0.002	< 0.001	< 0.001	< 0.001	0.0014
Barium	mg/L	0.072	2.0	0.016	0.018	0.020	0.020	0.013	0.009	0.011	0.009	0.015	0.015	0.020	0.013	0.013	0.040	0.022	0.019	
Beryllium	mg/L	0.002	0.004	< 0.0005	< 0.0005	< 0.005	< 0.005	< 0.0005	< 0.001	< 0.0005	< 0.0025	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.001	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Cadmium	mg/L	0.002	0.005	< 0.0005	< 0.0005	< 0.005	< 0.005	< 0.0005	< 0.001	< 0.0005	< 0.0025	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.001	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Chromium	mg/L	0.004	0.10	< 0.001	< 0.001	< 0.010	< 0.010	0.0018	< 0.002	0.0012	< 0.005	< 0.001	< 0.001	0.0015	< 0.001	< 0.002	0.0016	< 0.001	< 0.001	< 0.001
Cobalt	mg/L	0.042	0.042	< 0.001	< 0.001	< 0.010	< 0.010	< 0.001	< 0.002	< 0.001	< 0.005	< 0.001	< 0.001	0.0018	< 0.001	< 0.002	0.0028	0.0017	0.0024	
Fluoride	mg/L	1.17	4.0	0.77	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	0.29	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Lead	mg/L	0.004	0.015	< 0.001	< 0.001	< 0.010	< 0.010	< 0.001	< 0.002	< 0.001	< 0.005	< 0.001	< 0.002	< 0.002	< 0.002	< 0.002	< 0.001	< 0.002	< 0.002	< 0.002
Lithium	mg/L	0.57	0.57	0.304	0.300	0.280	0.281	0.390	0.373	0.346	0.337	0.289	0.279	0.549	0.510	0.542	0.304	0.294	0.288	
Mercury	mg/L	0.0002	0.002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Molybdenum	mg/L	0.056	0.10	0.0084	0.0069	< 0.010	< 0.010	0.0012	< 0.002	0.0014	< 0.005	< 0.001	< 0.001	0.0020	0.0014	< 0.002	0.0101	0.0026	0.0025	
Selenium	mg/L	0.034	0.05	< 0.001	< 0.001	< 0.010	< 0.010	0.0966	0.1020	0.0628	0.0703	0.0815	0.0784	0.0688	0.1530	0.1220	0.0073	< 0.001	< 0.001	< 0.001
Thallium	mg/L	0.004	0.004	< 0.001	< 0.001	< 0.010	< 0.010	< 0.001	< 0.002	< 0.001	< 0.005	< 0.001	< 0.002	< 0.002	< 0.002	< 0.002	< 0.001	< 0.002	< 0.002	< 0.002
Radium, total	pCi/L	2.63	5.0	0.357	0.746	1.25	1.22	1.39	0.979	1.98	1.65	1.89	0.255	2.62	1.01	0.292	1.29	0.750	1.13	

Notes:
N = primary sample
FD = field duplicate
mg/L = milligrams per liter
pCi/L = picoCuries per liter
Bold **black** value is detected result
Bold **red** value exceeds groundwater protection standard (GWPS)
SSI = statistically significant increase over background upper prediction limit (UPL)
SSL = statistically significant level above the GWPS

Figures









Appendix A

Boring Logs and Monitoring Well Construction Diagrams

AECOM Boring Log		Project Name: Rawhide Station Client: Platte River Power Authority Project Number: 60514655		Boring ID: <u>ASH-02/MW-2</u>			
Date(s) Drilled 12/6/80, 12/8/80		Logged By S. Roberts (Black and Veatch)		Checked By C. Littlefield (AECOM)			
Drilling Method HSA		Diameter of Borehole (in) 7		Total Depth of Borehole (ft) 54.3			
Drill Rig Type CME 55		Drilling Company Drilling Engineers		Ground Surface Elevation (ft-msl) see well construction details			
Driller's Name F. Schmidt		Sampler Type -		Groundwater Elevation (ft-msl)			
Description of Sample Location				Measuring Point Elevation (ft-msl)			
				Northing 1558450.627 Easting 3127250.213			
Depth (ft-bgs)	SAMPLES			UCSC Symbol	MATERIAL DESCRIPTION	Well Construction	
	Run Number	Recovery (%)	Sample ID				
1				CL	0-8.3: Silty clay, tan, trace sand, trace gravel		
2							
3							
4							
5							
6							
7							
8							
9				shale	8.3-26.7: Shale, tan to olive, severely weathered, firm		
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

AECOM Boring Log				Project Name: Rawhide Station Client: Platte River Power Authority Project Number: 60514655				Boring ID: <u>ASH-02/MW-2</u>											
Date(s) Drilled: 12/6/80, 12/8/80				Logged By: S. Roberts (Black and Veatch)				Checked By: C. Littlefield (AECOM)				Total Depth of Borehole (ft): 54.3				Depth to Water (ft bgs)			
Drilling Method: HSA				Diameter of Borehole (in): 7				Ground Surface Elevation (ft-msl): see well construction details				Groundwater Elevation (ft-msl)							
Drill Rig Type: CME 55				Drilling Company: Drilling Engineers				Measuring Point Elevation (ft-msl)											
Driller's Name: F. Schmidt				Sampler Type: -				Northing: 1558450.627				Easting: 3127250.213							
Description of Sample Location																			
Depth (ft-bgs)	SAMPLES			PID (ppm)	UCSC Symbol	MATERIAL DESCRIPTION	Well Construction												
	Run Number	Recovery (%)	Sample ID																
21					shale														
22																			
23																			
24																			
25																			
26																			
27					26.7-40: grades olive to grey														
28					shale														
29																			
30																			
31																			
32																			
33																			
34																			
35																			
36																			
37																			
38																			
39																			
40																			

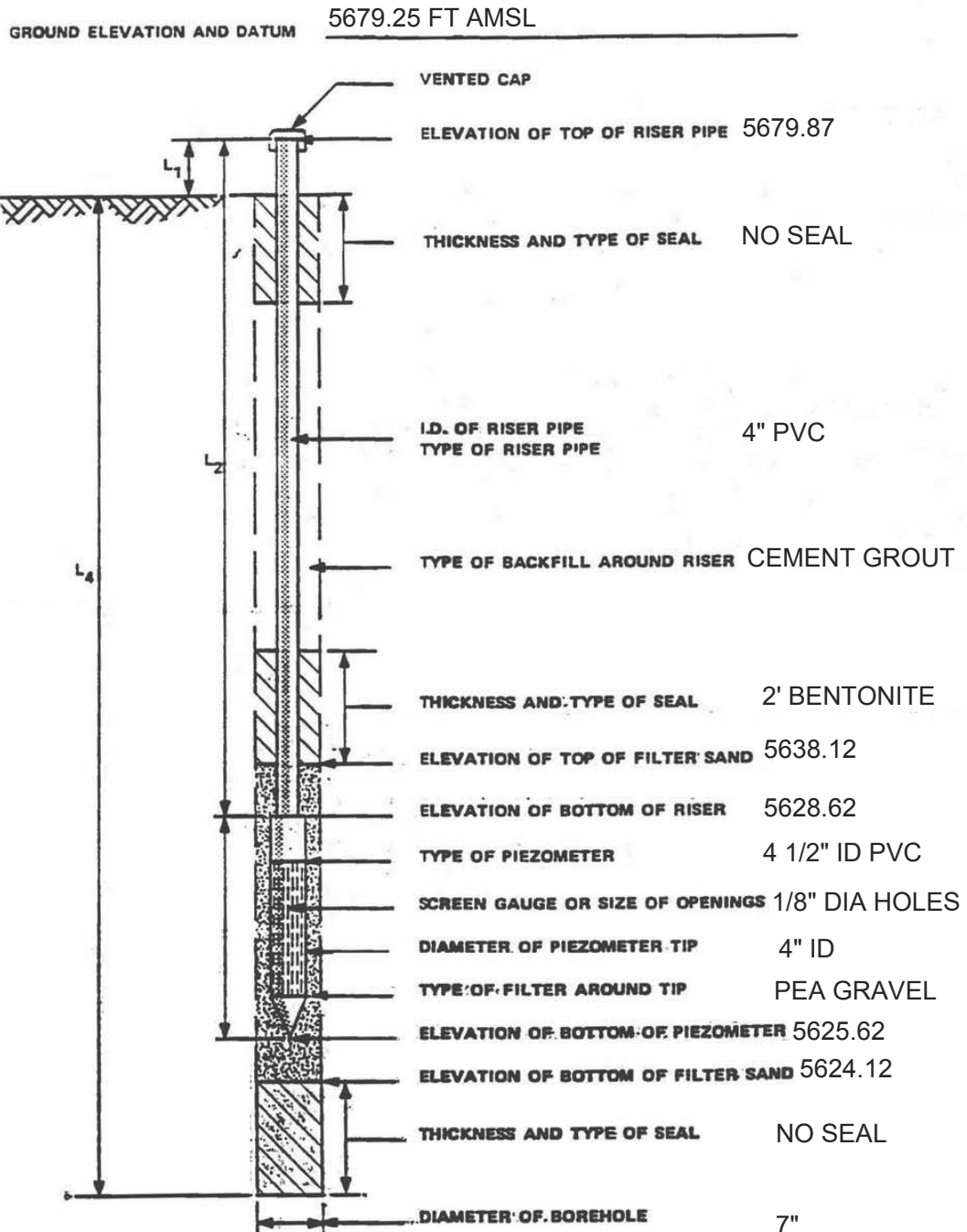
AECOM Boring Log				Project Name: Rawhide Station Client: Platte River Power Authority Project Number: 60514655				Boring ID: <u>ASH-02/MW-2</u>											
Date(s) Drilled: 12/6/80, 12/8/80				Logged By: S. Roberts (Black and Veatch)				Checked By: C. Littlefield (AECOM)				Total Depth of Borehole (ft): 54.3				Depth to Water (ft bgs)			
Drilling Method: HSA				Diameter of Borehole (in): 7				Ground Surface Elevation (ft-msl): see well construction details				Groundwater Elevation (ft-msl)							
Drill Rig Type: CME 55				Drilling Company: Drilling Engineers				Measuring Point Elevation (ft-msl)											
Driller's Name: F. Schmidt				Sampler Type: -				Northing: 1558450.627				Easting: 3127250.213							
Description of Sample Location																			
Depth (ft-bgs)	SAMPLES			PID (ppm)	UCSC Symbol	MATERIAL DESCRIPTION	Well Construction												
	Run Number	Recovery (%)	Sample ID																
41						40-54.3: grades hard, grades dark grey													
42																			
43																			
44																			
45																			
46																			
47					shale														
48																			
49																			
50																			
51																			
52																			
53																			
54																			
55						TD = 54.3 ft													
56						Notes: This boring log was adapted from the boring log done by Black and Veatch in 1980 as Piezometer 2. The original well development log from 1980 is not available. Northing and Easting are in NAD1983 State Plane Colorado North from the Northern Engineering survey on 12/20/18. Boring log was updated by CL on 1/6/20. *Gravel was not defined as well graded or poorly graded. USCS symbols were interpreted by AECOM.													
57																			
58																			
59																			
60																			



BLACK & VEATCH
consulting engineers

RENAMED ASH-02/MW-2

PIEZOMETER NO. 2



L₁= 0.62

L₂= 51.25

L₃= 3

L₄= 55.08

1/8" DIA HOLES DRILLED AT 4" CTRS AT 90 DEGS AROUND PIPE

Note: Elevations were edited on 1/15/19 by CL based on survey conducted by Northern Engineering on 12/20/18. Elevations below the ground surface were adjusted based on the depth below the top of riser elevation. The ground surface and top of riser elevations were taken directly from the recent survey.

NOTE: BLACK AND VEATCH DIAGRAM RESTORED BY CAMILLE LITTLEFIELD (AECOM)

<div><div>AECOMBoring Log</div></div>		Project Name: Rawhide - Well Installation		Client: Platte River Power Authority		Project Number: 60588513		Boring ID: <div>ASH-08</div>	
Date(s) Drilled: 4/24/2019		Logged By: J. Woodruff		Checked By: W. Weichert		Total Depth of Borehole (ft.): 29		Depth to Water (ft. bgs): 11.21	
Drilling Method: HSA		Diameter of Borehole (in): 8.25"				Ground Surface Elevation (ft-msl): see well construction details			
Drill Rig Type: CME		Drilling Company: Drilling Engineers				Groundwater Elevation (ft-msl):			
Driller's Name: Jase Staponski		Sampler Type: 5' core barrel				Measuring Point Elevation (ft-msl):			
Description of Sample Location						Northing: 1558046.977		Easting: 3126672.477	
Depth (ft.-bgs)	SAMPLES			PID (ppm)	USCS Symbol	MATERIAL DESCRIPTION	Well Construction		
	Run Number	Recovery (%)	Sample ID						
1	1	100	N/A	N/A	CL	0-4: CLAY; brown to tan, firm to hard, low to moderate plasticity, upper 10 inches moist, dryer with depth, trace silt, coarsens downward and becomes lighter in color, some fine sand and silt, trace gravel, abundant roots and grass, some orange oxidation, little moisture.	Portland Grout	riser	Portland Grout
2									
3									
4									
5	2	100	N/A	N/A	SM	4-9: SILT with FINE SAND; brown to light brown, reddish-orange, firm, low plasticity, some clay and fine sand, oxidized, trace roots, some light buff colored material, little moisture, fractures near bottom.			
6									
7									
8									
9	3	100	N/A	N/A	SM	9-11: SILT and FINE SAND; light brown to tan, reddish-orange, firm, low plasticity, some clay and fine sand, some laminar bedforms present, increasing organics throughout, oxidized trace gravel.			
10									
11									
12									
13	4	100	N/A	N/A	SM	11-19: SILT and FINE SAND; light brown to dark tan, reddish-orange, firm to hard, low plasticity, some clay and fine sand, dark organics along bedding planes, heavy oxidization, little moisture			
14									
15									
16									
17	5	100	ASH-08(14-19)	N/A	SM	19-22: SILTY SAND; light brown to buff tan and reddish-orange, firm to hard, friable in places, some clay (lower) and fine sand, fine laminations, wet at 19.7 ft., seam of fine to medium sand with little gravel at 20 ft., bands of organics and lighter silt in lower core			
18									
19									
20									

<div><div>AECOMBoring Log</div></div>		Project Name: Rawhide - Well Installation			Boring ID: <div>ASH-08</div>					
Client: Platte River Power Authority		Project Number: 60588513								
Date(s) Drilled: 4/24/2019		Logged By: J. Woodruff		Checked By: W. Weichert		Total Depth of Borehole (ft.): 29	Depth to Water (ft. bgs): 11.21			
Drilling Method: HSA		Diameter of Borehole (in): 8.25"		Ground Surface Elevation (ft-msl): see well construction details						
Drill Rig Type: CME		Drilling Company: Drilling Engineers		Groundwater Elevation (ft-msl):						
Driller's Name: Jase Staponski		Sampler Type: 5' core barrel		Measuring Point Elevation (ft-msl):						
Description of Sample Location				Northing: 1558046.977						
				Easting: 3126672.477						
Depth (ft.-bgs)	SAMPLES			PID (ppm)	USCS Symbol	MATERIAL DESCRIPTION	Well Construction			
	Run Number	Recovery (%)	Sample ID							
21			ASH-08(19-24)			22-24: SILTY SAND; as above, very hard, with bands of lighter colored silty material	10/20 Silica Sand	0.01 Slot Screen	10/20 Silica Sand	
22										
23	6	100		N/A	ML					
24			ASH-08(24-29)			24-29: SHALE; contact with Pierre Shale at 25 ft. bgs, dark gray, friable to hard, fissile and platy, fine laminated, oxidation in transition zone, no oxidation in shale, fossiliferous with bivalves, dry	10/20 Silica Sand	0.01 Slot Screen	10/20 Silica Sand	
25										
26										
27	7	100			N/A					ML
28										
29						TD = 29 ft. Well Completion: 0.01 slot screen: 19-29 ft. bgs 10/20 silica sand: 17-29 ft. bgs hydrated bentonite chips: 13-17 ft. Portland grout: 0-13ft bgs				
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										

WELL CONSTRUCTION DATA

PROJECT NAME: Platte River Power Authority - Rawhide Station		WELL ID: ASH-08	
PROJECT NO: 60588513	DATE INSTALLED: 4/24/2019	INSTALLED BY: JW	CHECKED BY:

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	CASING AND SCREEN DETAILS		
	<u>3.12</u> TOP OF CASING	TYPE OF RISER: <u>sch. 40 PVC</u>		
	<u>0</u> GROUND SURFACE bentonite chips	PIPE SCHEDULE: <u>sch. 40 PVC</u>		
	<u>NA</u> CEMENT SURFACE PLUG	PIPE JOINTS: <u>Threaded</u>		
	GROUT/BACKFILL MATERIAL <u>Portland Grout</u>	SOLVENT USED: <u>None</u>		
	GROUT/BACKFILL METHOD <u></u>	SCREEN TYPE: <u>sch. 40 PVC</u>		
	<u>13</u> GROUT	SCR. SLOT SIZE: <u>0.01</u> INCH		
	BENTONITE SEAL MATERIAL <u>Hydrated Chips</u>	BOREHOLE DIAMETER <u>8.25</u> IN. FROM <u>0</u> TO <u>29</u> FT. <u></u> IN. FROM <u></u> TO <u></u> FT.		
	<u>17</u> BENTONITE SEAL	SURF. CASING DIAMETER <u>2</u> IN. FROM <u>0</u> TO <u>29</u> FT. <u></u> IN. FROM <u></u> TO <u></u> FT.		
	<u>19</u> TOP OF SCREEN			
	FILTER PACK MATERIAL <u>10/20 Silica Sand</u>	WELL DEVELOPMENT		
<u>29</u> BOTTOM OF SCREEN	DEVELOPMENT METHOD: <u>see development form</u>	TIME DEVELOPING: <u>3</u> HOURS		
<u>NA</u> BOTTOM OF FILTER PACK	WATER REMOVED: <u>12</u> GALLONS	WATER ADDED: <u>-</u> GALLONS		
<u>NA</u> BENTONITE PLUG	WATER CLARITY BEFORE / AFTER DEVELOPMENT			
BACKFILL MATERIAL <u></u>	CLARITY BEFORE: <u>Low</u>	COLOR BEFORE: <u>Silty brownish-gray</u>		
<u>29</u> HOLE BOTTOM	CLARITY AFTER: <u>Low</u>	COLOR AFTER: <u>Silty brownish-ray</u>		
NOTES:		ODOR (IF PRESENT): <u>None</u>		
		WATER LEVEL SUMMARY		
		SWE MEASUREMENT	DATE	TIME
		BEFORE DEVELOPING T/PVC		
		AFTER DEVELOPING: T/PVC		
		OTHER T/PVC		
		OTHER T/PVC		
		PROTECTIVE COVER AND LOCK INSTALLED? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		
		PERMANENT, LEGIBLE WELL LABEL ADDED? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		

Appendix B

Well Development Forms

DO
(mg/L)

9.02
8.00
8.37
8.15

12/18 - Turbidity meter was not working. Water level after well was purged dry on 12/18 at 14:10 was 27.23 ft.
12/19 - Depth to water at start of development = 17.05 ft, total depth = 30.10 ft, well was purged dry for the second time after 15 minutes of purging

WATER VOLUME / FT OF CASING	
CASING DIAMETER	VOLUME (GALLONS/FOOT)
2"	0.16
4"	0.65
6"	1.47
8"	2.62
10"	4.09
12"	5.89

"JW" = Jessie Woodruff
"WW" = Wes Weichert

6200 S. Quebec St.
Greenwood Village, CO 80111
Tel: 303.694.2770
Fax: 303.694.3946

Well Development Form

Well Identification

ASTI-03

Page

1 of 1

Project Name: PRPA Corrective Actions

Developed By:

W. Weichert / J. Woodruff

Project Number: 60588513

Date:

4-26-2019

Site ID: PRPA Rawhide Station

Start Time:

10.20

Purging Information

Casing I.D. [a] (in.):

2

Static Water Column Height [e] = [d] - [c] (ft):

13.18

Unit Casing Volume [b] (gal/ft)

0.16

Casing Volume [f] = [b] x [e] (gal)

2.1

Initial Depth to Water [c] (ft, bTOC):

38.82

Total Purged Volume [g] (gal):

10

Initial Depth of Well [d] (ft, bTOC):

52.0

Number of Purged Volumes [h] = [g] / [f]:

5

[illegible]**End Time:**

1112

Purged Dry (Y/N):

Y

Casing Volume

Additional Remarks	
---------------------------	--

Casing I.D. (in.)	Unit Casing Volume Gal/Lin. Ft.)
1.0	0.04
1.5	0.09
2.0	0.16
2.2	0.20
3.0	0.37
4.0	0.65
4.3	0.75
5.0	1.00
6.0	1.55
7.0	2.00
8.0	2.60

6200 S. Quebec St.
Greenwood Village, CO 80111
Tel: 303.694.2770
Fax: 303.694.3946

Well Development Form

Well Identification

ASH-24

Page

of

Project Name: PRPA Corrective Actions

Developed By: W. Weichert / J. Woodruff

Project Number: 60588513

Date: 4-26-2019

Site ID: PRPA Rawhide Station

Start Time: 07:55

Purging Information

Casing I.D. [a] (in.):

2

Static Water Column Height [e] = [d] - [c] (ft):

17.93
~~11.62~~ w

Unit Casing Volume [b] (gal/ft)

0.16

Casing Volume [f] = [b] x [e] (gal)

2.2

Initial Depth to Water [c] (ft, bTOC):

14.62

Total Purged Volume [g] (gal):

25

Initial Depth of Well [d] (ft, bTOC):

32.55

Number of Purged Volumes $[h] = [q] / [f]$:

8.9

[illegible]

End Time: 09:00

Purged Dry (Y/N): N

Casing Volume

Casing I.D. (in.)	Unit Casing Volume Gal/Lin. Ft.)
1.0	0.04
1.5	0.09
2.0	0.16
2.2	0.20
3.0	0.37
4.0	0.65
4.3	0.75
5.0	1.00
6.0	1.55
7.0	2.00
8.0	2.60

Additional Remarks	
---------------------------	--

Turbidity over ranged, after Removing
9 Volumes

6200 S. Quebec St.
Greenwood Village, CO 80111
Tel: 303.694.2770
Fax: 303.694.3946

Well Development Form

Well Identification

ASH-Q5

Page

_____ of _____

Project Name: PRPA Corrective Actions

Developed By: W. Weichert / J. Woodruff

Project Number: 60588513

Date: 4-26-2019

Site ID: PRPA Rawhide Station

Start Time: 09:18

Purging Information

Casing I.D. [a] (in.):

2

Static Water Column Height [e] = [d] - [c] (ft):

9.29

Unit Casing Volume [b] (gal/ft)

0.16

Casing Volume [f] = [b] x [e] (gal)

1.4

Initial Depth to Water [c] (ft, bTOC):

22.6

Total Purged Volume [q] (gal):

15

Initial Depth of Well [d] (ft, bTOC):

31.9

Number of Purged Volumes [h] = [q] / [f]:

10.7

[illegible]

End Time: 10:02

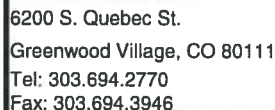
Purged Dry (Y/N): N

Casing Volume

Casing I.D. (in.)	Unit Casing Volume Gal/Lin. Ft.)
1.0	0.04
1.5	0.09
2.0	0.16
2.2	0.20
3.0	0.37
4.0	0.65
4.3	0.75
5.0	1.00
6.0	1.55
7.0	2.00
8.0	2.60

Additional Remarks	

Remove > 10 Volumes, still turbid.



Well Identification AST-027

_____ of _____

Project Name:	PRPA Corrective Actions
Project Number:	60588513
Site ID:	PRPA Rawhide Station

Date: 4-26-2019
Start Time: 7:30

Casing I.D. [a] (in.):	2
Unit Casing Volume [b] (gal/ft)	0.16
Initial Depth to Water [c] (ft, bTOC):	15.12
Initial Depth of Well [d] (ft, bTOC):	30.0

Number of Purged Volumes [h] = [g] / [f]:

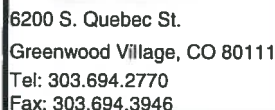
[illegible]

Purged Dry (Y/N): N

Additional Remarks	
<p> 1. The above information was obtained from the records of the [redacted] and is being provided for your information. </p> <p> 2. The above information was obtained from the records of the [redacted] and is being provided for your information. </p> <p> 3. The above information was obtained from the records of the [redacted] and is being provided for your information. </p>	

Casing I.D. (in.)	Unit Casing Volume Gal/Lin. Ft.)
1.0	0.04
1.5	0.09
2.0	0.16
2.2	0.20
3.0	0.37
4.0	0.65
4.3	0.75
5.0	1.00
6.0	1.55
7.0	2.00
8.0	2.60

Mistakenly re-developed ASH-07



Well Identification

A541-Q8

Page

of

Developed By: W. Weichert / J. Woodruff

Date: 4-25-2019

Start Time: 13:20

Casing I.D. [a] (in.):

2

Static Water Column Height [e] = [d] - [c] (ft):

17.69

Unit Casing Volume [b] (gal/ft)

D. 16

Casing Volume [f] = [b] x [e] (gal)

2. a

Initial Depth to Water [c] (ft, bTOC):

11.31

Total Purged Volume [q] (gal):

12

Initial Depth of Well [d] (ft, bTOC):

29

Number of Purged Volumes [h] = [q] / [f]:

4.2

[illegible]

End Time: 15:40

Purged Dry (Y/N): Y

Casing Volume

Casing I.D. (in.)	Unit Casing Volume Gal/Lin. Ft.)
1.0	0.04
1.5	0.09
2.0	0.16
2.2	0.20
3.0	0.37
4.0	0.65
4.3	0.75
5.0	1.00
6.0	1.55
7.0	2.00
8.0	2.60

Additional Remarks	

Bailed dry, waited over an hour for recovery, still no water.

Appendix C

Groundwater Sampling Forms

Ground Water Sample Collection Record

Client:	<u>PPPA</u>	Date:	<u>1/24/19</u>
Project No:		Time: Start	<u>0900</u>
Site Location:	<u>Roadside</u>	Finish	
Weather Conds:	<u>Cloudy, 18°, snow</u>	Collector(s)	<u>Hershman</u>

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length	<u>70.08</u>	c. Casing Material	<u>TPC</u>
b. Water Table Depth	<u>63.68</u>	d. Casing Diameter	<u>2</u>
		e. Length of Water Column	
		f. Calculated Well Volume (see back)	

WELL PURGING DATA

a. Purge Method bladder pump

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ _____ well volumes) -
- Maximum Allowable Turbidity _____ NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
<u>YSI 556</u>	<u>Hash 2100</u>	

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
0952	Initial	8.54	10.38	1678	190.0	6.29	10.3	low	
0954	1.0 L	9.44	9.91	1278	199.7	6.03	10.4	clear	
0956	2.0 L	9.62	9.66	1093	171.4	6.56	8.48	clear	
0959	3.0 L	9.51	9.49	1006	166.7	6.40	9.04	clear	
1002	3.5 L	9.60	9.25	980	160.5	7.06		clear	

e. Acceptance criteria pass/fail

Has required volume been removed	Yes <input type="checkbox"/>	No <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Has required turbidity been reached	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Have parameters stabilized	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If no or N/A - Explain below.

SAMPLE COLLECTION: Method: bladder

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
ASH-06	1 L	2	None	App 1/11 + IV	1005
	1 L	1	HNO ₃	App C&R	

Comments _____

Signature [Signature] Date 1/24/19

Ground Water Sample Collection Record

Client:	<u>PPPA</u>	Date:	<u>1/24/19</u>
Project No:		Time: Start	
Site Location:	<u>Riviera</u>	Finish	
Weather Conds:	<u>Sun, breezy, 25°</u>	Collector(s)	<u>Hurshman</u>

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length	<u>30.05</u>	c. Casing Material	<u>PVC</u>	e. Length of Water Column	
b. Water Table Depth	<u>16.55</u>	d. Casing Diameter	<u>2</u>	f. Calculated Well Volume (see back)	

Well ☒ Piezometer ☐

WELL PURGING DATA

a. Purge Method bladder

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ _____ well volumes) —
- Maximum Allowable Turbidity 10 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
<u>YSI</u>	<u>SSL</u>	
<u>Hach</u>	<u>2100P</u>	

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume L Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
1344	in 2 min (1L)	10.47	7.19	6279	127.6	4.51	—	Cloudy	
1347	1 L	10.79	6.98	6229	127.1	1.29	77.1	Cloudy	
1350	2 L	10.91	6.94	6211	126.5	0.95	62.3	"	
1353	3 L	10.82	6.91	6205	125.9	0.81	52.8	"	
1356	4 L	10.62	6.90	6205	125.6	0.82	36.0	"	
1359	5 L	10.64	6.89	6219	125.6	0.72	22.4	"	

e. Acceptance criteria pass/fail

Has required volume been removed	Yes <input type="checkbox"/>	No <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Has required turbidity been reached	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Have parameters stabilized	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If no or N/A - Explain below.

SAMPLE COLLECTION: Method: bladder

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
ASH-7	1 L	2	None	App. 111 + V	1405
	1 L	1	HNO3	CCP	
DUP-1					—

Comments DUP-1 collected

Signature [Signature] Date 1/24/19

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Groundwater Sample Collection Form

Well Identification **ASH-01**

Page

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Project Name: PRPA Corrective Actions

Sampled By: W. Weichert / J. Woodruff

Project Number: 60588513

Sample ID: ASH-01

Site ID: PRPA Rawhide Station

Sample Date: 5-2-19

Date: 5-2-19

Sample Time: 1035

Equipment

Purging Method	Low Flow
----------------	----------

Filtering Equipment None

Sampling Equipment QED SampPro Bladder Pump

Flow Rate 250 ml/min

Purging Information

Casing I.D. [a] (in.):

Length of Static Water Column [e] = [d] - [c] (ft):

Unit Casing Volume [b] (gal/ft)

Casing Water Volume [f] = [b] x [e] (gal)

Depth to Water [c] (ft, bgs):

Total Purged Volume [g] (gal):

Depth to Bottom of Well [d] (ft, bgs):

Number of Purged Volumes [h] = [g] / [f]:

See below

4

[illegible]

Total Volume Removed (gallons): ^{Liters}

Time:

Purged Dry (Y/N):

Casing Volume

Casing I.D. (in.)	Unit Casing Volume Gal/Lin. Ft.)
1.0	0.04
2.0	0.16
4.0	0.65
5.0	1.00
6.0	1.55
8.0	2.60

Additional Remarks

- Partly cloudy; 91°F

Appendix III & IV analysis



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Groundwater Sample Collection Form

Well Identification ASH-02 (MW-2)
MS / MSD

Page

1 of 1

Project Name: PRPA Corrective Actions
Project Number: 60588513
Site ID: PRPA Rawhide Station
Date: 5/6/19

Sampled By: W. Weichert / J. Woodruff
Sample ID: ASH-02 (MW-2)
Sample Date: 5-6-19
Sample Time: 1040

Equipment

Purging Method Low Flow
Sampling Equipment QED SampPro Bladder Pump

Filtering Equipment None
Flow Rate 0.20 L/min

Purging Information

Casing I.D. [a] (in.): 2" 4"
Unit Casing Volume [b] (gal/ft) -
Depth to Water [c] (ft, bgs): 3.71
Depth to Bottom of Well [d] (ft, bgs): 52.5

Length of Static Water Column [e] = [d] - [c] (ft): -
Casing Water Volume [f] = [b] x [e] (gal) -
Total Purged Volume [g] (gal): See below
Number of Purged Volumes [h] = [g] / [f]: -

Time	Volume (gallons)	Temp (°C)	pH	ORP (mV)	Conductivity (mS/cm) or (µS/cm)	DO (mg/L)	Turbidity (NTU)	Comments
1020	0.05	10.9	7.81	98.3	2941	5.53	6.98	DTW = 3.34
1025	0.50	12.2	7.65	97.2	3005	3.16	4.62	DTW = 3.75
1030	1.0	11.3	7.65	96.2	3017	3.02	4.82	DTW = 4.01
1035	1.7	11.3	7.65	95.7	3023	3.08	5.16	DTW = 4.22
1040	3	11.4	7.64	94.9	3035	2.89	4.33	DTW = 4.60
<div>SLW 5-6-19</div>								

Total Volume Removed (gallons): 4

Time: 1040

Purged Dry (Y/N): N

Casing Volume

Casing I.D. (in.)	Unit Casing Volume Gal/Lin. Ft.
1.0	0.04
2.0	0.16
4.0	0.65
5.0	1.00
6.0	1.55
8.0	2.60

Additional Remarks

- partly cloudy; 51°F
- collected MS / MSD
- Appendix III & IV analysis

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Groundwater Sample Collection Form

Well Identification

ASH-03

Page

of

1

Project Name: PRPA Corrective Actions

Sampled By: W. Weichert / J. Woodruff

Project Number: 60588513

Sample ID:

Site ID: PRPA Rawhide Station

Sample Date:

Date:

Sample Time:

Equipment

Purging Method Low Flow

Filtering Equipment None

Sampling Equipment QED SampPro Bladder Pump

Flow Rate

Purging Information

Casing I.D. [a] (in.):

Length of Static Water Column [e] = [d] - [c] (ft):

Unit Casing Volume [b] (gal/ft)

Casing Water Volume [f] = [b] x [e] (gal)

Depth to Water [c] (ft, bqs):

Total Purged Volume [q] (gal):

Depth to Bottom of Well [d] (ft, bgs):

Number of Purged Volumes [h] = [g] / [f]:

See below

[illegible]

Total Volume Removed (gallons): ^{Liters}

Time:

Purged Dry (Y/N):

Casing Volume

Casing I.D. (in.)	Unit Casing Volume Gal/Lin. Ft.)
1.0	0.04
2.0	0.16
4.0	0.65
5.0	1.00
6.0	1.55
8.0	2.60

Additional Remarks

Turbidity: +100 = overrange for instrument

Appendix III & IV analysis



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Groundwater Sample Collection Form

Well Identification

ASH-04

Page

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Project Name: PRPA Corrective Actions
Project Number: 60588513
Site ID: PRPA Rawhide Station
Date: 5-2-19

Sampled By: W. Weichert / J. Woodruff
Sample ID: ASH-04
Sample Date: 5-2-19
Sample Time: 1355

Equipment

Purging Method: Low Flow
Sampling Equipment: QED SampPro Bladder Pump

Filtering Equipment: None
Flow Rate:

Purging Information

Casing I.D. [a] (in.): 2"
Unit Casing Volume [b] (gal/ft):
Depth to Water [c] (ft, bgs): 14.75
Depth to Bottom of Well [d] (ft, bgs):

Length of Static Water Column [e] = [d] - [c] (ft):
Casing Water Volume [f] = [b] x [e] (gal):
Total Purged Volume [g] (gal): See below
Number of Purged Volumes [h] = [g] / [f]:

Time	Volume (gallons)	Temp (°C)	pH	ORP (mV)	Conductivity (mS/cm) or (µS/cm)	DO (mg/L)	Turbidity (NTU)	Comments
1310	0.25	12.0	7.44	90.7	4251	2.09	82.7	DTW = 14.82
1315	0.7	11.8	7.28	90.0	4213	0.47	90.2	DTW = 15.06
1320	1.3	11.5	7.30	89.0	4174	0.39	73.3	DTW = 15.3
1325	1.9	11.5	7.29	87.9	4180	0.34	68.7	DTW = 15.24
1330	2.5	11.5	7.29	86.9	4183	0.30	66.9	DTW = 15.38
1335	3.0	11.7	7.29	85.8	4194	0.27	38.4	DTW = 15.43
1340	3.5	11.6	7.29	84.8	4196	0.26	24.8	DTW = 15.41
1345	4	11.6	7.29	83.9	4197	0.23	17.3	DTW = 15.49
1350	4.5	11.6	7.29	82.8	4190	0.22	18.7	DTW = 15.44
1355	5	11.4	7.31	82.0	4192	0.20	10.85	DTW = 15.51
JLW 5-2-19								

Total Volume Removed (gallons): 5.5

Time: 1355

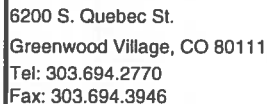
Purged Dry (Y/N): N

Casing Volume

Casing I.D. (in.)	Unit Casing Volume Gal/Lin. Ft.)
1.0	0.04
2.0	0.16
4.0	0.65
5.0	1.00
6.0	1.55
8.0	2.60

Additional Remarks

Appendix III & IV analysis



Well Identification

ASH-05

_____ of _____

Sampled By: W. Weichert / J. Woodruff

Sample ID:

Sample Date:

Sample Time:

Purging Method	Low Flow
----------------	----------

Low Flow

Filtering Equipment None

Sampling Equipment

QED SampPro Bladder Pump

Flow Rate

Casing I.D. [a] (in.):

$$\underline{2''}$$

Length of Static Water Column [e] = [d] - [c] (ft):

Unit Casing Volume [b] (gal/ft)

Casing Water Volume [f] = [b] x [e] (gal)

Depth to Water [c] (ft, bgs):

22.00

Total Purged Volume [g] (gal):

See below

Depth to Bottom of Well [d] (ft, bgs):

Number of Purged Volumes [h] = [q] / [f]:

Total Volume Removed (gallons): _____ **Time:** _____ **Purged Dry (Y/N):** _____

Additional Remarks	

Casing I.D. (in.)	Unit Casing Volume Gal/Lin. Ft.)
1.0	0.04
2.0	0.16
4.0	0.65
5.0	1.00
6.0	1.55
8.0	2.60

Appendix III & IV analysis



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Groundwater Sample Collection Form

Well Identification

ASH-06

Page

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Project Name: PRPA Corrective Actions

Sampled By: W. Weichert / J. Woodruff

Project Number: 60588513

Sample ID: ASH-06

Site ID: PRPA Rawhide Station

Sample Date: 5/6/19

Date: 5/6/19

Sample Time: 0920

Equipment

Purging Method: Low Flow

Filtering Equipment: None

Sampling Equipment: QED SampPro Bladder Pump

Flow Rate: 0.1 L/min

Purging Information

Casing I.D. [a] (in.): 2"

Length of Static Water Column [e] = [d] - [c] (ft):

Unit Casing Volume [b] (gal/ft): 0.163

Casing Water Volume [f] = [b] x [e] (gal):

Depth to Water [c] (ft, bgs): 62.8

Total Purged Volume [g] (gal):

See below

Depth to Bottom of Well [d] (ft, bgs): 71

Number of Purged Volumes [h] = [g] / [f]:

Time	Volume (gallons)	Temp (°C)	pH	ORP (mV)	Conductivity (mS/cm) or (uS/cm)	DO (mg/L)	Turbidity (NTU)	Comments
0956	0	11.8	7.92	73.7	591	4.84	26.4	DTW = 62.8
0900	0.5	11.9	7.98	61.4	543	4.46	26.5	DTW = 63.05
0905	1.0	12.2	8.01	57.0	544	4.18	24.9	DTW = 63.20
0910	1.2	12.1	8.01	56.2	543	4.22	24.0	DTW = 63.14 *flow rate slowed.
0915	1.5	12.3	8.01	54.3	522	4.88	9.21	DTW = 63.42
0920	2	12.3	8.00	54.1	510	5.02	4.56	DTW = 63.50
JLW 5/6/19								

Total Volume Removed (gallons): 2.5

Time: 0920

Purged Dry (Y/N): N

Casing Volume

Casing I.D. (in.)	Unit Casing Volume Gal/Lin. Ft.
1.0	0.04
2.0	0.16
4.0	0.65
5.0	1.00
6.0	1.55
8.0	2.60

Additional Remarks

- Partly Cloudy; 50°F
- Sampled due to low volume of water
- Appendix III & IV analysis



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Groundwater Sample Collection Form

Well Identification ASH-07

Page

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Project Name: PRPA Corrective Actions
Project Number: 60588513
Site ID: PRPA Rawhide Station
Date: 5-2-19

Sampled By: W. Weichert / J. Woodruff
Sample ID: ASH-07
Sample Date: 5-2-19
Sample Time: 1235

Equipment

Purging Method: Low Flow
Sampling Equipment: QED SampPro Bladder Pump

Filtering Equipment: None
Flow Rate: 300 ml/min

Purging Information

Casing I.D. [a] (in.): 2"
Unit Casing Volume [b] (gal/ft): -
Depth to Water [c] (ft, bgs): 15.19
Depth to Bottom of Well [d] (ft, bgs): -

Length of Static Water Column [e] = [d] - [c] (ft): -
Casing Water Volume [f] = [b] x [e] (gal): -
Total Purged Volume [g] (gal): See below
Number of Purged Volumes [h] = [g] / [f]: 8 L

Time	Volume (gallons)	Temp (°C)	pH	ORP (mV)	Conductivity (mS/cm) or (µS/cm)	DO (mg/L)	Turbidity (NTU)	Comments
1205	0.3	11.9	7.00	98.4	4440	2.94	+100	DTW = 15.42 * bladder pump hit bottom
1210	1.0	11.9	6.91	98.5	4432	2.23	53.0	DTW = 16.09
1215	2.0	11.8	6.89	99.1	4434	2.31	31.5	DTW = 16.34
1220	3	11.9	6.86	99.2	4441	2.26	28.6	DTW = 16.47
1225	4.5	11.5	6.90	99.4	4405	2.38	29.8	DTW = 16.56
1230	6	11.7	6.92	99.2	4438	2.39	24.9	DTW = 16.68
1235	7.5	11.8	6.92	98.6	4469	2.36	20.1	DTW = 16.75
JLW 5/2/19								

Total Volume Removed (gallons): 9

Time: 1235

Purged Dry (Y/N): N

Casing Volume

Casing I.D. (in.)	Unit Casing Volume Gal/Lin. Ft.
1.0	0.04
2.0	0.16
4.0	0.65
5.0	1.00
6.0	1.55
8.0	2.60

Additional Remarks

+100 means overrange for turbidimeter
Partly Sunny
Appendix III & IV analysis



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Groundwater Sample Collection Form

Well Identification ASH-08

Page

1 of 1

Project Name: PRPA Corrective Actions
Project Number: 60588513
Site ID: PRPA Rawhide Station
Date: 5/6/19

Sampled By: W. Weichert / J. Woodruff
Sample ID: ASH-08
Sample Date: 5-6-19
Sample Time: 1255

Equipment

Purging Method Low Flow
Sampling Equipment QED SampPro Bladder Pump

Filtering Equipment None
Flow Rate 0.2 L/min

Purging Information

Casing I.D. [a] (in.): 2"
Unit Casing Volume [b] (gal/ft) -
Depth to Water [c] (ft, bgs): 11.01
Depth to Bottom of Well [d] (ft, bgs): 32.10

Length of Static Water Column [e] = [d] - [c] (ft): -
Casing Water Volume [f] = [b] x [e] (gal) -
Total Purged Volume [g] (gal): See below
Number of Purged Volumes [h] = [g] / [f]: -

Time	Volume (gallons)	Temp (°C)	pH	ORP (mV)	Conductivity (mS/cm) or (uS/cm)	DO (mg/L)	Turbidity (NTU)	Comments
1230	0.0	12.5	7.19	117.6	3415	5.55	15.6	DTW = 10.58
1235	0.5	12.3	7.12	118.0	3387	4.44	16.7	DTW = 11.53
1240	2.0	12.2	7.11	117.1	3368	4.34	10.90	DTW = 12.55
1245	3.0	12.3	7.13	116.3	3374	4.32	9.40	DTW = 13.56
1250	3.5	12.4	7.12	116.2	3378	4.26	8.77	DTW = 13.62
1255	4.2	12.1	7.17	115.3	3362	3.96	7.98	DTW = 14.36
JLW 5-6-19								

Total Volume Removed (gallons): 5

Time: 1255

Purged Dry (Y/N): N

Casing Volume

Casing I.D. (in.)	Unit Casing Volume Gal/Lin. Ft.
1.0	0.04
2.0	0.16
4.0	0.65
5.0	1.00
6.0	1.55
8.0	2.60

Additional Remarks

New well production notes:

- Low turbidity
- Flow rate between 0.2 L/min and 0.3 L/min w/ OKAY production rate. OK for DUP; not MS/MSD
- Appendix III & IV analysis

- Partly cloudy; 55%

Ground Water Sample Collection Record

Client:	Platte River Power Authority - Rawhide Energy Station		Date:	7.17.19
Project No:	60605002		Time: Start	08:04
Site Location:	Wellington, CO		Finish	
Weather Conds:	Sunny 70°F	Collector(s)	WWJ + CH	

WATER LEVEL DATA: (measured from Top of Casing)

Well ☒ Piezometer ☐

a. Total Well Length _____ c. Casing Material _____ e. Length of Water Column _____
 b. Water Table Depth 27.904 d. Casing Diameter _____ f. Calculated Well Volume (see back) _____

WELL PURGING DATA

a. Purge Method Low Flow / MP-50

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ NA well volumes) _____
- Maximum Allowable Turbidity 5 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
VSI	556	
Hech	2100 Q	

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (us/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
Stabilization	--	+/- 10%	+/- 10%	+/- 10%	+/- 10%	+/- 10%	5.00		
8:12	Initial	15.65	5.37	2847	157.8	6.15	78.3	Clear	
8:15	1.5 L	13.83	5.53	3083	160.1	0.70	97.4	Lt. Brown	
8:19	1.5 L	13.58	5.72	3096	153.8	0.49	104	Lt. Brown	
8:22	2.0 L	13.47	6.87	3097	146.7	0.44	90.4	Lt Brown	
8:25	2.5 L	13.44	6.97	3095	140.3	0.42	87.3	Lt Brown	
8:28	3.0 L	13.39	6.12	3075	150.2	0.46	90.4	Lt Brown	
8:33	3.0 L	13.37	6.23	3029	121.2	0.51	98.4	Lt Brown	
8:36	5.0 L	13.38	6.32	2935	116.2	0.68	72.0	Clear	
8:39	5.2 L	13.71	6.38	2860	110.7	0.84	61.6	Clear	
8:42	5.5 L	13.84	6.47	2756	105.7	1.14	45.3	Clear	
8:45	6.0 L	13.91	6.56	2596	101.7	1.46	34.3	Clear	

e. Acceptance criteria pass/fail

Has required volume been removed

Yes ☐ No ☐ N/A ☒

Has required turbidity been reached

☐ ☐ ☐

Have parameters stabilized

☒ ☐ ☐

If no or N/A - Explain below.

SAMPLE COLLECTION:

Method: Low Flow

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
BAT-12	See COC	5 16		CDPH Analysis	09:00
BAT-12	See COC	5		CCR Analysis	09:00
DUP-3	See COC	5		CCR Analysis	6:00

Comments

Collect duplicate Sample for CCR labeled Dup-3

Signature

Wm Wainwright

Date

7.17.19

Ground Water Sample Collection Record

Client:	Platte River Power Authority - Rawhide Energy Station		Date:	<u>7-17-19</u>
Project No:	60605002		Time: Start	<u>13:20</u>
Site Location:	Wellington, CO		Finish	
Weather Conds:	<u>Partly cloudy 70°</u>		Collector(s)	<u>WW & CH</u>

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length		c. Casing Material	<u>PVC</u>	e. Length of Water Column	
b. Water Table Depth	<u>10.19</u>	d. Casing Diameter	<u>2"</u>	f. Calculated Well Volume (see back)	

 Well ☒ Piezometer ☐
WELL PURGING DATA

a. Purge Method _____

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ NA well volumes) _____
- Maximum Allowable Turbidity 5 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
<u>YSI</u>	<u>556</u>	
<u>Haer</u>	<u>2100 Q</u>	

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
Stabilization	--	+/- 10%	+/- 10%	+/- 10%	+/- 10%	+/- 10%	5.00		
<u>13:24</u>	<u>Initial</u>	<u>15.89</u>	<u>7.75</u>	<u>3731</u>	<u>87.2</u>	<u>4.71</u>	<u>39.2</u>	<u>Clear</u>	
<u>13:27</u>	<u>0.5L</u>	<u>15.08</u>	<u>7.35</u>	<u>3706</u>	<u>90.5</u>	<u>0.95</u>	<u>20.7</u>	<u>Clear</u>	
<u>13:30</u>	<u>1.0L</u>	<u>14.36</u>	<u>7.05</u>	<u>3702</u>	<u>90.5</u>	<u>0.37</u>	<u>20.1</u>	<u>Clear</u>	
<u>13:33</u>	<u>1.5L</u>	<u>14.27</u>	<u>6.94</u>	<u>3632</u>	<u>85.2</u>	<u>0.21</u>	<u>21.1</u>	<u>Clear</u>	
<u>13:36</u>	<u>2.0L</u>	<u>14.44</u>	<u>6.89</u>	<u>3631</u>	<u>76.3</u>	<u>0.20</u>	<u>NM</u>	<u>Clear</u>	
<u>13:39</u>	<u>2.5L</u>	<u>14.41</u>	<u>6.91</u>	<u>3680</u>	<u>70.5</u>	<u>0.17</u>	<u>22.7</u>	<u>Clear</u>	
<u>13:42</u>	<u>3.0</u>	<u>14.36</u>	<u>6.92</u>	<u>3684</u>	<u>69.8</u>	<u>0.17</u>	<u>15.2</u>	<u>Clear</u>	

e. Acceptance criteria pass/fail

Has required volume been removed	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	N/A <input type="checkbox"/>
Has required turbidity been reached	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Have parameters stabilized	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If no or N/A - Explain below.

SAMPLE COLLECTION:

 Method: Low Flow

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
<u>ASH-08</u>	<u>See CCL</u>	<u>→</u>	<u>→</u>	<u>CDPHE</u>	<u>1400</u>
<u>ASH-08</u>	<u>See CCL</u>	<u>→</u>	<u>→</u>	<u>CLR</u>	

Comments _____

 Signature WW Wmnd

 Date 7.17.19

Ground Water Sample Collection Record

Client:	Platte River Power Authority - Rawhide Energy Station		Date:	7.17.19
Project No:	60605002		Time: Start	10:45
Site Location:	Wellington, CO		Finish	
Weather Conds:	Sunny 80's	Collector(s)	WW & CH	

WATER LEVEL DATA: (measured from Top of Casing)

Well ☐ Piezometer ☐

a. Total Well Length		c. Casing Material		e. Length of Water Column	
b. Water Table Depth	2.79 A	d. Casing Diameter		f. Calculated Well Volume (see back)	

WELL PURGING DATA

a. Purge Method Low Flow / MP-50

- b. Acceptance Criteria defined (from workplan):
- Minimum Required Purge Volume (@ NA well volumes)
 - Maximum Allowable Turbidity 5 NTUs
 - Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
<u>YSI</u>	<u>556</u>	
<u>Hach</u>	<u>2100 Q</u>	

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
Stabilization	--	+/- 10%	+/- 10%	+/- 10%	+/- 10%	+/- 10%	5.00		
* 11:03	Initial	18.38	7.77	3563	114.1	7.56	11.3	Clear	
11:06	0.4	15.14	7.43	3391	130.4	2.08	10.4	Clear	
11:09	0.8	15.16	7.39	3345	132.5	2.01	10.9	Clear	
11:12	0.75	15.01	7.37	3391	132.3	19.3	10.0	Clear	
11:16	1.25	15.07	7.38	3394	130.2	1.89	9.29		

- e. Acceptance criteria pass/fail
- | | | | |
|-------------------------------------|------------------------------|-----------------------------|---|
| Has required volume been removed | Yes <input type="checkbox"/> | No <input type="checkbox"/> | N/A <input checked="" type="checkbox"/> |
| Has required turbidity been reached | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Have parameters stabilized | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
- If no or N/A - Explain below.

SAMPLE COLLECTION:

Method: Low Flow

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
MW-2	See COC				1130
MW-2	See COC				

Comments * Flow-through in direct sun, Collect CDPHE + CCR

Signature [Signature]

Date 7-17-19

Ground Water Sample Collection Record

Client:	Platte River Power Authority - Rawhide Energy Station		Date:	7.18.19
Project No:	60605002		Time: Start	08:20
Site Location:	Wellington, CO		Finish	
Weather Conds:	Sunny, 70's	Collector(s)	WW + CA	

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length	c. Casing Material	e. Length of Water Column
b. Water Table Depth	d. Casing Diameter	f. Calculated Well Volume (see back)

14.25 ft

WELL PURGING DATA

a. Purge Method Low Flow / MP-50

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ NA well volumes)
- Maximum Allowable Turbidity 5 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
<u>YSL</u>	<u>556</u>	
<u>Hach</u>	<u>2100 Q</u>	

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
Stabilization	--	+/- 10%	+/- 10%	+/- 10%	+/- 10%	+/- 10%	5.00		
8:27	Initial	13.79	5.73	4951	165.5	2.77	16.6	grayish	
8:30	1.0 L	13.04	5.88	4940	173.2	0.49	12.6	"	
8:33	2.0 L	12.70	6.01	4229	171.3	0.29	80.2	"	
8:36	3.0 L	12.57	6.14	4920	167.8	0.30	71.6	"	
8:39	4.0 L	12.52	6.19	4915	166.3	0.25	37.9	clear	
8:42	5.0 L	12.48	6.27	4919	164.1	0.34	28.8	clear	
0845	6.0 L	12.51	6.32	4922	162.7	0.35	20.4	clear	

e. Acceptance criteria pass/fail

Has required volume been removed	Yes <input type="checkbox"/>	No <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Has required turbidity been reached	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Have parameters stabilized	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If no or N/A - Explain below.

SAMPLE COLLECTION:

Method: Low Flow

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
ASH-07	See COC		→	CDPHE	0900
ASH-07	See COC		→	CCR	0900

Comments

Collect Sample for CDPHE + CCR, Collect MS/MSD for CCR

Signature

Wu Wun

Date

7.18.19

* Collect CCR MS/MSD

Ground Water Sample Collection Record

Client:	Platte River Power Authority - Rawhide Energy Station	Date:	7.18.19
Project No:	60605002	Time: Start	10:00
Site Location:	Wellington, CO	Finish	
Weather Conds:	Sunny 70°F	Collector(s)	WW & CA

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length	c. Casing Material	Well <input checked="" type="checkbox"/> Piezometer <input type="checkbox"/>
b. Water Table Depth	d. Casing Diameter	e. Length of Water Column
48.32 ft		f. Calculated Well Volume (see back)

WELL PURGING DATA

a. Purge Method Low Flow / MP-50

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ NA well volumes)
- Maximum Allowable Turbidity 5 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
YSI	556	
Hach	2100 Q	

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
Stabilization	--	+/- 10%	+/- 10%	+/- 10%	+/- 10%	+/- 10%	5.00		
10:03	Initial	17.45	7.72	1146	99.4	2.12	65.2	Clear	
10:06	0.5 L	15.77	7.60	1071	69.0	3.73	37.7	Clear	
10:09	1.0 L	14.35	7.43	1037	34.0	1.36	45.2	Clear	
10:12	1.5 L	14.48	7.16	1014	18.3	0.77	44.7	Clear	
10:15	2.0 L	14.33	7.05	1003	13.2	0.59	47.1	Clear	
10:18	2.5 L	14.23	7.01	994	16.3	0.55	46.3	Clear	
10:21	3.0 L	14.21	7.02	988	18.7	0.48	34.6	Clear	
				WW					

e. Acceptance criteria pass/fail

Has required volume been removed	Yes <input type="checkbox"/>	No <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Has required turbidity been reached	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Have parameters stabilized	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If no or N/A - Explain below.

SAMPLE COLLECTION:

Method: Low Flow

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
PRS-03	See 60C				1030
PRS-03	See 60C				1030

Comments

Signature

Wm Wainwright

Date

7.18.2019

Ground Water Sample Collection Record

Client:	Platte River Power Authority - Rawhide Energy Station	Date:	<u>7-18-19</u>
Project No:	60605002	Time: Start	<u>11:10</u>
Site Location:	Wellington, CO	Finish	
Weather Conds:	<u>Sunny 70's</u>	Collector(s)	<u>WW + CA</u>

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length _____ c. Casing Material PVC Well ☒ Piezometer ☐
 b. Water Table Depth 62.88 ft d. Casing Diameter 2" e. Length of Water Column _____
 f. Calculated Well Volume (see back) _____

WELL PURGING DATA

a. Purge Method Low Flow / MP-50

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ N/A well volumes) _____
- Maximum Allowable Turbidity 5 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
<u>Ysi</u>	<u>556</u>	
<u>Hach</u>	<u>2100 Q</u>	

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
Stabilization	--	+/- 10%	+/- 10%	+/- 10%	+/- 10%	+/- 10%	5.00		
* 11:20	Initial	17.85	8.92	903	858.3	12.54	879	55.4	Clear
11:23	0.6 L	15.67	8.87	837	131.0	4.83	30.8	Clear	
11:26	1.2 L	16.06	8.64	789	129.7	3.06	24.3	Clear	
11:29	1.5 L	17.06	8.37	743	131.2	2.74	17.5	Clear	
11:32	2.0 L	17.37	8.35	729	124.6	2.19	14.5	Clear	
11:35	2.5 L	17.31	8.33	713	120.6	2.32	8.74	Clear	
11:38	3.0 L	17.49	8.28	687	117.8	2.38	11.8	Clear	
				WW					

e. Acceptance criteria pass/fail

Has required volume been removed

Yes

No

N/A

Has required turbidity been reached

Have parameters stabilized

If no or N/A - Explain below.

Under 50 NTU

SAMPLE COLLECTION:

Method: Low Flow

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
<u>ASH-06</u>				<u>CDHE</u>	<u>1145</u>
<u>ASH-06</u>				<u>CR</u>	

Comments

* Check DO probe (reading 879 mg/L)

Signature

Wm W. W. W.

Date

7.18.19

* Well Pumped dry before Collecting Radium
 Will return + attempt to re-sample this afternoon.

Ground Water Sample Collection Record

Client:	Platte River Power Authority - Rawhide Energy Station	Date: 7.18.19
Project No:	60605002	Time: Start 13:20
Site Location:	Wellington, CO	Finish _____
Weather Conds:	Sunny 80°F Collector(s) WW & CA	

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length _____	c. Casing Material _____	Well <input checked="" type="checkbox"/> Piezometer <input type="checkbox"/>
b. Water Table Depth 19.12	d. Casing Diameter _____	e. Length of Water Column _____
f. Calculated Well Volume (see back) _____		

WELL PURGING DATA

a. Purge Method **Low Flow**

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ **NA** well volumes) _____
- Maximum Allowable Turbidity **5** NTUs
- Stabilization of parameters **10** %

c. Field Testing Equipment Used:

Make	Model	Serial Number
YSI	556	
Hydram	2100 Q	

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
Stabilization	--	+/- 10%	+/- 10%	+/- 10%	+/- 10%	+/- 10%	~ 5.00		
13:30	Initial	16.40	8.14	1697	48.1	226.3	6.58	Gray/Cloudy	
13:33	0.7L	16.04	7.76	1699	109.5	4.40	2.55	Gray/Cloudy	
13:36	1.5L	16.11	7.42	1707	122.0	2.86	1.75	Lt Gray	
13:39	2.0L	16.04	7.29	1711	124.3	2.37	1.30	Lt Gray	
13:42	2.5L	15.99	7.24	1698	123.3	1.50	0.91	" "	
13:45	3.0L	16.05	7.27	1700	120.2	1.11	0.63	" "	
13:48	3.5L	15.67	7.29	1692	118.3	0.91	0.38	" "	

e. Acceptance criteria pass/fail

- Has required volume been removed ☒ Yes ☐ No ☐ N/A
- Has required turbidity been reached ☒ Yes ☐ No ☐ N/A
- Have parameters stabilized ☒ Yes ☐ No ☐ N/A

If no or N/A - Explain below.

SAMPLE COLLECTION:

Method: _____

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
PRS-04	See Coc	1	→	CDPHE List	1400

Comments _____

Signature _____

Date **7.18.19**

Ground Water Sample Collection Record

Client:	Platte River Power Authority - Rawhide Energy Station	Date:	7/22/19
Project No:	60605002	Time: Start	1230
Site Location:	Wellington, CO	Finish	
Weather Conds:	cloudy, 70	Collector(s)	J. Hochum, C. Ahlrodt

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length	c. Casing Material	Well <input checked="" type="checkbox"/> Piezometer <input type="checkbox"/>
<u>NM</u>	<u>PVC</u>	e. Length of Water Column
b. Water Table Depth	d. Casing Diameter	f. Calculated Well Volume (see back)
<u>8.20</u>	<u>2</u>	

WELL PURGING DATA

a. Purge Method bladder

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ _____ well volumes)
- Maximum Allowable Turbidity 5 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
<u>YSI 556</u>	<u>Hach 2000</u>	

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
Stabilization	--	+/- 10%	+/- 10%	+/- 10%	+/- 10%	+/- 10%	5.00		
1244	initial	17.18	7.52	3412	118.1	4.98	62.7	Lt Brown	-
1247	0.5	16.35	7.36	3402	121.5	2.48	148	Brown	=
1250	1.0	16.33	7.31	3381	122.7	1.55	213	Brown	-
1253	1.2	16.40	7.26	3365	123.9	1.16	239	Brown	-
1257	1.5	17.00	7.23	3351	124.1	0.57	248	Brown	-
1303	2.2	16.74	7.22	3349	124.4	0.89	241	Brown	-
1307	3.0	16.66	7.21	3336	125.5	0.37	234	Brown	-
1313	4.0	17.05	7.19	3315	125.7	0.31	188	Brown	-
1323	5.0	16.64	7.19	3330	126.5	0.28	100	tan	
1327	6.0	16.29	7.18	3331	126.6	0.27	82.2	tan	
1332	2.0	16.12	7.17	3324	122.3	0.26	52.6	Cloudy	

e. Acceptance criteria pass/fail

Has required volume been removed	Yes <input type="checkbox"/>	No <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Has required turbidity been reached	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Have parameters stabilized	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If no or N/A - Explain below.

SAMPLE COLLECTION:

Method: bladder

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
MW-8	See Col				1335

Comments _____

Signature _____

Date _____

Ground Water Sample Collection Record

CCP + CDPE

Client: Platte River Power Authority - Rawhide Energy Station Date: 7/22/19
 Project No: 60605002 Time: Start 1030
 Site Location: Wellington, CO Finish _____
 Weather Conds: cloudy, 70° Collector(s) J. Hershman, C. Khrushchev

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length NM c. Casing Material PVC Well ☒ Piezometer ☐
 b. Water Table Depth 10.75 d. Casing Diameter 2 e. Length of Water Column _____
 f. Calculated Well Volume (see back) _____

WELL PURGING DATA

a. Purge Method bladder - low flow
 b. Acceptance Criteria defined (from workplan)
 - Minimum Required Purge Volume (@ _____ well volumes) _____
 - Maximum Allowable Turbidity 5 NTUs
 - Stabilization of parameters 10 %
 c. Field Testing Equipment Used: Make _____ Model _____ Serial Number _____
YSI 556
Hach 2100 Q
 d. Field Testing Equipment Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
Stabilization	--	+/- 10%	+/- 10%	+/- 10%	+/- 10%	+/- 10%	5.00		
1040	1.4L	14.32	7.52	3362	139.8	error	31.5	cloudy	
1044	0.7L	13.79	7.55	3379	140.3	8.18	27	clear	
1047	1.2L	13.62	7.53	3374	139.8	7.90	44.7	clear	
1051	1.8L	13.63	7.61	3372	139.5	7.67	20.4	clear	
1054	2.4L	13.65	7.65	3374	139.0	7.60	18.8	clear	

e. Acceptance criteria pass/fail
 Has required volume been removed Yes ☐ No ☐ N/A ☒
 Has required turbidity been reached Yes ☐ No ☐ N/A ☐
 Have parameters stabilized Yes ☐ No ☐ N/A ☐
 If no or N/A - Explain below.

SAMPLE COLLECTION:

Method: bladder

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
<u>BAT-10</u>	<u>See notes</u>	<u>1</u>	<u>→</u>		<u>1100</u>

Comments _____

Signature _____ Date _____

Ground Water Sample Collection Record

Client:	Platte River Power Authority - Rawhide Energy Station	Date:	7/22/09
Project No:	60605002	Time: Start	845
Site Location:	Wellington, CO	Finish	
Weather Conds:	Cloudy, 65°	Collector(s)	J. Hurshman, C. Ahmudt

WATER LEVEL DATA: (measured from Top of Casing)

Well ☒ Piezometer ☐

a. Total Well Length NM c. Casing Material PVC e. Length of Water Column _____
 b. Water Table Depth 24.35 d. Casing Diameter 2 f. Calculated Well Volume (see back) _____

WELL PURGING DATA

a. Purge Method bladder - no flow
 b. Acceptance Criteria defined (from workplan)
 - Minimum Required Purge Volume (@ _____ well volumes)
 - Maximum Allowable Turbidity 10 NTUs
 - Stabilization of parameters 10 %
 c. Field Testing Equipment Used: Make _____ Model _____ Serial Number 09F100 455
Y&J 556
Flach 2000 Q
 d. Field Testing Equipment Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
Stabilization	--	+/- 10%	+/- 10%	+/- 10%	+/- 10%	+/- 10%	5.00		
0903	in-trail	13.13	6.98	901	177.7	5.09	22.4	Clear	Recalibrated pH 0901
0909	0.2 L	13.67	6.51	941	143.5	2.22	17.6	Clear	
0913	1.0 L	12.24	6.55	911	145.2	1.69	15.1	Clear	
0916	1.5 L	11.95	6.35	891	152.2	1.53	14.5	Clear	
0919	2.0 L	11.84	6.36	884	151.5	1.64	21.4	Clear	

e. Acceptance criteria pass/fail
 Has required volume been removed Yes ☐ No ☐ N/A ☒
 Has required turbidity been reached Yes ☐ No ☐ N/A ☐
 Have parameters stabilized Yes ☐ No ☐ N/A ☐
 If no or N/A - Explain below.

SAMPLE COLLECTION:

Method: bladder

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
BAT-11	See Cor				0925

Comments _____

Signature [Signature]

Date 7/22/09

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.


Page: 1 of 1

Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:			
Company: AECOM		Report To: Geoff Webb		Attention: Accounts Payable			
Address: 6200 South Quebec St		Copy To: Brian Rothmeyer		Company Name: AECOM		REGULATORY AGENCY:	
Greenwood Village, CO 80111				Address: Same as Section A		<input type="checkbox"/> NPDES <input type="checkbox"/> GROUND WATER <input type="checkbox"/> DRINKING WATER <input type="checkbox"/> UST <input type="checkbox"/> RCRA <input type="checkbox"/> OTHER _____	
Email To: brian.rothmeyer@aecom.com		Purchase Order No.:		Pace Quote Reference: 42700			
Phone: (303) 740-2614 Fax:		Project Name: PRPA Rawhide		Pace Project Manager: Heather Wilson		Site Location	
Requested Due Date/TAT:		Project Number:		Pace Profile #: 11033, 3		STATE: CO	

ITEM #	Section D Required Client Information	Valid Matrix Codes MATRIX CODE DRINKING WATER DW WATER WT WASTE WATER WW PRODUCT P SOIL/SOLID SL OIL OL WIPE WP AIR AR OTHER OT TISSUE TS	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED				SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives										Analysis Test ↓	Requested Analysis Filtered (Y/N)										Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.			
					COMPOSITE START		COMPOSITE END/GRAB				Unpreserved	H ₂ SO ₄	HNO ₃	HCl	NaOH	Na ₂ S ₂ O ₃	Methanol	Other	9056 Cl, F, SO ₄	6020 Total Metals*		6010 Total Metals**	7470 Total Mercury	2540C TDS												
					DATE	TIME	DATE	TIME																												
1	BAT-11		WT 6		7/22/19	925			3	X	X								X	X	X	X	X													
2	BAT-10		WT 6		7/22/19	100			3	X	X							X	X	X	X	X														
3																																				
4																																				
5																																				
6																																				
7																																				
8																																				
9																																				
10																																				
11																																				
12																																				

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS				
*Be, Cr, Co, As, Se, Mo, Cd, Sb, Ba, Tl, Pb	TDA AECOM	7/22/19	1630								
**B, Ca, Li											

SAMPLER NAME AND SIGNATURE		Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
PRINT Name of SAMPLER: Jeremy Hushman					
SIGNATURE of SAMPLER: TDA					
DATE Signed (MM/DD/YY): 7/22/19					

	Document Name: Sample Acceptance Policy	Document Revised: March 31, 2017 Page 1 of 1
	Document No.: F-ALL-C-006-rev.03	Issuing Authority: Pace Corporate Quality office

Pace Sample Acceptance Policy

In accordance with regulatory guidelines, Pace Analytical facilities comply with the following sample acceptance policy for all samples received.

If the samples do not meet the sample receipt acceptance criteria outlined below, the Pace facility is required to document all non-compliances, contact the client, and either reject the samples or fully document any decisions to proceed with analyses of samples that do not meet these criteria. Any results reported from samples not meeting these criteria are appropriately qualified on the final report.

Sample Acceptance Policy requirements:

1. Sample containers must have unique client identification designations, and dates and times of collection, that are clearly marked with indelible ink on durable, water-resistant labels. The client identifications must match those on the chain-of-custody (COC);
2. There must be clear documentation on the COC, or related documents such as the Sample Condition Upon Receipt (SCUR) form, that lists the unique sample identification, sampling site location (including state; some regulations may require city, county, etc.), date and time of sample collection, and name and signature of the sample collector;
3. There must be clear documentation on the COC, or related documents, that lists the requested analyses, the preservatives used, sample matrix, and any special remarks concerning the samples (i.e., data deliverables, samples are for evidentiary purposes, field filtration, etc.);
4. Samples must be in appropriate sample containers. If the sample containers show signs of damage (i.e., broken or leaking) or if the samples show signs of contamination, the samples will not be processed without prior client approval;
5. Samples must be correctly preserved upon receipt, unless the method requested allows for laboratory preservation. If the samples are received with inadequate preservation, and the samples cannot be preserved by the lab appropriately, the samples will not be processed without prior client approval;
6. Samples must be received within required holding time. Any samples with hold times that are exceeded will not be processed without prior client approval;
7. Samples must be received with sufficient sample volume or weight to proceed with the analytical testing. If insufficient sample volume or weight is received, analysis will not proceed without client approval;
8. All samples that require thermal preservation are considered acceptable if they are received at a temperature within 2°C of the required temperature, or within the method-specified range. For samples with a required temperature of 4°C, samples with a temperature ranging from just above freezing to 6°C are acceptable. Samples that are delivered to the lab on the same day they are collected are considered acceptable if the samples are received on ice. Any samples that are not received at the required temperature will not be processed without prior client approval.
9. For all compliance **drinking water** samples, analyses will be rejected at the time of receipt if they are not received in a secure manner, are received in inappropriate containers, are received outside the required temperature range, are received outside the recognized holding time, are received with inadequate identification on sample containers or COC, or are improperly preserved (with the exception of VOA samples- tested for pH at time of analysis and TOC- tested for pH in the field).
10. Some specific clients may require custody seals. **For these clients**, samples or coolers that are not received with the proper custody seals will not be processed without prior client approval.

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A

Required Client Information:

Company: AECOM
Address: 6200 South Quebec St
Greenwood Village, CO 80111
Email To: brian.rothmeyer@aecom.com
Phone: (303) 740-2614 Fax:
Requested Due Date/TAT: 15 Day TAT

Section B

Required Project Information:

Report To: Geoff Webb
Copy To: Brian Rothmeyer
Purchase Order No.:
Project Name: PRPA Rawhide
Project Number:

Section C

Invoice Information:

Attention: Accounts Payable
Company Name: AECOM
Address: Same as Section A
Pace Quote Reference: 51654
Pace Project Manager: Heather Wilson
Pace Profile #: 11033, 2

Page: 1 of 2

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER

Site Location

CO

STATE:

ITEM #	Section D Required Client Information		Valid Matrix Codes		MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED				SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives												Analysis Test Y/N																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
			MATRIX	CODE			COMPOSITE START		COMPOSITE END/GRAB				Unpreserved	H ₂ SO ₄	HNO ₃	HCl	NaOH	Na ₂ S ₂ O ₃	Methanol	Other	300.0 Nitrate & Nitrite	365.1 Orthophosphate	BOD, COD, 8260 BTEX	300 Cl.F,SO4,5310C TOC														6020 Total/Diss. Metals*	6010 Total/Diss. Metals**	7470 Total Mercury	2540C TDS, 2540D TSS	2320B Alkalinity	365.4 Total Phosphorus	1664 O&G,420.1 Phenolic	Ammonia, Cyanide	Residual Chlorine (Y/N)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
*Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Ag, Sr, Ti, V, Zn **Al, Ca, Mg, Fe, K, Na, B, Li, Total Hardness	T. H. / AECOM	7/24/19	1630							
3 coolers										

COPHE

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Jeremy Hushman

SIGNATURE of SAMPLER: [Signature]

DATE Signed (MM/DD/YY): 7/22/19

Temp in °C
Received on Ice (Y/N)
Custody Sealed Cooler (Y/N)
Samples Intact (Y/N)

Ground Water Sample Collection Record

Client:	Platte River Power Authority	Date:	10.8.19
Project No:	60605002	Time: Start	8:10
Site Location:	Wellington Colorado	Finish	9:45
Weather Conds:	60°F partly cloudy	Collector(s)	WW + GD

WATER LEVEL DATA: (measured from Top of Casing)

Well ☒ Piezometer ☐

a. Total Well Length c. Casing Material PVC e. Length of Water Column (a-b)

b. Water Table Depth 12.88 d. Casing Diameter 4" f. Calculated Well Volume (see back)

WELL PURGING DATA

a. Purge Method Low Flow

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ NA well volumes) Low Flow

- Maximum Allowable Turbidity 20-30 NTUs

- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make
VSIModel
556

Serial Number

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # Page #

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
08:20	Initial	12.83	6.61	3795	185.4	5.36	—	Very clear	No Silt
08:23	0.4	12.41	6.87	3733	171.4	2.92	—	"	"
08:26	0.8	12.24	6.88	3739	166.6	2.92	—	"	"
08:29	1.2	12.33	7.03	3729	163.8	0.98	—	"	"
08:32	1.6	12.13	7.10	3725	155.8	0.70	—	"	"
08:35	2.0	12.07	7.10	3722	153.9	0.62	—	"	"
08:38	2.4	12.04	7.14	3718	151.1	0.59	—	"	"
08:41	2.8	11.97	6.96	3714	151.6	0.58	—	"	"
08:44	3.2	11.93	7.24	3717	149.3	0.59	—	"	"

e. Acceptance criteria pass/fail

Has required volume been removed

Yes

No

N/A

Has required turbidity been reached

☒☐☒

Have parameters stabilized

☒☐☐

If no or N/A - Explain below.

* No turbidity, Hach Z100 @ Malfunctioned + Will not turn on.
Sample visually clear water only.

SAMPLE COLLECTION:

Method: Bladder Pump

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
ASH-01 (MW-01)	See COL	10	See COL	CDPHE	9:00
ASH-01 (MW-01)	See COL	5	See COL	CCR + Radium	9:00

Comments

Signature

Wm Wint

Date

10/8/19

Ground Water Sample Collection Record

Client:	Platte River Power Authority	Date:	10.8.19
Project No:	60605002	Time: Start	9:55
Site Location:	Wellington Colorado	Finish	11:55
Weather Conds:	60°F Cloudy	Collector(s)	WW + GD

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length — c. Casing Material PVC e. Length of Water Column — (a-b)
 b. Water Table Depth 62.78 d. Casing Diameter 2" f. Calculated Well Volume (see back) —

WELL PURGING DATA

a. Purge Method Low Flow

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ NA well volumes) Low Flow
- Maximum Allowable Turbidity 20-30 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make VSI Model 550 Serial Number —

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # — Page # —

Time	Volume Removed (gal) L	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
10:03	Initial	14.07	8.26	835	137.4	8.29	—	Very clear	no silt
10:06	0.85	13.29	8.16	740	130.8	5.13	—	"	"
10:09	1.55	13.34	8.29	699	122.0	5.22	—	"	"
10:12	1.90	13.77	8.25	656.83	119.5	5.19	—	"	"
10:15	2.05	14.26	8.12	672	130.3	5.17	—	"	"
10:18	2.30	14.57	8.28	671	135.0	5.24	—	"	"
10:21	2.55	14.72	8.44	667	129.2	5.41	—	"	"
10:24	2.8	14.83	8.26	663	139.1	5.56	—	"	"

e. Acceptance criteria pass/fail

- Has required volume been removed ☐ Yes ☐ No ☒ N/A
 Has required turbidity been reached ☐ Yes ☐ No ☒ N/A
 Have parameters stabilized ☒ Yes ☐ No ☐ N/A

If no or N/A - Explain below.

* No turbidity. Turbidity meter Malfunctioned & will not turn on.
 Sample visually clear water only

SAMPLE COLLECTION:

Method: Bladder Pump

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
ASH-06	See COC	16	See COC	CDPHE	11:00
ASH-06	See COC	5	See COC	CCR + Radium	11:00

Comments

Well nearly pumped dry, Several bottles not quite full

Signature

Wm Wint

Date

10/8/19

Well pumped Dry @ 11:51, Was able to collect nearly all the required Volume

Ground Water Sample Collection Record

Client:	Platte River Power Authority	Date:	10.8.19
Project No:	60605002	Time: Start	12:00
Site Location:	Wellington Colorado	Finish	14:20
Weather Conds:	60°F Cloudy	Collector(s)	WW + GD

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length c. Casing Material PVC Well ☒ Piezometer ☐
 b. Water Table Depth 4.10 d. Casing Diameter 4" e. Length of Water Column (a-b)
 f. Calculated Well Volume (see back)

WELL PURGING DATA

a. Purge Method Low Flow

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ VA well volumes) Low Flow
- Maximum Allowable Turbidity 20-30 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
YSI	556	

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # Page #

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
12:16	initial	16.96	8.5	4155	148.7	4.77	N/A	low	
12:19	0.3	16.21	8.49	4176	138.8	2.47	N/A	low	
12:22	0.6	16.09	7.93	4173	147.1	2.11	...	...
12:25	0.9	16.05	8.25	4173	136.4	1.54	...	...
12:28	1.2	15.93	8.02	4174	139.9	1.5	...	...
12:31	1.5	15.56	8.89	4174	130.0	0.65	...	...
12:34	1.8	15.44	8.02	4174	139.0	0.54	...	...
12:37	2.1	15.44	7.97	4177	139.1	0.45	...	...
12:40	2.4	16.01	7.76	4175	153.3	0.33	...	...

e. Acceptance criteria pass/fail

Has required volume been removed

Has required turbidity been reached

Have parameters stabilized

If no or N/A - Explain below.

Yes ☐ No ☒ N/A ☒
 No turbidity. Hatch 2100 @ Malfunctioned & will not turn on.

SAMPLE COLLECTION:

Method: Bladder pump

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
ASH-02(MW-2)	See COC	16	See COC	CDPHE	13:15
ASH-02(MW-2)	See COC	5	See COC	CCR + Radium	13:15
DUP-2	See COC	5	See COC	CCR + Radium	

Comments

Collect Duplicate Sample labeled "DUP-2"

Signature

Wm Wainwright

Date

10/8/19

Ground Water Sample Collection Record

Client:	Platte River Power Authority		Date:	10.8.19
Project No:	60605002		Time: Start	14:20
Site Location:	Wellington Colorado		Finish	
Weather Conds:	65°F partly cloudy	Collector(s)	WW + GD	

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length c. Casing Material PVC e. Length of Water Column (a-b)
b. Water Table Depth 13.05 d. Casing Diameter 2" f. Calculated Well Volume (see back)

WELL PURGING DATA

a. Purge Method Low Flow

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ NA well volumes) Low Flow
- Maximum Allowable Turbidity 20-30 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used: Make YSI Model 556 Serial Number

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # Page #

Time	Volume Removed (gal) L	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
14:28	Initial	15.38	7.80	5624	154.0	5.56	—	Very Clear	
14:31	0.3	16.11	7.67	5644	146.3	2.20	—	" "	
14:34	0.6	16.20	7.61	5667	141.4	1.14	—	" "	
14:37	0.9	16.46	7.57	5648	137.8	0.56	—	" "	
14:40	1.2	16.51	7.56	5694	135.3	0.43	—	" "	
14:43	1.5	16.70	7.55	5705	132.7	0.36	—	" "	

Flow through in direct sun increasing temp

e. Acceptance criteria pass/fail
Has required volume been removed ☐ Yes ☐ No ☒ N/A
Has required turbidity been reached ☐ ☐ ☒
Have parameters stabilized ☒ ☐ ☐

If no or N/A - Explain below.

No Turbidity meter. Hach 2100 Q malfunctioned & will not turn on
Sample only visually clear water

SAMPLE COLLECTION:

Method: Bladder pump

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
ASH-04	see loc	16	see loc	CDPHE	15:30
ASH-04	see loc	5	see loc	CCR	15:30

Comments

Signature Wm Winst

Date 10/8/19

Ground Water Sample Collection Record

Client:	Platte River Power Authority	Date:	10.9.19
Project No:	60605002	Time: Start	08:10
Site Location:	Wellington Colorado	Finish	09:35
Weather Conds:	55°F partly cloudy Collector(s) <u>WW + GD</u>		

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length c. Casing Material PVC Well ☒ Piezometer ☐
 b. Water Table Depth 37.72 d. Casing Diameter 2" e. Length of Water Column (a-b)
 f. Calculated Well Volume (see back)

WELL PURGING DATA

a. Purge Method Low Flow

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ N/A well volumes) Low Flow
- Maximum Allowable Turbidity 20-30 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
<u>YSI</u>	<u>556</u>	
<u>Hach</u>	<u>2100 Q</u>	

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # Page #

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
8:19	Initial	12.37	6.20	5079	187.1	8.63	4.83	Clear	
8:22	0.6	12.19	6.49	5144	176.1	1.90	3.70	" "	
8:25	0.95	12.12	6.60	5134	173.7	0.96	4.23	" "	
8:28	1.3	12.03	6.69	5139	169.9	0.90	3.65	" "	
8:31	1.65	11.96	6.74	5136	166.6	0.77	4.14		
8:34	2.00	11.91	6.78	5136	164.3	0.73	3.67		

e. Acceptance criteria pass/fail

Has required volume been removed

Yes ☐No ☐N/A ☒

Has required turbidity been reached

☒☐☐

Have parameters stabilized

☒☐☐

If no or N/A - Explain below.

SAMPLE COLLECTION:

Method: Bladder pump.

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
ASH-03	<u>See COL</u>	<u>16</u>	<u>See COL</u>	<u>CDPHE</u>	<u>9:15</u>
ASH-03	<u>See COL</u>	<u>5</u>	<u>See COL</u>	<u>CCR + Radium</u>	<u>9:15</u>

Comments

Signature

Wm. Whitt

Date

10/9/19

Ground Water Sample Collection Record

Client: Platte River Power Authority
 Project No: 60605002
 Site Location: Wellington Colorado
 Weather Conds: 50°F Partly Cloudy Collector(s) WW + GD

Date: 10.9.19
 Time: Start 09:40
 Finish 11:05

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length —c. Casing Material PVCWell ☒Piezometer ☐e. Length of Water Column — (a-b)b. Water Table Depth 11.19d. Casing Diameter 2"f. Calculated Well Volume (see back) —

WELL PURGING DATA

a. Purge Method Low Flow

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ NA well volumes) Low Flow
- Maximum Allowable Turbidity 20-30 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
<u>Ysi</u>	<u>556</u>	<u>—</u>
<u>Hann</u>	<u>2100 Q</u>	<u>—</u>

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # — Page # —

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
9:47	Initial	12.15	7.06	4274	135.9	13.60	0.23	Clear	
9:50	0.55	11.74	6.99	4246	126.3	1.88	6.52	hazy	
9:53	0.95	11.72	7.00	4231	120.6	1.13	7.69	hazy	
9:56	1.35	11.71	7.12	4214	110.0	0.81	8.63	hazy	
9:59	1.75	11.72	7.03	4202	105.2	0.75	9.14	hazy	
10:02	2.15	11.70	7.07	4195	96.3	0.67	9.37	hazy	
10:05	2.55	11.66	7.00	4192	92.6	0.60	8.93	hazy	
10:08	2.95	11.67	7.04	4187	86.3	0.54	8.74	hazy	

e. Acceptance criteria pass/fail

Has required volume been removed

Yes ☐No ☐N/A ☒

Has required turbidity been reached

Yes ☒No ☐N/A ☐

Have parameters stabilized

Yes ☒No ☐N/A ☐

If no or N/A - Explain below.

SAMPLE COLLECTION:

Method: Bladder pump

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
ASH-08	See LOC	16	See LOC	CDPHE	10:45
ASH-08	See LOC	10	See LOC	CCR + Radium	10:45

MS/MSD

Comments

Collect MS/MSD For CLR @ ASH-08

Signature

Wm Winters

Date

10/9/19

Ground Water Sample Collection Record

Client:	Platte River Power Authority	Date:	10.9.19
Project No:	60605002	Time: Start	11:15
Site Location:	Wellington Colorado	Finish	12:40
Weather Conds:	55°F Partly Cloudy Collector(s) <u>WW + GD</u>		

WATER LEVEL DATA: (measured from Top of Casing)

Well ☒ Piezometer ☐

a. Total Well Length c. Casing Material PVC e. Length of Water Column (a-b)
 b. Water Table Depth d. Casing Diameter 2" f. Calculated Well Volume (see back)

WELL PURGING DATA

a. Purge Method Low Flow

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ NA well volumes) Low Flow
- Maximum Allowable Turbidity 20-30 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
<u>YSI</u>	<u>556</u>	<u> </u>
<u>Hach</u>	<u>2100 Q</u>	<u> </u>

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # Page #

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
11:22	Initial	15.29	7.03	5682	152.3	9.43	31.4	Clear	
11:25	0.25	14.97	6.99	5672	147.4	1.53	31.3	" "	
11:28	0.5	14.16	6.96	5662	143.4	0.94	30.0	" "	
11:31	0.75	14.10	7.03	5654	140.0	0.75	26.4	" "	
11:34	1.00	14.07	6.90	5654	140.1	0.64	24.5	" "	
11:37	1.25	14.17	6.96	5650	137.9	0.65	19.1	" "	
11:40	1.50	14.14	6.95	5653	136.4	0.57	16.2	" "	
11:43	1.75	14.20	6.94	5647	135.7	0.51	16.4	" "	
11:46	2.00	14.17	6.92	5656	135.9	0.44	14.3	" "	

e. Acceptance criteria pass/fail

Has required volume been removed

Has required turbidity been reached

Have parameters stabilized

If no or N/A - Explain below.

Yes

☒

No

☐

N/A

☒☐☐

SAMPLE COLLECTION:

Method: Bladder pump

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
ASH-07	<u>See COL</u>	<u>16</u>	<u>See COL</u>	<u>CDPHE</u>	<u>12:30</u>
ASH-07	<u>See COL</u>	<u>5</u>	<u>See COL</u>	<u>CCR + Radium</u>	<u>12:30</u>

Comments

Signature

Wm Wink

Date

10/9/2019

Ground Water Sample Collection Record

Client:	Platte River Power Authority	Date:	10.9.19
Project No:	60605002	Time: Start	12:50
Site Location:	Wellington Colorado	Finish	
Weather Conds:	65° partly sunny	Collector(s)	WW + GD

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length c. Casing Material PVC e. Length of Water Column (a-b)
 b. Water Table Depth 21.03 d. Casing Diameter 2" f. Calculated Well Volume (see back)

Well ☒ Piezometer ☐

WELL PURGING DATA

a. Purge Method Low Flow

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ NA well volumes) Low Flow
- Maximum Allowable Turbidity 20-30 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
YSI	556	
Hach	2100 Q	

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # Page #

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
12:53	Initial	14.99	7.44	4838	144.1	2.19	71000	lt brown	Cloudy
12:58	0.6	15.29	7.20	4774	142.6	0.74	740	"	Clearing
13:03	1.2	15.79	7.18	4670	139.9	0.53	196	"	Clearing up
13:08	1.5	16.41	7.10	4639	133.5	0.50	142	"	"
13:13	1.8	16.91	7.12	4629	132.6	0.55	94.9	"	"
13:18	2.1	17.02	7.11	4618	130.4	0.53	74.7	"	"
13:23	2.4	18.12	7.10	4577	128.2	0.47	59.0	"	"
13:28	2.7	19.44	7.05	4595	126.2	0.43	46.4	"	"
13:33	3.0	15.91	7.06	4593	125.6	0.53	58.8	"	"

e. Acceptance criteria pass/fail

Has required volume been removed ☐Has required turbidity been reached ☒Have parameters stabilized ☒

If no or N/A - Explain below.

Tapped bottom w/ pump, Flow through cell in sun, problems w/ when adjusting Flow Rate

Tapped bottom w/ pump.
Lower pressure
Flow through in sun
Flow through in direct sun
Flow Rate low
turn up pressure
Switch to 3 mins stability

SAMPLE COLLECTION:

Method: Bladder Pump

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
ASH-05	See LOC	16	See LOC	CDPHE	14:15
ASH-05	See LOC	5	See LOC	CCR + Radium	14:15

Comments Signature Wm WintDate 10/9/19

Time	Vol	Temp	pH	Cond	ORP	DO	Tur
13:36	3.3	15.07	7.08	4577	124.8	0.47	44.5
13:39	3.6	15.46	7.07	4575	124.4	0.47	31.2
13:42	3.9	15.59	7.07	4579	124.2	0.45	24.8

Ground Water Sample Collection Record

Client:	Platte River Power Authority		Date:	10.11.19
Project No:	60605002		Time: Start	08:05
Site Location:	Wellington Colorado		Finish	11:30
Weather Conds:	31°F Sunny	Collector(s)	WW + GD	

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length c. Casing Material PVC Well ☒ Piezometer ☐
 b. Water Table Depth 28.36 d. Casing Diameter 2" e. Length of Water Column (a-b)
 f. Calculated Well Volume (see back)

WELL PURGING DATA

a. Purge Method Low Flow

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ NA well volumes) Low Flow
 - Maximum Allowable Turbidity 20-30 NTUs
 - Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
<u>Y61</u>	<u>556</u>	<u> </u>
<u>Hach</u>	<u>2100</u>	<u> </u>

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # Page #

Time	Volume Removed (gal) L	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	DTW Other
8:36	Initial	9.00	5.57	3005	174.2	6.68	525	gray	28.57
8:41	0.9	9.27	6.12	3435	90.0	4.46	575	"	28.08
8:46	1.6	8.72	6.37	3355	73.8	2.96	352	"	28.72
8:51	2.2	8.82	6.57	3196	71.7	2.17	260	clearer	28.83
8:56	3.0	9.23	6.70	2965	74.1	1.69	233	"	28.84
9:01	3.6	8.92	6.79	2783	74.9	1.62	224	"	28.86
9:06	4.3	9.05	6.87	2584	77.1	1.73	249	"	28.87
9:11	5.0	8.96	6.95	2460	79.4	2.01	272	"	28.89
9:16	5.6	9.33	6.99	2330	82.5	2.24	251	"	28.89

e. Acceptance criteria pass/fail

Has required volume been removed

Yes ☐No ☐N/A ☒

Has required turbidity been reached

Yes ☐No ☒N/A ☐

Have parameters stabilized

Yes ☐No ☒N/A ☐

If no or N/A - Explain below.

WQ parameters fluctuating after one hour, turbidity > 100 NTU

SAMPLE COLLECTION:

Method: Bladder pump

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
BAT-12	See LOC	16	See LOC	CDPHE	10:30
DUP-3	See LOC	16	See LOC	CDPHE	
BAT-12	See LOC	10	See LOC	CCR + Radium	10:30

Duplicate For CDPHE
MS/MSD For CCR

Comments

Collect 2nd duplicate sample for CDPHE BAT wells
Collect MS/MSD For CCR

Signature

Wm Winn

Date

10/11/19

Time	Vol	Temp	pH	Cond	ORP	DO	TUR
9:21	6.2	9.57	7.04	2266	85.8	2.46	234
9:26	6.9	9.87	7.08	2215	88.4	2.66	163
9:31	7.5	10.00	7.11	2196	93.8	2.75	125
9:36	8.1	10.19	7.14	2160	96.6	2.85	110
9:41	8.7	10.57	7.17	2138	100.3	3.03	97.5

Ground Water Sample Collection Record

Client:	Platte River Power Authority		Date:	10.11.19
Project No:	60605002		Time: Start	11:40
Site Location:	Wellington Colorado		Finish	13:05
Weather Conds:	38°F Sun, Very Windy		Collector(s)	WW + GD

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length _____ c. Casing Material PVC e. Length of Water Column _____ (a-b)
 b. Water Table Depth 24.60 d. Casing Diameter 2" f. Calculated Well Volume (see back) _____

Well ☒ Piezometer ☐

WELL PURGING DATA

a. Purge Method Low Flow

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ NA well volumes) Low Flow
- Maximum Allowable Turbidity 20-30 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
<u>VSI</u>	<u>556</u>	
<u>Hach</u>	<u>2100 Q</u>	

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
11:51	Initial	10.95	7.60	1045	118.1	1.72	10.4	Clear	
11:54	0.5	11.03	7.39	1035	128.1	2.66	6.55	---	
11:57	0.9	11.11	7.52	1021	124.6	1.97	8.89	---	
12:00	1.3	11.19	7.46	1015	121.4	1.63	7.35	---	
12:03	1.7	11.24	7.43	1014	119.1	1.74	8.1	---	
12:06	2.1	11.34	7.42	1009	114.0	2.01	12.0	---	
12:09	2.5	11.34	7.45	1000	117.2	2.76	12.9	---	
12:12	2.9	11.34	7.52	995	117.4	3.35	15.9	---	
12:15	3.3	11.44	7.55	990	118.4	3.96	17.4	---	

e. Acceptance criteria pass/fail

Has required volume been removed

Has required turbidity been reached

Have parameters stabilized

If no or N/A - Explain below.

Yes

☐☒☒☒

No

☐☐☐☐

N/A

☒☐☐☐

SAMPLE COLLECTION:

Method: Bladder pump

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
BAT-11	<u>See LOC</u>	<u>10</u>	<u>See LOC</u>	<u>CDPHE</u>	<u>12:45</u>
BAT-11	<u>See LOC</u>	<u>5</u>	<u>See LOC</u>	<u>CCR + Radium</u>	<u>12:45</u>

Comments

Dissolved Oxygen increasing?

Signature

Wm Wint

Date

10/11/19

Ground Water Sample Collection Record

Client:	Platte River Power Authority	Date:	10.11.19
Project No:	60605002	Time: Start	13:10
Site Location:	Wellington Colorado	Finish	14:30
Weather Conds:	40°F Very Windy	Collector(s)	WW + GD

WATER LEVEL DATA: (measured from Top of Casing)

Well ☒Piezometer ☐

a. Total Well Length

c. Casing Material PVC

e. Length of Water Column _____ (a-b)

b. Water Table Depth

d. Casing Diameter 2"

f. Calculated Well Volume (see back) _____

WELL PURGING DATA

a. Purge Method

Low Flow

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ NA well volumes) Low Flow
- Maximum Allowable Turbidity 20-30 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make

Model

Serial Number

Y61556Flash2100 Q

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (us/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
13:29	Initial	11.56	7.70	4065	173.2	9.66	10.6	Clear	
13:32	0.5	11.86	7.64	4117	170.6	2.99	9.95	mm	
13:35	0.85	11.94	7.65	4146	167.1	1.49	10.9	mm	
13:38	1.2	11.93	7.62	4158	165.1	1.10	11.0	mm	
13:41	1.55	11.96	7.61	4160	162.0	0.67	13.1	mm	
13:44	1.9	11.92	7.59	4161	160.8	0.56	11.9	mm	

e. Acceptance criteria pass/fail

Yes

No

N/A

Has required volume been removed

☒☐☒

Has required turbidity been reached

☒☐☐

Have parameters stabilized

☒☐☐

If no or N/A - Explain below.

SAMPLE COLLECTION:

Method:

Bladder Pump

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
BAT-10	See LOC	16	See LOC	CDPHE	14:15
BAT-10	See LOC	5	See LOC	CCR + Radium	14:15

Comments

Signature

Wm Winters

Date

10/11/19

Ground Water Sample Collection Record

Client:	Platte River Power Authority	Date:	10.14.19
Project No:	60605002	Time: Start	11:35
Site Location:	Wellington Colorado	Finish	14:10
Weather Conds:	44°F Very Very Windy Collector(s) <u>WW + GD</u>		

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length c. Casing Material PVC e. Length of Water Column (a-b)
 b. Water Table Depth 8.66 d. Casing Diameter 2" f. Calculated Well Volume (see back)

WELL PURGING DATA

a. Purge Method Low Flow

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ NA well volumes) Low Flow
- Maximum Allowable Turbidity 20-30 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
<u>KSI</u>	<u>556</u>	
<u>Hach</u>	<u>2100 Q</u>	

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # Page #

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	DTW Other
11:46	Initial	15.89	6.94	4296	144.9	7.32	71.7	H gray	8.96
11:49	0.2	15.25	6.99	4277	137.3	7.26	78.5	"	9.28
11:52	0.4	15.17	7.01	4271	132.3	1.03	85.6	"	4.60
11:55	0.65	15.35	7.00	4261	129.2	0.75	101.0	"	4.87
11:58	0.9	15.33	7.02	4277	135.4	0.74	40.0	"	10.11
12:01	1.5	15.33	6.72	4265	133.9	0.61	74.5	"	10.40
12:04	1.40	15.44	6.93	4259	129.8	0.52	77.1	"	10.53
12:07	1.65	15.32	6.95	4261	127.0	0.47	59.1	"	10.74
12:10	1.90	15.35	6.96	4252	124.3	0.41	54.5	"	10.92

e. Acceptance criteria pass/fail

Has required volume been removed

Has required turbidity been reached

Have parameters stabilized

If no or N/A - Explain below.

Yes

No

N/A

☐☐☒☐☒☐☒☐☐Sample due to rapid drawdown of well, avoid pumping dry

SAMPLE COLLECTION:

Method: Bladder pump

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
BAT-3	See Col	16	See Col	CDPHE	13:15
BAT-3	See Col	5	See Col	CER + Radium	13:15

Comments

Signature Wm WintDate 10/14/19

12:13 2.15 15.56 6.95 4253 122.0 0.37 443 " 11.10

Ground Water Sample Collection Record

Client:	Platte River Power Authority	Date:	10.14.19
Project No:	60605002	Time: Start	08:10
Site Location:	Wellington Colorado	Finish	11:30
Weather Conds:	44°F Sunny Collector(s) <u>WW + GD</u>		

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length c. Casing Material PVC e. Length of Water Column (a-b)
 b. Water Table Depth 12.68 d. Casing Diameter 2" f. Calculated Well Volume (see back)

WELL PURGING DATA

a. Purge Method Low Flow

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ NA well volumes) Low Flow
- Maximum Allowable Turbidity 20-30 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
<u>YSI</u>	<u>556</u>	<u> </u>
<u>Hach</u>	<u>2100 Q</u>	<u> </u>

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # Page #

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Drw Other
6:25	Initial	13.13	6.16	3109	143.4	11.43	191		12.90
8:30	0.6	13.51	6.41	3178	145.2	11.43	158	Cloudy	
8:35	1.25	13.56	6.66	3210	141.0	6.81	72.9	Clear	13.07
8:40	1.90	13.54	6.71	3232	134.5	0.54	52.0	" "	13.14
8:45	2.50	13.80	6.88	3235	129.6	0.45	41.3	" "	13.15
8:50	3.10	13.69	6.84	3246	124.6	0.40	34.2	" "	13.20
8:55	3.70	13.70	6.83	3245	126.3	0.35	31.1	" "	13.21
9:00	4.3	13.78	6.89	3248	122.8	0.32	29.8	" "	13.22

e. Acceptance criteria pass/fail

Has required volume been removed

Yes ☐

No ☐

N/A ☒

Has required turbidity been reached

☒

☐

☐

Have parameters stabilized

☒

☐

☐

If no or N/A - Explain below.

SAMPLE COLLECTION:

Method: Low Flow Bladder pump

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
BAT-04R	See LOC	32	See LOC	CDPHE	10:15
BAT-04R	See LOC	5	See LOC	CCR + Rad	10:15
DUP-4	See LOC	5	See LOC	CCR + Rad	

MS/MSD
DUP 4

Comments

Collect CDPHE MS/MSD, Collect Duplicate Sample for CCR labeled "DUP-4"

Signature

Wm Wund

Date

10/14/19

Ground Water Sample Collection Record

Client:	Platte River Power Authority	Date:	10.15.19
Project No:	60605002	Time: Start	08:10
Site Location:	Wellington Colorado	Finish	9:45
Weather Conds:	36° F Sunny	Collector(s)	WW & GD

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length c. Casing Material PVC e. Length of Water Column (a-b)
 b. Water Table Depth 17.15 d. Casing Diameter 2" f. Calculated Well Volume (see back)

WELL PURGING DATA

a. Purge Method Low Flow

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ N/A well volumes) Low Flow
- Maximum Allowable Turbidity 20-30 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
VSI	556	
Hach	2100 Q	

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # Page #

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
08:20	Initial	10.42	5.82	3519	109.8	9.76	21.7	Clear	
08:23	0.7	11.05	6.36	3527	61.6	3.42	16.7	"	
08:26	1.2	10.94	6.54	3546	37.7	1.63	13.7	"	
08:29	1.7	10.91	6.75	3544	19.7	0.84	9.96	"	
08:32	2.05	10.82	6.74	3546	9.4	0.64	6.35	"	
08:35	2.40	10.81	6.94	3543	2.1	0.53	4.49	"	
08:38	2.85	10.79	6.47	3543	-4.4	0.47	4.45	"	
8:41	3.30	10.81	7.04	3539	-11.4	0.42	3.60	"	
8:44	3.75	10.81	7.04	3540	-16.4	0.38	2.8	"	

e. Acceptance criteria pass/fail

Has required volume been removed

Yes

No

N/A

Has required turbidity been reached

Have parameters stabilized

If no or N/A - Explain below.

ORP Very Low?

SAMPLE COLLECTION:

Method: Bladder pump

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
BAT-09	See CCL	16	See CCL	C DPHE	9:30
BAT-09	See CCL	5	See CCL	C CR + Rad	9:30

Comments

Signature Wm WunstDate 10.15.19

Ground Water Sample Collection Record

Client:	Platte River Power Authority		Date:	10.15.19
Project No:	60605002		Time: Start	09:50
Site Location:	Wellington Colorado		Finish	12:00
Weather Conds:	40°F Sunny	Collector(s)	WW & GD	

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length c. Casing Material PVC Well ☒ Piezometer ☐
 b. Water Table Depth 10.08 d. Casing Diameter 2" e. Length of Water Column (a-b)
 f. Calculated Well Volume (see back)

WELL PURGING DATA

a. Purge Method Low Flow

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ N/A well volumes) Low Flow
- Maximum Allowable Turbidity 20-30 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
<u>YSI</u>	<u>556</u>	<u> </u>
<u>Hach</u>	<u>2100 Q</u>	<u> </u>

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # Page #

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	Other
10:11	Initial	13.56	7.80	1836	81.2	6.66	46.4	clear	11.40
10:14	0.3	13.50	7.77	1795	60.7	4.66	47.9	clear	11.45
10:17	0.6	13.24	7.72	1778	43.2	3.88	45.8	1.1	11.92
10:20	0.9	13.33	7.78	1766	26.6	3.30	45.6	1.2	12.4
10:23	1.2	13.31	7.78	1754	6.1	2.74	39.9	1.2	12.75
10:26	1.5	13.31	7.78	1757	-2.6	2.52	36.6	1.2	13.10
10:29	1.8	13.32	7.80	1757	-16.5	2.13	32.3	1.1	13.52

e. Acceptance criteria pass/fail

Has required volume been removed

Yes ☐No ☐N/A ☒

Has required turbidity been reached

☒☐☐

Have parameters stabilized

☐☒☐

If no or N/A - Explain below.

ORP still dropping. Collect sample because of drawdown

SAMPLE COLLECTION:

Method: Bladder pump

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
BAT-09	see COL	16	see COL	CDPHE	11:15
BAT-09	see COL	5	see COL	CCR + Radium	11:15

Comments Signature Wm WmDate 10/15/19

Ground Water Sample Collection Record

Client:	Platte River Power Authority	Date:	10.15.19
Project No:	60605002	Time: Start	12:05
Site Location:	Wellington Colorado	Finish	
Weather Conds:	40°F Sunny	Collector(s)	WW + GD

WATER LEVEL DATA: (measured from Top of Casing)

- a. Total Well Length c. Casing Material PVC Well ☒ Piezometer ☐
- b. Water Table Depth 15.01 d. Casing Diameter 2" e. Length of Water Column (a-b)
- f. Calculated Well Volume (see back)

WELL PURGING DATA

- a. Purge Method
- Low Flow

- b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ NA well volumes) Low Flow
- Maximum Allowable Turbidity 20-30 NTUs
- Stabilization of parameters 10 %

- c. Field Testing Equipment Used:

Make	Model	Serial Number
YSI	556	
Flow	2100 Q	

- d. Field Testing Equipment Calibration Documentation Found in Field Notebook #
-
- Page #
-

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	DTW Other
12:10	Initial	13.42	8.08	3219	19.1	21.22	11.5	Clear	15.29
12:13	0.3	13.06	7.94	3220	-12.2	3.19	11.4	Clear	15.73
12:16	0.6	12.96	7.74	3214	-26.3	1.68	11.6	"	16.19
12:19	0.9	12.94	7.62	3216	-33.7	1.00	11.5	"	16.53
12:22	1.2	12.97	7.55	3211	-35.9	0.45	11.9	"	16.96
12:25	1.5	13.05	7.86	3209	-42.4	0.64	10.0	"	17.36

- e. Acceptance criteria pass/fail

Has required volume been removed

Yes

☒

No

☐

N/A

☒

Has required turbidity been reached

☐☒☐

Have parameters stabilized

☐☒☐

If no or N/A - Explain below.

Well rapidly drawing down, begin collecting sample early

SAMPLE COLLECTION:

Method:

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
BAT-06	See LOC	16	See LOC	CDPHE	13:15
BAT-06	See LOC	5	See LOC	CCR + Radium	13:15

Comments Signature Wm WmDate 10/15/19

Ground Water Sample Collection Record

Client:	Platte River Power Authority	Date:	10.16.19
Project No:	60605002	Time: Start	10:25
Site Location:	Wellington Colorado	Finish	
Weather Conds:	39°F Cloudy	Collector(s)	WW + GD

WATER LEVEL DATA: (measured from Top of Casing)

Well ☒ Piezometer ☐

- a. Total Well Length — c. Casing Material PVC e. Length of Water Column — (a-b)
- b. Water Table Depth 10.67 d. Casing Diameter 2" f. Calculated Well Volume (see back) —

WELL PURGING DATA

a. Purge Method Low Flow

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ NA well volumes) Low Flow
- Maximum Allowable Turbidity 20-30 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
YSI	556	
Hach	2100 Q	

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # — Page # —

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	DSW Other
10:34	Initial	14.86	7.46	23.59	80.1	15.90	8.12	Clear	11.09
10:37	0.35	14.51	7.45	24.45	54.8	2.92	7.66	"	11.29
10:40	0.7	14.42	7.43	24.65	37.1	3.01	19.7	"	11.44
10:43	0.9	14.38	7.54	24.65	34.6	1.70	8.65	"	11.55
10:46	1.1	14.25	7.43	24.73	14.6	1.68	10.0	"	11.61
10:49	1.4	14.09	6.95	24.64	24.9	2.07	5.48	"	
10:52	1.7	13.76	7.51	25.04	23.1	2.02	5.56	"	
10:55	2.05	13.74	7.41	25.32	21.2	2.11	5.30	"	
10:58	2.35	13.51	7.54	25.60	9.2	1.96	4.52	"	

e. Acceptance criteria pass/fail

- Has required volume been removed ☐
- Has required turbidity been reached ☒
- Have parameters stabilized ☒
- If no or N/A - Explain below.

SAMPLE COLLECTION:

Method: Bladder Pump

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
BAT-02	see col	16	see col	CDPHE	11:45
BAT-02	see col	5	see col	CLR + Pnd	9:00

Comments

Collect CDPHE Sample Only

Signature

Wm Wint

Date

10/16/19

11:01 265 13.92 7.40 2586 -1.7 1.65 3.79 ...

sample CCR on 10/17

Ground Water Sample Collection Record

Client:	Platte River Power Authority	Date:	10.16.19
Project No:	60605002	Time: Start	8:05
Site Location:	Wellington Colorado	Finish	10:20
Weather Conds:	40°F partly cloudy Collector(s) WW + GD		

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length	c. Casing Material <u>PVC</u>	Well <input checked="" type="checkbox"/> Piezometer <input type="checkbox"/>
b. Water Table Depth <u>9.44</u>	d. Casing Diameter <u>2"</u>	e. Length of Water Column _____ (a-b)
		f. Calculated Well Volume (see back) _____

WELL PURGING DATA

 a. Purge Method Low Flow

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ <u>NA</u> well volumes)	<u>Low Flow</u>
- Maximum Allowable Turbidity <u>20.30</u> NTUs	
- Stabilization of parameters <u>10</u> %	

c. Field Testing Equipment Used:

Make	Model	Serial Number
<u>YSI</u>	<u>556</u>	
<u>Haem</u>	<u>2100 Q</u>	

d. Field Testing Equipment Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C)	pH	Spec. Cond (µs/cm)	ORP	DO mg/L	Turbidity (NTU)	Color	DTW Other
8:17	Initial	13.43	6.11	1687	132.0	14.99	15.6	Clear	9.81
8:20	0.7	12.98	6.48	1676	102.7	5.85	6.66	"	10.52
8:23	1.0	12.94	6.72	1670	84.9	2.79	5.39	"	10.74
8:26	1.2	12.85	6.87	1668	69.7	2.77	4.53	"	11.00
8:29	1.45	12.80	6.99	1667	56.8	2.74	5.18	"	11.34
8:32	1.75	12.74	7.06	1668	48.4	2.76	4.94	"	11.61

e. Acceptance criteria pass/fail

Has required volume been removed	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Has required turbidity been reached	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Have parameters stabilized	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

If no or N/A - Explain below.

Well Rapidly drawing down. Collect Sample early.
SAMPLE COLLECTION:

 Method: Bladder Pump

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
BAT-01	See COC	16	See COC	CDPHE	9:15
BAT-01	See COC	5	See COC	CCR + Rad	8:30

Comments

Well Went dry before collecting CCR sample, Collect CDPHE only

Signature

Wm Wrinch

Date

10.16.19
Collect CCR on 10/17/2019

Ground Water Sample Collection Record

Client:	Platte River Power Authority	Date:	10.16.19
Project No:	60605002	Time: Start	12:20
Site Location:	Wellington Colorado	Finish	13:50
Weather Conds:	60°F Cloudy Collector(s) WJW & GD		

WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length c. Casing Material PVC Well ☒ Piezometer ☐
 b. Water Table Depth 11.15 d. Casing Diameter 2" e. Length of Water Column (a-b)
 f. Calculated Well Volume (see back)

WELL PURGING DATA

 a. Purge Method Low Flow

b. Acceptance Criteria defined (from workplan)

- Minimum Required Purge Volume (@ NA well volumes) Low Flow
- Maximum Allowable Turbidity 20-30 NTUs
- Stabilization of parameters 10 %

c. Field Testing Equipment Used:

Make	Model	Serial Number
YSI	556	
flach	2100 Q	

 d. Field Testing Equipment Calibration Documentation Found in Field Notebook # Page #

Time	Volume Removed (gal) L	T° (C)	pH	Spec. Cond (µs/cm)	DRP	DO mg/L	Turbidity (NTU)	Color	DTW Other
12:31	Initial	14.95	7.28	4154	13.7	5.88	29.1	clear	11.52
12:34	0.3	14.55	6.63	4212	19.6	2.16	37.1	"	11.78
12:37	0.6	14.41	7.24	4229	2.0	2.24	37.3	"	11.90
12:40	0.9	14.31	7.24	4236	-4.5	1.36	41.2	"	12.03
12:43	1.2	14.31	7.25	4242	-7.3	1.28	36.4	"	
12:46	1.5	14.33	7.24	4239	-5.3	1.26	38.1	"	
12:49	1.8	14.33	7.23	4239	-6.6	1.06	37.4	"	

e. Acceptance criteria pass/fail

- | | | | |
|-------------------------------------|-------------------------------------|-----------------------------|---|
| Has required volume been removed | Yes <input type="checkbox"/> | No <input type="checkbox"/> | N/A <input checked="" type="checkbox"/> |
| Has required turbidity been reached | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Have parameters stabilized | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

If no or N/A - Explain below

BAT-05 is typically turbid sample if below 50 NTU

SAMPLE COLLECTION:

 Method: Bladder pump

Sample ID	Container Type	No. of Containers	Preservation	Analysis	Time
BAT-05	See Col	16	See Col	CDPHE	13:45
BAT-05	See Col	5	See Col	CCR & Rad	9:30

Comments

Sample for CDPHE only, skip CCR Sample

Signature

Wm Wint

Date

10/16/19

collect CCR on 10/17/19

10/16

10/17

Appendix D

Laboratory Analytical and Data Validation Reports

February 13, 2019

Geoff Webb
AECOM
6200 South Quebec St
Greenwood Village, CO 80111

RE: Project: PRPA RAWHIDE GW
Pace Project No.: 60292862

Dear Geoff Webb:

Enclosed are the analytical results for sample(s) received by the laboratory on January 26, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Heather Wilson
heather.wilson@pacelabs.com
1(913)563-1407
Project Manager

Enclosures

cc: Brian Rothmeyer, AECOM



REPORT OF LABORATORY ANALYSIS

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CERTIFICATIONS

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Kansas Certification IDs

9608 Loiret Boulevard, Lenexa, KS 66219

Missouri Certification Number: 10090

Arkansas Drinking Water

WY STR Certification #: 2456.01

Arkansas Certification #: 18-016-0

Arkansas Drinking Water

Illinois Certification #: 004455

Iowa Certification #: 118

Kansas/NELAP Certification #: E-10116 / E10426

Louisiana Certification #: 03055

Nevada Certification #: KS000212018-1

Oklahoma Certification #: 9205/9935

Texas Certification #: T104704407-18-11

Utah Certification #: KS000212018-8

Kansas Field Laboratory Accreditation: # E-92587

Missouri Certification: 10070

Missouri Certification Number: 10090

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SAMPLE SUMMARY

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60292862001	ASH-06	Water	01/24/19 10:05	01/26/19 09:20
60292862002	PRS-3	Water	01/24/19 10:55	01/26/19 09:20
60292862003	BAT-11	Water	01/24/19 11:35	01/26/19 09:20
60292862004	PRS-2	Water	01/24/19 13:10	01/26/19 09:20
60292862005	ASH-7	Water	01/24/19 14:05	01/26/19 09:20
60292862006	DUP-1	Water	01/24/19 08:00	01/26/19 09:20
60292862007	BAT-12	Water	01/24/19 15:20	01/26/19 09:20
60292862008	BAT-10	Water	01/24/19 16:10	01/26/19 09:20
60292862009	ERB-1	Water	01/24/19 17:25	01/26/19 09:20
60292862010	PZ-5	Water	01/25/19 08:45	01/26/19 09:20
60292862011	PZ-4	Water	01/25/19 09:50	01/26/19 09:20
60292862012	PZ-3	Water	01/25/19 10:55	01/26/19 09:20
60292862013	PZ-2	Water	01/25/19 12:15	01/26/19 09:20
60292862014	PZ-6	Water	01/25/19 13:35	01/26/19 09:20
60292862015	PZ-1	Water	01/25/19 14:35	01/26/19 09:20

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SAMPLE ANALYTE COUNT

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60292862001	ASH-06	EPA 6010	EMR	6	PASI-K
		EPA 6020	CTR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2320B	MJK	4	PASI-K
		SM 2540C	JES	1	PASI-K
		EPA 9040	MJK	1	PASI-K
		EPA 9056	MGS	3	PASI-K
60292862002	PRS-3	EPA 6010	EMR	6	PASI-K
		EPA 6020	CTR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2320B	MJK	4	PASI-K
		SM 2540C	JES	1	PASI-K
		EPA 9040	MJK	1	PASI-K
		EPA 9056	MGS	3	PASI-K
60292862003	BAT-11	EPA 6010	EMR	6	PASI-K
		EPA 6020	CTR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2320B	MJK	4	PASI-K
		SM 2540C	JES	1	PASI-K
		EPA 9040	MJK	1	PASI-K
		EPA 9056	MGS	3	PASI-K
60292862004	PRS-2	EPA 6010	EMR	6	PASI-K
		EPA 6020	CTR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2320B	MJK	4	PASI-K
		SM 2540C	JES	1	PASI-K
		EPA 9040	MJK	1	PASI-K
		EPA 9056	MGS, WNM	3	PASI-K
60292862005	ASH-7	EPA 6010	EMR	6	PASI-K
		EPA 6020	CTR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2320B	MJK	4	PASI-K
		SM 2540C	JES	1	PASI-K
		EPA 9040	MJK	1	PASI-K
		EPA 9056	MGS	3	PASI-K
60292862006	DUP-1	EPA 6010	EMR	6	PASI-K
		EPA 6020	CTR	11	PASI-K

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SAMPLE ANALYTE COUNT

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60292862007	BAT-12	EPA 7470	HKC	1	PASI-K
		SM 2320B	MJK	4	PASI-K
		SM 2540C	JES	1	PASI-K
		EPA 9040	MJK	1	PASI-K
		EPA 9056	MGS	3	PASI-K
		EPA 6010	EMR	6	PASI-K
		EPA 6020	CTR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2320B	MJK	4	PASI-K
		SM 2540C	JES	1	PASI-K
		EPA 9040	MJK	1	PASI-K
		EPA 9056	MGS	3	PASI-K
60292862008	BAT-10	EPA 6010	EMR	6	PASI-K
		EPA 6020	CTR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2320B	MJK	4	PASI-K
		SM 2540C	JES	1	PASI-K
		EPA 9040	MJK	1	PASI-K
		EPA 9056	MGS	3	PASI-K
		EPA 6010	EMR	6	PASI-K
		EPA 6020	CTR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2320B	MJK	4	PASI-K
		SM 2540C	JES	1	PASI-K
60292862009	ERB-1	EPA 9040	MJK	1	PASI-K
		EPA 9056	MGS	3	PASI-K
		EPA 6010	EMR	6	PASI-K
		EPA 6020	CTR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2320B	MJK	4	PASI-K
		SM 2540C	JES	1	PASI-K
		EPA 9040	MJK	1	PASI-K
		EPA 9056	MGS	3	PASI-K
		EPA 6010	EMR	6	PASI-K
		EPA 6020	CTR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
60292862010	PZ-5	SM 2320B	MJK	4	PASI-K
		SM 2540C	JES	1	PASI-K
		EPA 9040	MJK	1	PASI-K
		EPA 9056	MGS	3	PASI-K
		EPA 6010	EMR	6	PASI-K
		EPA 6020	CTR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2320B	MJK	4	PASI-K
		SM 2540C	JES	1	PASI-K
		EPA 9040	MJK	1	PASI-K
		EPA 9056	MGS	3	PASI-K
		EPA 6010	EMR	6	PASI-K
60292862011	PZ-4	EPA 6020	CTR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2320B	MJK	4	PASI-K
		SM 2540C	JES	1	PASI-K

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SAMPLE ANALYTE COUNT

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60292862012	PZ-3	SM 2540C	JES	1	PASI-K
		EPA 9040	MJK	1	PASI-K
		EPA 9056	MGS	3	PASI-K
		EPA 6010	EMR	6	PASI-K
		EPA 6020	CTR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2320B	MJK	4	PASI-K
		SM 2540C	JES	1	PASI-K
60292862013	PZ-2	EPA 9040	MJK	1	PASI-K
		EPA 9056	MGS	3	PASI-K
		EPA 6010	EMR	6	PASI-K
		EPA 6020	CTR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2320B	MJK	4	PASI-K
		SM 2540C	JES	1	PASI-K
		EPA 9040	MJK	1	PASI-K
60292862014	PZ-6	EPA 9056	MGS	3	PASI-K
		EPA 6010	EMR	6	PASI-K
		EPA 6020	CTR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2320B	MJK	4	PASI-K
		SM 2540C	JES	1	PASI-K
		EPA 9040	MJK	1	PASI-K
		EPA 9056	MGS	3	PASI-K
60292862015	PZ-1	EPA 6010	EMR	6	PASI-K
		EPA 6020	CTR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2320B	MJK	4	PASI-K
		SM 2540C	JES	1	PASI-K
		EPA 9040	MJK	1	PASI-K
		EPA 9056	MGS	3	PASI-K

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Sample: ASH-06		Lab ID: 60292862001		Collected: 01/24/19 10:05		Received: 01/26/19 09:20		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	288	ug/L	100	1	02/08/19 12:06	02/11/19 10:22	7440-42-8		
Calcium	27500	ug/L	200	1	02/08/19 12:06	02/11/19 10:22	7440-70-2		
Lithium	89.5	ug/L	10.0	1	02/08/19 12:06	02/11/19 10:22	7439-93-2		
Magnesium	7260	ug/L	50.0	1	02/08/19 12:06	02/11/19 10:22	7439-95-4		
Potassium	31000	ug/L	500	1	02/08/19 12:06	02/11/19 10:22	7440-09-7		
Sodium	126000	ug/L	500	1	02/08/19 12:06	02/11/19 10:22	7440-23-5		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:19	7440-36-0		
Arsenic	1.3	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:19	7440-38-2		
Barium	72.2	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:19	7440-39-3		
Beryllium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:19	7440-41-7		
Cadmium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:19	7440-43-9		
Chromium	42.2	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:19	7440-47-3		
Cobalt	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:19	7440-48-4		
Lead	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:19	7439-92-1		
Molybdenum	41.0	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:19	7439-98-7		
Selenium	20.6	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:19	7782-49-2		
Thallium	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:19	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	02/06/19 14:30	02/07/19 10:20	7439-97-6		
2320B Alkalinity		Analytical Method: SM 2320B							
Alkalinity,Bicarbonate (CaCO3)	254	mg/L	20.0	1		02/05/19 12:01			
Alkalinity,Carbonate (CaCO3)	ND	mg/L	20.0	1		02/05/19 12:01			
Alkalinity, Hydroxide (CaCO3)	ND	mg/L	20.0	1		02/05/19 12:01			
Alkalinity, Total as CaCO3	273	mg/L	20.0	1		02/05/19 12:01			
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	487	mg/L	5.0	1		01/28/19 13:00			
9040 pH		Analytical Method: EPA 9040							
pH	8.4	Std. Units	0.10	1		02/06/19 10:51		H6	
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	7.8	mg/L	1.0	1		02/08/19 19:05	16887-00-6		
Fluoride	0.84	mg/L	0.20	1		02/08/19 19:05	16984-48-8		
Sulfate	104	mg/L	50.0	50		02/08/19 19:57	14808-79-8		

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Sample: PRS-3		Lab ID: 60292862002		Collected: 01/24/19 10:55		Received: 01/26/19 09:20		Matrix: Water	
Parameters		Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	495	ug/L	100	1	02/08/19 12:06	02/11/19 10:25	7440-42-8		
Calcium	60100	ug/L	200	1	02/08/19 12:06	02/11/19 10:25	7440-70-2		
Lithium	115	ug/L	10.0	1	02/08/19 12:06	02/11/19 10:25	7439-93-2		
Magnesium	23000	ug/L	50.0	1	02/08/19 12:06	02/11/19 10:25	7439-95-4		
Potassium	9480	ug/L	500	1	02/08/19 12:06	02/11/19 10:25	7440-09-7		
Sodium	187000	ug/L	500	1	02/08/19 12:06	02/11/19 10:25	7440-23-5		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:25	7440-36-0		
Arsenic	1.5	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:25	7440-38-2		
Barium	113	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:25	7440-39-3		
Beryllium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:25	7440-41-7		
Cadmium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:25	7440-43-9		
Chromium	3.3	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:25	7440-47-3		
Cobalt	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:25	7440-48-4		
Lead	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:25	7439-92-1		
Molybdenum	31.8	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:25	7439-98-7		
Selenium	63.3	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:25	7782-49-2		
Thallium	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:25	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	02/06/19 14:30	02/07/19 10:23	7439-97-6		
2320B Alkalinity		Analytical Method: SM 2320B							
Alkalinity,Bicarbonate (CaCO3)	501	mg/L	20.0	1		02/05/19 12:13			
Alkalinity,Carbonate (CaCO3)	ND	mg/L	20.0	1		02/05/19 12:13			
Alkalinity, Hydroxide (CaCO3)	ND	mg/L	20.0	1		02/05/19 12:13			
Alkalinity, Total as CaCO3	501	mg/L	20.0	1		02/05/19 12:13			
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	712	mg/L	5.0	1		01/28/19 13:00			
9040 pH		Analytical Method: EPA 9040							
pH	7.7	Std. Units	0.10	1		02/06/19 10:54			H6
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	5.7	mg/L	1.0	1		02/11/19 11:29	16887-00-6		
Fluoride	0.33	mg/L	0.20	1		02/11/19 11:29	16984-48-8		
Sulfate	123	mg/L	10.0	10		02/12/19 09:57	14808-79-8		

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Sample: BAT-11		Lab ID: 60292862003		Collected: 01/24/19 11:35		Received: 01/26/19 09:20		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	366	ug/L	100	1	02/08/19 12:06	02/11/19 10:27	7440-42-8		
Calcium	71000	ug/L	200	1	02/08/19 12:06	02/11/19 10:27	7440-70-2		
Lithium	76.2	ug/L	10.0	1	02/08/19 12:06	02/11/19 10:27	7439-93-2		
Magnesium	19400	ug/L	50.0	1	02/08/19 12:06	02/11/19 10:27	7439-95-4		
Potassium	13500	ug/L	500	1	02/08/19 12:06	02/11/19 10:27	7440-09-7		
Sodium	124000	ug/L	500	1	02/08/19 12:06	02/11/19 10:27	7440-23-5		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	1.7	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:27	7440-36-0		
Arsenic	2.1	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:27	7440-38-2		
Barium	140	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:27	7440-39-3		
Beryllium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:27	7440-41-7		
Cadmium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:27	7440-43-9		
Chromium	24.9	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:27	7440-47-3		
Cobalt	1.2	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:27	7440-48-4		
Lead	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:27	7439-92-1		
Molybdenum	54.7	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:27	7439-98-7		
Selenium	7.2	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:27	7782-49-2		
Thallium	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:27	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	02/06/19 14:30	02/07/19 10:25	7439-97-6		
2320B Alkalinity		Analytical Method: SM 2320B							
Alkalinity,Bicarbonate (CaCO3)	330	mg/L	20.0	1		02/05/19 12:17			
Alkalinity,Carbonate (CaCO3)	ND	mg/L	20.0	1		02/05/19 12:17			
Alkalinity, Hydroxide (CaCO3)	ND	mg/L	20.0	1		02/05/19 12:17			
Alkalinity, Total as CaCO3	330	mg/L	20.0	1		02/05/19 12:17			
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	637	mg/L	5.0	1		01/28/19 13:00			
9040 pH		Analytical Method: EPA 9040							
pH	7.8	Std. Units	0.10	1		02/06/19 10:58		H6	
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	7.5	mg/L	1.0	1		02/11/19 11:59	16887-00-6		
Fluoride	0.26	mg/L	0.20	1		02/11/19 11:59	16984-48-8		
Sulfate	209	mg/L	20.0	20		02/12/19 10:09	14808-79-8		

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Sample: PRS-2		Lab ID: 60292862004		Collected: 01/24/19 13:10		Received: 01/26/19 09:20		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	1080	ug/L	100	1	02/08/19 12:06	02/11/19 10:29	7440-42-8		
Calcium	443000	ug/L	200	1	02/08/19 12:06	02/11/19 10:29	7440-70-2		
Lithium	435	ug/L	10.0	1	02/08/19 12:06	02/11/19 10:29	7439-93-2		
Magnesium	386000	ug/L	50.0	1	02/08/19 12:06	02/11/19 10:29	7439-95-4		
Potassium	30700	ug/L	500	1	02/08/19 12:06	02/11/19 10:29	7440-09-7		
Sodium	1030000	ug/L	5000	10	02/08/19 12:06	02/11/19 10:32	7440-23-5		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:29	7440-36-0		
Arsenic	3.1	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:29	7440-38-2		
Barium	95.5	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:29	7440-39-3		
Beryllium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:29	7440-41-7		
Cadmium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:29	7440-43-9		
Chromium	11.5	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:29	7440-47-3		
Cobalt	9.3	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:29	7440-48-4		
Lead	7.2	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:29	7439-92-1		
Molybdenum	3.8	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:29	7439-98-7		
Selenium	49.5	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:29	7782-49-2		
Thallium	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:29	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	02/06/19 14:30	02/07/19 10:32	7439-97-6		
2320B Alkalinity		Analytical Method: SM 2320B							
Alkalinity,Bicarbonate (CaCO3)	500	mg/L	20.0	1		02/05/19 12:24			
Alkalinity,Carbonate (CaCO3)	ND	mg/L	20.0	1		02/05/19 12:24			
Alkalinity, Hydroxide (CaCO3)	ND	mg/L	20.0	1		02/05/19 12:24			
Alkalinity, Total as CaCO3	500	mg/L	20.0	1		02/05/19 12:24			
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	6630	mg/L	5.0	1		01/28/19 13:00			
9040 pH		Analytical Method: EPA 9040							
pH	7.4	Std. Units	0.10	1		02/06/19 11:01		H6	
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	32.3	mg/L	5.0	5		02/12/19 10:22	16887-00-6		
Fluoride	ND	mg/L	0.20	1		02/11/19 12:30	16984-48-8		
Sulfate	4230	mg/L	500	500		02/12/19 17:18	14808-79-8		

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Sample: ASH-7		Lab ID: 60292862005		Collected: 01/24/19 14:05		Received: 01/26/19 09:20		Matrix: Water	
Parameters		Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	689	ug/L	100	1	02/08/19 12:06	02/11/19 10:34	7440-42-8		
Calcium	448000	ug/L	200	1	02/08/19 12:06	02/11/19 10:34	7440-70-2		
Lithium	562	ug/L	10.0	1	02/08/19 12:06	02/11/19 10:34	7439-93-2		
Magnesium	297000	ug/L	50.0	1	02/08/19 12:06	02/11/19 10:34	7439-95-4		
Potassium	18600	ug/L	500	1	02/08/19 12:06	02/11/19 10:34	7440-09-7		
Sodium	932000	ug/L	5000	10	02/08/19 12:06	02/11/19 11:29	7440-23-5		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:31	7440-36-0		
Arsenic	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:31	7440-38-2		
Barium	28.0	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:31	7440-39-3		
Beryllium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:31	7440-41-7		
Cadmium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:31	7440-43-9		
Chromium	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:31	7440-47-3		
Cobalt	3.1	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:31	7440-48-4		
Lead	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:31	7439-92-1		
Molybdenum	4.5	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:31	7439-98-7		
Selenium	91.9	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:31	7782-49-2		
Thallium	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:31	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	02/06/19 14:30	02/07/19 10:34	7439-97-6		
2320B Alkalinity		Analytical Method: SM 2320B							
Alkalinity,Bicarbonate (CaCO3)	431	mg/L	20.0	1		02/05/19 12:30			
Alkalinity,Carbonate (CaCO3)	ND	mg/L	20.0	1		02/05/19 12:30			
Alkalinity, Hydroxide (CaCO3)	ND	mg/L	20.0	1		02/05/19 12:30			
Alkalinity, Total as CaCO3	431	mg/L	20.0	1		02/05/19 12:30			
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	5890	mg/L	5.0	1		01/28/19 13:00			
9040 pH		Analytical Method: EPA 9040							
pH	7.3	Std. Units	0.10	1		02/06/19 11:04			H6
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	66.6	mg/L	50.0	50		02/11/19 13:46	16887-00-6		
Fluoride	ND	mg/L	0.20	1		02/11/19 13:30	16984-48-8		
Sulfate	3760	mg/L	500	500		02/12/19 10:46	14808-79-8		

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Sample: DUP-1		Lab ID: 60292862006		Collected: 01/24/19 08:00		Received: 01/26/19 09:20		Matrix: Water	
Parameters		Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	701	ug/L	100	1	02/08/19 12:06	02/11/19 10:36	7440-42-8		
Calcium	453000	ug/L	200	1	02/08/19 12:06	02/11/19 10:36	7440-70-2		
Lithium	575	ug/L	10.0	1	02/08/19 12:06	02/11/19 10:36	7439-93-2		
Magnesium	294000	ug/L	50.0	1	02/08/19 12:06	02/11/19 10:36	7439-95-4		
Potassium	19000	ug/L	500	1	02/08/19 12:06	02/11/19 10:36	7440-09-7		
Sodium	924000	ug/L	5000	10	02/08/19 12:06	02/11/19 11:31	7440-23-5		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:33	7440-36-0		
Arsenic	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:33	7440-38-2		
Barium	28.4	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:33	7440-39-3		
Beryllium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:33	7440-41-7		
Cadmium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:33	7440-43-9		
Chromium	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:33	7440-47-3		
Cobalt	3.2	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:33	7440-48-4		
Lead	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:33	7439-92-1		
Molybdenum	4.5	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:33	7439-98-7		
Selenium	76.5	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:33	7782-49-2		
Thallium	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:33	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	02/06/19 14:30	02/07/19 10:36	7439-97-6		
2320B Alkalinity		Analytical Method: SM 2320B							
Alkalinity,Bicarbonate (CaCO3)	404	mg/L	20.0	1		02/05/19 12:36			
Alkalinity,Carbonate (CaCO3)	ND	mg/L	20.0	1		02/05/19 12:36			
Alkalinity, Hydroxide (CaCO3)	ND	mg/L	20.0	1		02/05/19 12:36			
Alkalinity, Total as CaCO3	404	mg/L	20.0	1		02/05/19 12:36			
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	6300	mg/L	5.0	1		01/28/19 13:00			
9040 pH		Analytical Method: EPA 9040							
pH	7.3	Std. Units	0.10	1		02/06/19 11:06			H6
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	79.9	mg/L	10.0	10		02/12/19 11:23	16887-00-6		
Fluoride	ND	mg/L	0.20	1		02/11/19 14:01	16984-48-8		
Sulfate	5050	mg/L	5000	5000		02/12/19 11:35	14808-79-8		

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Sample: BAT-12		Lab ID: 60292862007		Collected: 01/24/19 15:20		Received: 01/26/19 09:20		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	606	ug/L	100	1	02/08/19 12:06	02/11/19 10:46	7440-42-8		
Calcium	331000	ug/L	200	1	02/08/19 12:06	02/11/19 10:46	7440-70-2		
Lithium	141	ug/L	10.0	1	02/08/19 12:06	02/11/19 10:46	7439-93-2		
Magnesium	122000	ug/L	50.0	1	02/08/19 12:06	02/11/19 10:46	7439-95-4		
Potassium	13300	ug/L	500	1	02/08/19 12:06	02/11/19 10:46	7440-09-7		
Sodium	280000	ug/L	500	1	02/08/19 12:06	02/11/19 10:46	7440-23-5		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:38	7440-36-0		
Arsenic	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:38	7440-38-2		
Barium	48.1	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:38	7440-39-3		
Beryllium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:38	7440-41-7		
Cadmium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:38	7440-43-9		
Chromium	1.0	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:38	7440-47-3		
Cobalt	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:38	7440-48-4		
Lead	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:38	7439-92-1		
Molybdenum	5.2	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:38	7439-98-7		
Selenium	1.9	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:38	7782-49-2		
Thallium	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:38	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	02/06/19 14:30	02/07/19 10:39	7439-97-6		
2320B Alkalinity		Analytical Method: SM 2320B							
Alkalinity,Bicarbonate (CaCO3)	192	mg/L	20.0	1		02/05/19 12:40			
Alkalinity,Carbonate (CaCO3)	ND	mg/L	20.0	1		02/05/19 12:40			
Alkalinity, Hydroxide (CaCO3)	ND	mg/L	20.0	1		02/05/19 12:40			
Alkalinity, Total as CaCO3	192	mg/L	20.0	1		02/05/19 12:40			
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	2630	mg/L	5.0	1		01/28/19 13:00			
9040 pH		Analytical Method: EPA 9040							
pH	7.5	Std. Units	0.10	1		02/06/19 11:09		H6	
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	37.6	mg/L	5.0	5		02/12/19 11:47	16887-00-6		
Fluoride	0.42	mg/L	0.20	1		02/11/19 14:31	16984-48-8		
Sulfate	1680	mg/L	200	200		02/12/19 11:59	14808-79-8		

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Sample: BAT-10		Lab ID: 60292862008		Collected: 01/24/19 16:10		Received: 01/26/19 09:20		Matrix: Water	
Parameters		Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	813	ug/L	100	1	02/08/19 12:06	02/11/19 10:48	7440-42-8		
Calcium	363000	ug/L	200	1	02/08/19 12:06	02/11/19 10:48	7440-70-2		
Lithium	221	ug/L	10.0	1	02/08/19 12:06	02/11/19 10:48	7439-93-2		
Magnesium	140000	ug/L	50.0	1	02/08/19 12:06	02/11/19 10:48	7439-95-4		
Potassium	27800	ug/L	500	1	02/08/19 12:06	02/11/19 10:48	7440-09-7		
Sodium	551000	ug/L	5000	10	02/08/19 12:06	02/11/19 11:40	7440-23-5		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	1.2	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:40	7440-36-0		
Arsenic	2.6	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:40	7440-38-2		
Barium	34.1	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:40	7440-39-3		
Beryllium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:40	7440-41-7		
Cadmium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:40	7440-43-9		
Chromium	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:40	7440-47-3		
Cobalt	1.1	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:40	7440-48-4		
Lead	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:40	7439-92-1		
Molybdenum	36.8	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:40	7439-98-7		
Selenium	131	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:40	7782-49-2		
Thallium	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:40	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	02/06/19 14:30	02/07/19 10:41	7439-97-6		
2320B Alkalinity		Analytical Method: SM 2320B							
Alkalinity,Bicarbonate (CaCO3)	147	mg/L	20.0	1		02/05/19 12:45			
Alkalinity,Carbonate (CaCO3)	ND	mg/L	20.0	1		02/05/19 12:45			
Alkalinity, Hydroxide (CaCO3)	ND	mg/L	20.0	1		02/05/19 12:45			
Alkalinity, Total as CaCO3	147	mg/L	20.0	1		02/05/19 12:45			
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	3820	mg/L	5.0	1		01/28/19 13:00			
9040 pH		Analytical Method: EPA 9040							
pH	7.7	Std. Units	0.10	1		02/06/19 11:14			H6
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	22.2	mg/L	5.0	5		02/12/19 20:09	16887-00-6		
Fluoride	0.53	mg/L	0.20	1		02/11/19 15:02	16984-48-8		
Sulfate	2760	mg/L	200	200		02/12/19 20:22	14808-79-8		

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Sample: ERB-1		Lab ID: 60292862009		Collected: 01/24/19 17:25		Received: 01/26/19 09:20		Matrix: Water	
Parameters		Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	ND	ug/L	100	1	02/08/19 12:06	02/11/19 10:50	7440-42-8		
Calcium	ND	ug/L	200	1	02/08/19 12:06	02/11/19 10:50	7440-70-2		
Lithium	ND	ug/L	10.0	1	02/08/19 12:06	02/11/19 10:50	7439-93-2		
Magnesium	ND	ug/L	50.0	1	02/08/19 12:06	02/11/19 10:50	7439-95-4		
Potassium	ND	ug/L	500	1	02/08/19 12:06	02/11/19 10:50	7440-09-7		
Sodium	ND	ug/L	500	1	02/08/19 12:06	02/11/19 10:50	7440-23-5		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:42	7440-36-0		
Arsenic	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:42	7440-38-2		
Barium	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:42	7440-39-3		
Beryllium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:42	7440-41-7		
Cadmium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:42	7440-43-9		
Chromium	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:42	7440-47-3		
Cobalt	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:42	7440-48-4		
Lead	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:42	7439-92-1		
Molybdenum	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:42	7439-98-7		
Selenium	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:42	7782-49-2		
Thallium	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:42	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	02/06/19 14:30	02/07/19 10:43	7439-97-6		
2320B Alkalinity		Analytical Method: SM 2320B							
Alkalinity,Bicarbonate (CaCO3)	ND	mg/L	20.0	1		02/05/19 12:58			
Alkalinity,Carbonate (CaCO3)	ND	mg/L	20.0	1		02/05/19 12:58			
Alkalinity, Hydroxide (CaCO3)	ND	mg/L	20.0	1		02/05/19 12:58			
Alkalinity, Total as CaCO3	ND	mg/L	20.0	1		02/05/19 12:58			
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	ND	mg/L	5.0	1		01/28/19 13:00			
9040 pH		Analytical Method: EPA 9040							
pH	5.4	Std. Units	0.10	1		02/06/19 16:41			H6,R1
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	ND	mg/L	1.0	1		02/11/19 15:32	16887-00-6		
Fluoride	ND	mg/L	0.20	1		02/11/19 15:32	16984-48-8		
Sulfate	ND	mg/L	1.0	1		02/11/19 15:32	14808-79-8		CH

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Sample: PZ-5		Lab ID: 60292862010		Collected: 01/25/19 08:45		Received: 01/26/19 09:20		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	1330	ug/L	100	1	02/08/19 12:06	02/11/19 10:52	7440-42-8		
Calcium	84500	ug/L	200	1	02/08/19 12:06	02/11/19 10:52	7440-70-2		
Lithium	225	ug/L	10.0	1	02/08/19 12:06	02/11/19 10:52	7439-93-2		
Magnesium	29500	ug/L	50.0	1	02/08/19 12:06	02/11/19 10:52	7439-95-4		
Potassium	11700	ug/L	500	1	02/08/19 12:06	02/11/19 10:52	7440-09-7		
Sodium	570000	ug/L	5000	10	02/08/19 12:06	02/11/19 11:43	7440-23-5		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:44	7440-36-0		
Arsenic	1.9	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:44	7440-38-2		
Barium	27.5	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:44	7440-39-3		
Beryllium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:44	7440-41-7		
Cadmium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:44	7440-43-9		
Chromium	1.7	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:44	7440-47-3		
Cobalt	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:44	7440-48-4		
Lead	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:44	7439-92-1		
Molybdenum	155	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:44	7439-98-7		
Selenium	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:44	7782-49-2		
Thallium	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:44	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	02/06/19 14:30	02/07/19 10:45	7439-97-6		
2320B Alkalinity		Analytical Method: SM 2320B							
Alkalinity,Bicarbonate (CaCO3)	291	mg/L	20.0	1		02/05/19 13:03			
Alkalinity,Carbonate (CaCO3)	ND	mg/L	20.0	1		02/05/19 13:03			
Alkalinity, Hydroxide (CaCO3)	ND	mg/L	20.0	1		02/05/19 13:03			
Alkalinity, Total as CaCO3	291	mg/L	20.0	1		02/05/19 13:03			
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	2010	mg/L	5.0	1		01/28/19 13:00			
9040 pH		Analytical Method: EPA 9040							
pH	7.7	Std. Units	0.10	1		02/06/19 15:18		H6	
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	31.6	mg/L	2.0	2		02/12/19 12:11	16887-00-6		
Fluoride	0.23	mg/L	0.20	1		02/11/19 16:33	16984-48-8		
Sulfate	1290	mg/L	100	100		02/12/19 12:24	14808-79-8		

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Sample: PZ-4		Lab ID: 60292862011	Collected: 01/25/19 09:50	Received: 01/26/19 09:20	Matrix: Water			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010						
Boron	782	ug/L	100	1	02/08/19 12:06	02/11/19 10:55	7440-42-8	
Calcium	74700	ug/L	200	1	02/08/19 12:06	02/11/19 10:55	7440-70-2	
Lithium	168	ug/L	10.0	1	02/08/19 12:06	02/11/19 10:55	7439-93-2	
Magnesium	28200	ug/L	50.0	1	02/08/19 12:06	02/11/19 10:55	7439-95-4	
Potassium	8610	ug/L	500	1	02/08/19 12:06	02/11/19 10:55	7440-09-7	
Sodium	329000	ug/L	500	1	02/08/19 12:06	02/11/19 10:55	7440-23-5	
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010						
Antimony	1.2	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:46	7440-36-0	
Arsenic	4.8	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:46	7440-38-2	
Barium	60.0	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:46	7440-39-3	
Beryllium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:46	7440-41-7	
Cadmium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:46	7440-43-9	
Chromium	2.5	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:46	7440-47-3	
Cobalt	1.1	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:46	7440-48-4	
Lead	1.0	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:46	7439-92-1	
Molybdenum	56.4	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:46	7439-98-7	
Selenium	1.3	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:46	7782-49-2	
Thallium	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:46	7440-28-0	
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470						
Mercury	ND	ug/L	0.20	1	02/06/19 14:30	02/07/19 10:48	7439-97-6	
2320B Alkalinity		Analytical Method: SM 2320B						
Alkalinity,Bicarbonate (CaCO3)	284	mg/L	20.0	1		02/05/19 13:07		
Alkalinity,Carbonate (CaCO3)	ND	mg/L	20.0	1		02/05/19 13:07		
Alkalinity, Hydroxide (CaCO3)	ND	mg/L	20.0	1		02/05/19 13:07		
Alkalinity, Total as CaCO3	284	mg/L	20.0	1		02/05/19 13:07		
2540C Total Dissolved Solids		Analytical Method: SM 2540C						
Total Dissolved Solids	1270	mg/L	5.0	1		01/28/19 13:00		
9040 pH		Analytical Method: EPA 9040						
pH	7.8	Std. Units	0.10	1		02/06/19 15:21		H6
9056 IC Anions		Analytical Method: EPA 9056						
Chloride	17.1	mg/L	1.0	1		02/11/19 19:00	16887-00-6	
Fluoride	0.23	mg/L	0.20	1		02/11/19 19:00	16984-48-8	
Sulfate	703	mg/L	50.0	50		02/12/19 12:36	14808-79-8	

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Sample: PZ-3		Lab ID: 60292862012		Collected: 01/25/19 10:55		Received: 01/26/19 09:20		Matrix: Water	
Parameters		Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	909	ug/L	100	1	02/08/19 12:06	02/11/19 10:57	7440-42-8		
Calcium	280000	ug/L	200	1	02/08/19 12:06	02/11/19 10:57	7440-70-2		
Lithium	226	ug/L	10.0	1	02/08/19 12:06	02/11/19 10:57	7439-93-2		
Magnesium	140000	ug/L	50.0	1	02/08/19 12:06	02/11/19 10:57	7439-95-4		
Potassium	17700	ug/L	500	1	02/08/19 12:06	02/11/19 10:57	7440-09-7		
Sodium	773000	ug/L	5000	10	02/08/19 12:06	02/11/19 11:45	7440-23-5		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:48	7440-36-0		
Arsenic	1.5	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:48	7440-38-2		
Barium	38.6	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:48	7440-39-3		
Beryllium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:48	7440-41-7		
Cadmium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:48	7440-43-9		
Chromium	1.5	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:48	7440-47-3		
Cobalt	1.3	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:48	7440-48-4		
Lead	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:48	7439-92-1		
Molybdenum	47.6	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:48	7439-98-7		
Selenium	57.3	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:48	7782-49-2		
Thallium	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:48	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	02/06/19 14:30	02/07/19 10:50	7439-97-6		
2320B Alkalinity		Analytical Method: SM 2320B							
Alkalinity,Bicarbonate (CaCO3)	224	mg/L	20.0	1		02/05/19 13:13			
Alkalinity,Carbonate (CaCO3)	ND	mg/L	20.0	1		02/05/19 13:13			
Alkalinity, Hydroxide (CaCO3)	ND	mg/L	20.0	1		02/05/19 13:13			
Alkalinity, Total as CaCO3	224	mg/L	20.0	1		02/05/19 13:13			
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	3570	mg/L	5.0	1		01/28/19 13:00			
9040 pH		Analytical Method: EPA 9040							
pH	7.5	Std. Units	0.10	1		02/06/19 15:24			H6
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	22.6	mg/L	5.0	5		02/12/19 13:00	16887-00-6		
Fluoride	ND	mg/L	0.20	1		02/12/19 12:48	16984-48-8		
Sulfate	2770	mg/L	200	200		02/12/19 15:32	14808-79-8		

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Sample: PZ-2		Lab ID: 60292862013		Collected: 01/25/19 12:15		Received: 01/26/19 09:20		Matrix: Water	
Parameters		Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	846	ug/L	100	1	02/08/19 12:06	02/11/19 10:59	7440-42-8		
Calcium	394000	ug/L	200	1	02/08/19 12:06	02/11/19 10:59	7440-70-2		
Lithium	316	ug/L	10.0	1	02/08/19 12:06	02/11/19 10:59	7439-93-2		
Magnesium	229000	ug/L	50.0	1	02/08/19 12:06	02/11/19 10:59	7439-95-4		
Potassium	16900	ug/L	500	1	02/08/19 12:06	02/11/19 10:59	7440-09-7		
Sodium	747000	ug/L	5000	10	02/08/19 12:06	02/11/19 11:47	7440-23-5		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:50	7440-36-0		
Arsenic	1.2	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:50	7440-38-2		
Barium	30.0	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:50	7440-39-3		
Beryllium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:50	7440-41-7		
Cadmium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:50	7440-43-9		
Chromium	1.9	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:50	7440-47-3		
Cobalt	1.7	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:50	7440-48-4		
Lead	1.2	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:50	7439-92-1		
Molybdenum	1.7	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:50	7439-98-7		
Selenium	226	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:50	7782-49-2		
Thallium	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:50	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	02/06/19 14:30	02/07/19 10:52	7439-97-6		
2320B Alkalinity		Analytical Method: SM 2320B							
Alkalinity,Bicarbonate (CaCO3)	292	mg/L	20.0	1		02/07/19 12:45			
Alkalinity,Carbonate (CaCO3)	ND	mg/L	20.0	1		02/07/19 12:45			
Alkalinity, Hydroxide (CaCO3)	ND	mg/L	20.0	1		02/07/19 12:45			
Alkalinity, Total as CaCO3	292	mg/L	20.0	1		02/07/19 12:45			
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	4320	mg/L	5.0	1		01/28/19 13:00			
9040 pH		Analytical Method: EPA 9040							
pH	7.2	Std. Units	0.10	1		02/06/19 15:26			H6
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	74.0	mg/L	50.0	50		02/12/19 13:49	16887-00-6		
Fluoride	ND	mg/L	0.20	1		02/11/19 19:59	16984-48-8		
Sulfate	3040	mg/L	500	500		02/12/19 15:57	14808-79-8		

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Sample: PZ-6		Lab ID: 60292862014		Collected: 01/25/19 13:35		Received: 01/26/19 09:20		Matrix: Water	
Parameters		Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	1890	ug/L	100	1	02/08/19 12:06	02/11/19 11:02	7440-42-8		
Calcium	250000	ug/L	200	1	02/08/19 12:06	02/11/19 11:02	7440-70-2		
Lithium	366	ug/L	10.0	1	02/08/19 12:06	02/11/19 11:02	7439-93-2		
Magnesium	107000	ug/L	50.0	1	02/08/19 12:06	02/11/19 11:02	7439-95-4		
Potassium	17500	ug/L	500	1	02/08/19 12:06	02/11/19 11:02	7440-09-7		
Sodium	916000	ug/L	5000	10	02/08/19 12:06	02/11/19 11:49	7440-23-5		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:52	7440-36-0		
Arsenic	2.3	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:52	7440-38-2		
Barium	37.6	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:52	7440-39-3		
Beryllium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:52	7440-41-7		
Cadmium	ND	ug/L	0.50	1	02/06/19 15:14	02/08/19 11:52	7440-43-9		
Chromium	2.2	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:52	7440-47-3		
Cobalt	5.3	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:52	7440-48-4		
Lead	1.3	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:52	7439-92-1		
Molybdenum	27.6	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:52	7439-98-7		
Selenium	1.1	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:52	7782-49-2		
Thallium	ND	ug/L	1.0	1	02/06/19 15:14	02/08/19 11:52	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	02/06/19 14:30	02/07/19 10:59	7439-97-6		
2320B Alkalinity		Analytical Method: SM 2320B							
Alkalinity,Bicarbonate (CaCO3)	569	mg/L	20.0	1		02/07/19 12:52			
Alkalinity,Carbonate (CaCO3)	ND	mg/L	20.0	1		02/07/19 12:52			
Alkalinity, Hydroxide (CaCO3)	ND	mg/L	20.0	1		02/07/19 12:52			
Alkalinity, Total as CaCO3	569	mg/L	20.0	1		02/07/19 12:52			
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	3810	mg/L	5.0	1		01/30/19 16:30			
9040 pH		Analytical Method: EPA 9040							
pH	7.4	Std. Units	0.10	1		02/06/19 15:30			H6
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	26.1	mg/L	10.0	10		02/12/19 14:01	16887-00-6		
Fluoride	ND	mg/L	0.20	1		02/11/19 20:29	16984-48-8		
Sulfate	2490	mg/L	200	200		02/12/19 14:14	14808-79-8		

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE GW
Pace Project No.: 60292862

Sample: PZ-1		Lab ID: 60292862015		Collected: 01/25/19 14:35		Received: 01/26/19 09:20		Matrix: Water	
Parameters		Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	778	ug/L	100	1	02/08/19 12:06	02/11/19 11:04	7440-42-8		
Calcium	460000	ug/L	200	1	02/08/19 12:06	02/11/19 11:04	7440-70-2		M1
Lithium	303	ug/L	10.0	1	02/08/19 12:06	02/11/19 11:04	7439-93-2		
Magnesium	219000	ug/L	50.0	1	02/08/19 12:06	02/11/19 11:04	7439-95-4		M1
Potassium	15400	ug/L	500	1	02/08/19 12:06	02/11/19 11:04	7440-09-7		
Sodium	729000	ug/L	5000	10	02/08/19 12:06	02/11/19 11:52	7440-23-5		M1
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	02/06/19 14:20	02/08/19 12:05	7440-36-0		
Arsenic	ND	ug/L	1.0	1	02/06/19 14:20	02/08/19 12:05	7440-38-2		
Barium	24.8	ug/L	1.0	1	02/06/19 14:20	02/08/19 12:05	7440-39-3		
Beryllium	ND	ug/L	0.50	1	02/06/19 14:20	02/08/19 12:05	7440-41-7		
Cadmium	ND	ug/L	0.50	1	02/06/19 14:20	02/08/19 12:05	7440-43-9		
Chromium	ND	ug/L	1.0	1	02/06/19 14:20	02/08/19 12:05	7440-47-3		
Cobalt	4.7	ug/L	1.0	1	02/06/19 14:20	02/08/19 12:05	7440-48-4		
Lead	ND	ug/L	1.0	1	02/06/19 14:20	02/08/19 12:05	7439-92-1		
Molybdenum	4.0	ug/L	1.0	1	02/06/19 14:20	02/08/19 12:05	7439-98-7		
Selenium	323	ug/L	1.0	1	02/06/19 14:20	02/08/19 12:05	7782-49-2		
Thallium	ND	ug/L	1.0	1	02/06/19 14:20	02/08/19 12:05	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	02/06/19 14:30	02/07/19 11:01	7439-97-6		
2320B Alkalinity		Analytical Method: SM 2320B							
Alkalinity,Bicarbonate (CaCO3)	247	mg/L	20.0	1		02/07/19 12:56			
Alkalinity,Carbonate (CaCO3)	ND	mg/L	20.0	1		02/07/19 12:56			
Alkalinity, Hydroxide (CaCO3)	ND	mg/L	20.0	1		02/07/19 12:56			
Alkalinity, Total as CaCO3	247	mg/L	20.0	1		02/07/19 12:56			
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	3860	mg/L	5.0	1		01/30/19 16:30			
9040 pH		Analytical Method: EPA 9040							
pH	7.3	Std. Units	0.10	1		02/06/19 15:33			H6
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	127	mg/L	50.0	50		02/11/19 22:00	16887-00-6		
Fluoride	ND	mg/L	0.20	1		02/11/19 21:30	16984-48-8		
Sulfate	3180	mg/L	500	500		02/12/19 14:26	14808-79-8		

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

QC Batch:	567185	Analysis Method:	EPA 7470
QC Batch Method:	EPA 7470	Analysis Description:	7470 Mercury
Associated Lab Samples:	60292862001, 60292862002, 60292862003, 60292862004, 60292862005, 60292862006, 60292862007, 60292862008, 60292862009, 60292862010, 60292862011, 60292862012, 60292862013, 60292862014, 60292862015		

METHOD BLANK: 2326314 Matrix: Water

Associated Lab Samples: 60292862001, 60292862002, 60292862003, 60292862004, 60292862005, 60292862006, 60292862007, 60292862008, 60292862009, 60292862010, 60292862011, 60292862012, 60292862013, 60292862014, 60292862015

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	02/07/19 10:16	

LABORATORY CONTROL SAMPLE: 2326315

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	5	4.9	99	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2326316 2326317

Parameter	Units	60292862015 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	5	5	5.0	5.0	100	101	75-125	1	20	

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE GW
Pace Project No.: 60292862

QC Batch:	568135	Analysis Method:	EPA 6010
QC Batch Method:	EPA 3010	Analysis Description:	6010 MET
Associated Lab Samples:	60292862001, 60292862002, 60292862003, 60292862004, 60292862005, 60292862006, 60292862007, 60292862008, 60292862009, 60292862010, 60292862011, 60292862012, 60292862013, 60292862014, 60292862015		

METHOD BLANK:	2330112	Matrix:	Water
Associated Lab Samples:	60292862001, 60292862002, 60292862003, 60292862004, 60292862005, 60292862006, 60292862007, 60292862008, 60292862009, 60292862010, 60292862011, 60292862012, 60292862013, 60292862014, 60292862015		

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	ug/L	ND	100	02/11/19 10:18	
Calcium	ug/L	ND	200	02/11/19 10:18	
Lithium	ug/L	ND	10.0	02/11/19 10:18	
Magnesium	ug/L	ND	50.0	02/11/19 10:18	
Potassium	ug/L	ND	500	02/11/19 10:18	
Sodium	ug/L	ND	500	02/11/19 10:18	

LABORATORY CONTROL SAMPLE: 2330113

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	1000	944	94	80-120	
Calcium	ug/L	10000	10100	101	80-120	
Lithium	ug/L	1000	958	96	80-120	
Magnesium	ug/L	10000	9710	97	80-120	
Potassium	ug/L	10000	9770	98	80-120	
Sodium	ug/L	10000	9660	97	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2330114 2330115

Parameter	Units	60292862015 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	778	1000	1000	1720	1740	94	97	75-125	2	20	
Calcium	ug/L	460000	10000	10000	500000	494000	400	339	75-125	1	20	M1
Lithium	ug/L	303	1000	1000	1310	1290	101	99	75-125	1	20	
Magnesium	ug/L	219000	10000	10000	235000	233000	164	145	75-125	1	20	M1
Potassium	ug/L	15400	10000	10000	25300	24900	99	95	75-125	1	20	
Sodium	ug/L	729000	10000	10000	756000	748000	274	189	75-125	1	20	M1

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

QC Batch:	567872	Analysis Method:	EPA 6020
QC Batch Method:	EPA 3010	Analysis Description:	6020 MET
Associated Lab Samples:	60292862001, 60292862002, 60292862003, 60292862004, 60292862005, 60292862006, 60292862007, 60292862008, 60292862009, 60292862010, 60292862011, 60292862012, 60292862013, 60292862014		

METHOD BLANK: 2328953

Matrix: Water

Associated Lab Samples: 60292862001, 60292862002, 60292862003, 60292862004, 60292862005, 60292862006, 60292862007, 60292862008, 60292862009, 60292862010, 60292862011, 60292862012, 60292862013, 60292862014

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	1.0	02/08/19 11:16	
Arsenic	ug/L	ND	1.0	02/08/19 11:16	
Barium	ug/L	ND	1.0	02/08/19 11:16	
Beryllium	ug/L	ND	0.50	02/08/19 11:16	
Cadmium	ug/L	ND	0.50	02/08/19 11:16	
Chromium	ug/L	ND	1.0	02/08/19 11:16	
Cobalt	ug/L	ND	1.0	02/08/19 11:16	
Lead	ug/L	ND	1.0	02/08/19 11:16	
Molybdenum	ug/L	ND	1.0	02/08/19 11:16	
Selenium	ug/L	ND	1.0	02/08/19 11:16	
Thallium	ug/L	ND	1.0	02/08/19 11:16	

LABORATORY CONTROL SAMPLE: 2328954

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	40	41.2	103	80-120	
Arsenic	ug/L	40	42.1	105	80-120	
Barium	ug/L	40	40.3	101	80-120	
Beryllium	ug/L	40	41.2	103	80-120	
Cadmium	ug/L	40	42.1	105	80-120	
Chromium	ug/L	40	42.1	105	80-120	
Cobalt	ug/L	40	41.6	104	80-120	
Lead	ug/L	40	41.0	102	80-120	
Molybdenum	ug/L	40	42.4	106	80-120	
Selenium	ug/L	40	41.5	104	80-120	
Thallium	ug/L	40	39.9	100	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2328955 2328956

Parameter	Units	60292862001		MSD		MS		MSD		MS		MSD		% Rec		Max	
		Result	Spike Conc.	Spike Conc.	Result	Result	% Rec	Result	% Rec	% Rec	% Rec	% Rec	% Rec	Limits	RPD	RPD	Qual
Antimony	ug/L	ND	40	40	41.6	41.6	103	103	75-125	0	20						
Arsenic	ug/L	1.3	40	40	43.5	43.5	105	105	75-125	0	20						
Barium	ug/L	72.2	40	40	112	114	100	103	75-125	1	20						
Beryllium	ug/L	ND	40	40	39.0	37.9	98	95	75-125	3	20						
Cadmium	ug/L	ND	40	40	40.2	40.6	100	101	75-125	1	20						
Chromium	ug/L	42.2	40	40	81.5	81.8	98	99	75-125	0	20						

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2328955 2328956											
Parameter	Units	60292862001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	Max RPD	Qual
Cobalt	ug/L	ND	40	40	41.1	41.3	103	103	75-125	0	20
Lead	ug/L	ND	40	40	38.3	38.6	95	96	75-125	1	20
Molybdenum	ug/L	41.0	40	40	84.1	85.3	108	111	75-125	1	20
Selenium	ug/L	20.6	40	40	58.0	58.0	93	93	75-125	0	20
Thallium	ug/L	ND	40	40	37.9	38.0	95	95	75-125	0	20

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE GW
Pace Project No.: 60292862

QC Batch: 567873 Analysis Method: EPA 6020
QC Batch Method: EPA 3010 Analysis Description: 6020 MET
Associated Lab Samples: 60292862015

METHOD BLANK: 2328959 Matrix: Water
Associated Lab Samples: 60292862015

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	1.0	02/08/19 12:01	
Arsenic	ug/L	ND	1.0	02/08/19 12:01	
Barium	ug/L	ND	1.0	02/08/19 12:01	
Beryllium	ug/L	ND	0.50	02/08/19 12:01	
Cadmium	ug/L	ND	0.50	02/08/19 12:01	
Chromium	ug/L	ND	1.0	02/08/19 12:01	
Cobalt	ug/L	ND	1.0	02/08/19 12:01	
Lead	ug/L	ND	1.0	02/08/19 12:01	
Molybdenum	ug/L	ND	1.0	02/08/19 12:01	
Selenium	ug/L	ND	1.0	02/08/19 12:01	
Thallium	ug/L	ND	1.0	02/08/19 12:01	

LABORATORY CONTROL SAMPLE: 2328960

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	40	40.8	102	80-120	
Arsenic	ug/L	40	40.5	101	80-120	
Barium	ug/L	40	39.9	100	80-120	
Beryllium	ug/L	40	41.2	103	80-120	
Cadmium	ug/L	40	41.2	103	80-120	
Chromium	ug/L	40	40.2	101	80-120	
Cobalt	ug/L	40	39.4	99	80-120	
Lead	ug/L	40	41.0	103	80-120	
Molybdenum	ug/L	40	41.5	104	80-120	
Selenium	ug/L	40	41.8	104	80-120	
Thallium	ug/L	40	39.7	99	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2328961 2328962

Parameter	Units	60292862015 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	ND	40	40	39.1	39.1	97	97	75-125	0	20	
Arsenic	ug/L	ND	40	40	40.5	40.6	99	100	75-125	0	20	
Barium	ug/L	24.8	40	40	66.6	66.3	105	104	75-125	0	20	
Beryllium	ug/L	ND	40	40	32.0	32.1	80	80	75-125	0	20	
Cadmium	ug/L	ND	40	40	34.3	34.7	86	87	75-125	1	20	
Chromium	ug/L	ND	40	40	32.3	31.7	80	79	75-125	2	20	
Cobalt	ug/L	4.7	40	40	43.8	44.1	98	98	75-125	1	20	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2328961 2328962											
Parameter	Units	60292862015 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	Max RPD	Qual
Lead	ug/L	ND	40	40	33.9	34.1	84	85	75-125	1	20
Molybdenum	ug/L	4.0	40	40	45.9	46.3	105	106	75-125	1	20
Selenium	ug/L	323	40	40	365	357	105	86	75-125	2	20
Thallium	ug/L	ND	40	40	34.6	34.7	86	87	75-125	0	20

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

QC Batch:	567636	Analysis Method:	SM 2320B
QC Batch Method:	SM 2320B	Analysis Description:	2320B Alkalinity
Associated Lab Samples:	60292862001, 60292862002, 60292862003, 60292862004, 60292862005, 60292862006, 60292862007, 60292862008, 60292862009, 60292862010, 60292862011, 60292862012		

METHOD BLANK:	2328005	Matrix:	Water
Associated Lab Samples:	60292862001, 60292862002, 60292862003, 60292862004, 60292862005, 60292862006, 60292862007, 60292862008, 60292862009, 60292862010, 60292862011, 60292862012		

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Alkalinity, Hydroxide (CaCO ₃)	mg/L	ND	20.0	02/05/19 10:54	
Alkalinity, Total as CaCO ₃	mg/L	ND	20.0	02/05/19 10:54	
Alkalinity,Bicarbonate (CaCO ₃)	mg/L	ND	20.0	02/05/19 10:54	
Alkalinity,Carbonate (CaCO ₃)	mg/L	ND	20.0	02/05/19 10:54	

LABORATORY CONTROL SAMPLE: 2328006						
Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Alkalinity, Total as CaCO3	mg/L	500	497	99	90-110	

SAMPLE DUPLICATE: 2328007						
Parameter	Units	60292904001 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Hydroxide (CaCO3)	mg/L	ND	ND		10	
Alkalinity, Total as CaCO3	mg/L	285	295	4	10	
Alkalinity,Bicarbonate (CaCO3)	mg/L	285	295	4	10	
Alkalinity,Carbonate (CaCO3)	mg/L	ND	ND		10	

SAMPLE DUPLICATE: 2328008						
Parameter	Units	60292862001 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Hydroxide (CaCO3)	mg/L	ND	ND		10	
Alkalinity, Total as CaCO3	mg/L	273	278	2	10	
Alkalinity,Bicarbonate (CaCO3)	mg/L	254	258	2	10	
Alkalinity,Carbonate (CaCO3)	mg/L	ND	19.8J		10	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

QC Batch: 568032 Analysis Method: SM 2320B
QC Batch Method: SM 2320B Analysis Description: 2320B Alkalinity
Associated Lab Samples: 60292862013, 60292862014, 60292862015

METHOD BLANK: 2329672 Matrix: Water

Associated Lab Samples: 60292862013, 60292862014, 60292862015

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Alkalinity, Hydroxide (CaCO ₃)	mg/L	ND	20.0	02/07/19 12:24	
Alkalinity, Total as CaCO ₃	mg/L	ND	20.0	02/07/19 12:24	
Alkalinity,Bicarbonate (CaCO ₃)	mg/L	ND	20.0	02/07/19 12:24	
Alkalinity,Carbonate (CaCO ₃)	mg/L	ND	20.0	02/07/19 12:24	

LABORATORY CONTROL SAMPLE: 2329673

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Alkalinity, Total as CaCO ₃	mg/L	500	501	100	90-110	

SAMPLE DUPLICATE: 2329674

Parameter	Units	60292862015 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Hydroxide (CaCO ₃)	mg/L	ND	ND		10	
Alkalinity, Total as CaCO ₃	mg/L	247	247	0	10	
Alkalinity,Bicarbonate (CaCO ₃)	mg/L	247	247	0	10	
Alkalinity,Carbonate (CaCO ₃)	mg/L	ND	ND		10	

SAMPLE DUPLICATE: 2329675

Parameter	Units	60293314004 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Hydroxide (CaCO ₃)	mg/L	<6.5	ND		10	
Alkalinity, Total as CaCO ₃	mg/L	235	233	1	10	
Alkalinity,Bicarbonate (CaCO ₃)	mg/L	235	233	1	10	
Alkalinity,Carbonate (CaCO ₃)	mg/L	<6.5	ND		10	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

QC Batch:	566539	Analysis Method:	SM 2540C
QC Batch Method:	SM 2540C	Analysis Description:	2540C Total Dissolved Solids
Associated Lab Samples:	60292862001, 60292862002, 60292862003, 60292862004, 60292862005, 60292862006, 60292862007, 60292862008, 60292862009, 60292862010, 60292862011, 60292862012, 60292862013		

METHOD BLANK: 2324059 Matrix: Water
Associated Lab Samples: 60292862001, 60292862002, 60292862003, 60292862004, 60292862005, 60292862006, 60292862007, 60292862008, 60292862009, 60292862010, 60292862011, 60292862012, 60292862013

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	5.0	01/28/19 13:00	

LABORATORY CONTROL SAMPLE: 2324060

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	984	98	80-120	

SAMPLE DUPLICATE: 2324061

Parameter	Units	60292531006 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	5360	5140	4	10	

SAMPLE DUPLICATE: 2324062

Parameter	Units	60292862005 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	5890	6060	3	10	

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

QC Batch:	566866	Analysis Method:	SM 2540C
QC Batch Method:	SM 2540C	Analysis Description:	2540C Total Dissolved Solids
Associated Lab Samples:	60292862014, 60292862015		

METHOD BLANK: 2325191 Matrix: Water

Associated Lab Samples: 60292862014, 60292862015

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	5.0	01/30/19 16:30	

LABORATORY CONTROL SAMPLE: 2325192

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	988	99	80-120	

SAMPLE DUPLICATE: 2325193

Parameter	Units	60292862015 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	3860	3780	2	10	

SAMPLE DUPLICATE: 2325194

Parameter	Units	60292928001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	514	484	6	10	

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

QC Batch:	567831	Analysis Method:	EPA 9040
QC Batch Method:	EPA 9040	Analysis Description:	9040 pH
Associated Lab Samples:	60292862001, 60292862002, 60292862003, 60292862004, 60292862005, 60292862006, 60292862007, 60292862008, 60292862009, 60292862010, 60292862011, 60292862012, 60292862013, 60292862014, 60292862015		

SAMPLE DUPLICATE: 2328859

Parameter	Units	60292862015 Result	Dup Result	RPD	Max RPD	Qualifiers
pH	Std. Units	7.3	7.3	0	10	H6

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE GW
Pace Project No.: 60292862

QC Batch:	568380	Analysis Method:	EPA 9056
QC Batch Method:	EPA 9056	Analysis Description:	9056 IC Anions
Associated Lab Samples:	60292862001		

METHOD BLANK: 2330920 Matrix: Water
Associated Lab Samples: 60292862001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	02/08/19 18:30	
Fluoride	mg/L	ND	0.20	02/08/19 18:30	
Sulfate	mg/L	ND	1.0	02/08/19 18:30	

LABORATORY CONTROL SAMPLE: 2330921

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.9	99	80-120	
Fluoride	mg/L	2.5	2.7	106	80-120	
Sulfate	mg/L	5	5.0	100	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2330922 2330923

Parameter	Units	60292862001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	7.8	5	5	12.9	13.4	101	110	80-120	3	15	
Fluoride	mg/L	0.84	2.5	2.5	3.3	3.5	98	108	80-120	7	15	

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

QC Batch:	568501	Analysis Method:	EPA 9056
QC Batch Method:	EPA 9056	Analysis Description:	9056 IC Anions
Associated Lab Samples:	60292862002, 60292862003, 60292862004, 60292862005, 60292862006, 60292862007, 60292862008, 60292862009, 60292862010, 60292862011, 60292862013, 60292862014, 60292862015		

METHOD BLANK:	2331450	Matrix:	Water
Associated Lab Samples:	60292862002, 60292862003, 60292862004, 60292862005, 60292862006, 60292862007, 60292862008, 60292862009, 60292862010, 60292862011, 60292862012, 60292862013, 60292862014, 60292862015		

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	02/11/19 09:36	
Fluoride	mg/L	ND	0.20	02/11/19 09:36	
Sulfate	mg/L	ND	1.0	02/11/19 09:36	

LABORATORY CONTROL SAMPLE: 2331451

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.5	91	80-120	
Fluoride	mg/L	2.5	2.4	94	80-120	
Sulfate	mg/L	5	4.9	97	80-120	

MATRIX SPIKE SAMPLE: 2331452

Parameter	Units	60292862015 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	127	250	414	115	80-120	
Fluoride	mg/L	ND	2.5	2.2	87	80-120	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

QC Batch:	568701	Analysis Method:	EPA 9056
QC Batch Method:	EPA 9056	Analysis Description:	9056 IC Anions
Associated Lab Samples:	60292862002, 60292862003, 60292862004, 60292862005, 60292862006, 60292862007, 60292862010, 60292862011, 60292862012, 60292862013, 60292862014, 60292862015		

METHOD BLANK:	2331952	Matrix:	Water
Associated Lab Samples:	60292862002, 60292862003, 60292862004, 60292862005, 60292862006, 60292862007, 60292862010, 60292862011, 60292862012, 60292862013, 60292862014, 60292862015		

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	02/12/19 09:21	
Fluoride	mg/L	ND	0.20	02/12/19 09:21	
Sulfate	mg/L	ND	1.0	02/12/19 09:21	

LABORATORY CONTROL SAMPLE: 2331953

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.7	95	80-120	
Fluoride	mg/L	2.5	2.4	98	80-120	
Sulfate	mg/L	5	5.0	100	80-120	

MATRIX SPIKE SAMPLE: 2331954

Parameter	Units	60292862015 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	3180	2500	5780	104	80-120	

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

QC Batch: 568939

Analysis Method: EPA 9056

QC Batch Method: EPA 9056

Analysis Description: 9056 IC Anions

Associated Lab Samples: 60292862008

METHOD BLANK: 2332545

Matrix: Water

Associated Lab Samples: 60292862008

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	02/12/19 19:45	
Sulfate	mg/L	ND	1.0	02/12/19 19:45	

LABORATORY CONTROL SAMPLE: 2332546

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.7	94	80-120	
Sulfate	mg/L	5	4.9	99	80-120	

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QUALIFIERS

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K Pace Analytical Services - Kansas City

ANALYTE QUALIFIERS

CH The continuing calibration for this compound is outside of Pace Analytical acceptance limits. The results may be biased high.

H6 Analysis initiated outside of the 15 minute EPA required holding time.

M1 Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

R1 RPD value was outside control limits.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60292862001	ASH-06	EPA 3010	568135	EPA 6010	568326
60292862002	PRS-3	EPA 3010	568135	EPA 6010	568326
60292862003	BAT-11	EPA 3010	568135	EPA 6010	568326
60292862004	PRS-2	EPA 3010	568135	EPA 6010	568326
60292862005	ASH-7	EPA 3010	568135	EPA 6010	568326
60292862006	DUP-1	EPA 3010	568135	EPA 6010	568326
60292862007	BAT-12	EPA 3010	568135	EPA 6010	568326
60292862008	BAT-10	EPA 3010	568135	EPA 6010	568326
60292862009	ERB-1	EPA 3010	568135	EPA 6010	568326
60292862010	PZ-5	EPA 3010	568135	EPA 6010	568326
60292862011	PZ-4	EPA 3010	568135	EPA 6010	568326
60292862012	PZ-3	EPA 3010	568135	EPA 6010	568326
60292862013	PZ-2	EPA 3010	568135	EPA 6010	568326
60292862014	PZ-6	EPA 3010	568135	EPA 6010	568326
60292862015	PZ-1	EPA 3010	568135	EPA 6010	568326
60292862001	ASH-06	EPA 3010	567872	EPA 6020	567990
60292862002	PRS-3	EPA 3010	567872	EPA 6020	567990
60292862003	BAT-11	EPA 3010	567872	EPA 6020	567990
60292862004	PRS-2	EPA 3010	567872	EPA 6020	567990
60292862005	ASH-7	EPA 3010	567872	EPA 6020	567990
60292862006	DUP-1	EPA 3010	567872	EPA 6020	567990
60292862007	BAT-12	EPA 3010	567872	EPA 6020	567990
60292862008	BAT-10	EPA 3010	567872	EPA 6020	567990
60292862009	ERB-1	EPA 3010	567872	EPA 6020	567990
60292862010	PZ-5	EPA 3010	567872	EPA 6020	567990
60292862011	PZ-4	EPA 3010	567872	EPA 6020	567990
60292862012	PZ-3	EPA 3010	567872	EPA 6020	567990
60292862013	PZ-2	EPA 3010	567872	EPA 6020	567990
60292862014	PZ-6	EPA 3010	567872	EPA 6020	567990
60292862015	PZ-1	EPA 3010	567873	EPA 6020	567984
60292862001	ASH-06	EPA 7470	567185	EPA 7470	568035
60292862002	PRS-3	EPA 7470	567185	EPA 7470	568035
60292862003	BAT-11	EPA 7470	567185	EPA 7470	568035
60292862004	PRS-2	EPA 7470	567185	EPA 7470	568035
60292862005	ASH-7	EPA 7470	567185	EPA 7470	568035
60292862006	DUP-1	EPA 7470	567185	EPA 7470	568035
60292862007	BAT-12	EPA 7470	567185	EPA 7470	568035
60292862008	BAT-10	EPA 7470	567185	EPA 7470	568035
60292862009	ERB-1	EPA 7470	567185	EPA 7470	568035
60292862010	PZ-5	EPA 7470	567185	EPA 7470	568035
60292862011	PZ-4	EPA 7470	567185	EPA 7470	568035
60292862012	PZ-3	EPA 7470	567185	EPA 7470	568035
60292862013	PZ-2	EPA 7470	567185	EPA 7470	568035
60292862014	PZ-6	EPA 7470	567185	EPA 7470	568035
60292862015	PZ-1	EPA 7470	567185	EPA 7470	568035
60292862001	ASH-06	SM 2320B	567636		
60292862002	PRS-3	SM 2320B	567636		

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60292862003	BAT-11	SM 2320B	567636		
60292862004	PRS-2	SM 2320B	567636		
60292862005	ASH-7	SM 2320B	567636		
60292862006	DUP-1	SM 2320B	567636		
60292862007	BAT-12	SM 2320B	567636		
60292862008	BAT-10	SM 2320B	567636		
60292862009	ERB-1	SM 2320B	567636		
60292862010	PZ-5	SM 2320B	567636		
60292862011	PZ-4	SM 2320B	567636		
60292862012	PZ-3	SM 2320B	567636		
60292862013	PZ-2	SM 2320B	568032		
60292862014	PZ-6	SM 2320B	568032		
60292862015	PZ-1	SM 2320B	568032		
60292862001	ASH-06	SM 2540C	566539		
60292862002	PRS-3	SM 2540C	566539		
60292862003	BAT-11	SM 2540C	566539		
60292862004	PRS-2	SM 2540C	566539		
60292862005	ASH-7	SM 2540C	566539		
60292862006	DUP-1	SM 2540C	566539		
60292862007	BAT-12	SM 2540C	566539		
60292862008	BAT-10	SM 2540C	566539		
60292862009	ERB-1	SM 2540C	566539		
60292862010	PZ-5	SM 2540C	566539		
60292862011	PZ-4	SM 2540C	566539		
60292862012	PZ-3	SM 2540C	566539		
60292862013	PZ-2	SM 2540C	566539		
60292862014	PZ-6	SM 2540C	566866		
60292862015	PZ-1	SM 2540C	566866		
60292862001	ASH-06	EPA 9040	567831		
60292862002	PRS-3	EPA 9040	567831		
60292862003	BAT-11	EPA 9040	567831		
60292862004	PRS-2	EPA 9040	567831		
60292862005	ASH-7	EPA 9040	567831		
60292862006	DUP-1	EPA 9040	567831		
60292862007	BAT-12	EPA 9040	567831		
60292862008	BAT-10	EPA 9040	567831		
60292862009	ERB-1	EPA 9040	567831		
60292862010	PZ-5	EPA 9040	567831		
60292862011	PZ-4	EPA 9040	567831		
60292862012	PZ-3	EPA 9040	567831		
60292862013	PZ-2	EPA 9040	567831		
60292862014	PZ-6	EPA 9040	567831		
60292862015	PZ-1	EPA 9040	567831		
60292862001	ASH-06	EPA 9056	568380		
60292862002	PRS-3	EPA 9056	568501		

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: PRPA RAWHIDE GW

Pace Project No.: 60292862

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60292862002	PRS-3	EPA 9056	568701		
60292862003	BAT-11	EPA 9056	568501		
60292862003	BAT-11	EPA 9056	568701		
60292862004	PRS-2	EPA 9056	568501		
60292862004	PRS-2	EPA 9056	568701		
60292862005	ASH-7	EPA 9056	568501		
60292862005	ASH-7	EPA 9056	568701		
60292862006	DUP-1	EPA 9056	568501		
60292862006	DUP-1	EPA 9056	568701		
60292862007	BAT-12	EPA 9056	568501		
60292862007	BAT-12	EPA 9056	568701		
60292862008	BAT-10	EPA 9056	568501		
60292862008	BAT-10	EPA 9056	568939		
60292862009	ERB-1	EPA 9056	568501		
60292862010	PZ-5	EPA 9056	568501		
60292862010	PZ-5	EPA 9056	568701		
60292862011	PZ-4	EPA 9056	568501		
60292862011	PZ-4	EPA 9056	568701		
60292862012	PZ-3	EPA 9056	568701		
60292862013	PZ-2	EPA 9056	568501		
60292862013	PZ-2	EPA 9056	568701		
60292862014	PZ-6	EPA 9056	568501		
60292862014	PZ-6	EPA 9056	568701		
60292862015	PZ-1	EPA 9056	568501		
60292862015	PZ-1	EPA 9056	568701		

REPORT OF LABORATORY ANALYSIS

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CHAIN-OF-CUSTODY Analytical Request Document

LAB USE ONLY

WO#: 60292862

number or

Company: AECOM

Address: 6200 South Quebec St

Greenwood Village, CO 80111

Report To: Brian Rothmeyer

Copy To: Geoff Webb

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevant fields
Billing Information: Accounts Payable

Email To: usapimaging@aecom.com

Site Collection Info/Address:

Customer Project Name/Number: PRPA Rawhide Soil

Phone: (303) 740-2614

Email: brian.rothmeyer@aecom.com

Collected By (Print):

Geoff Webb

Turnaround Date Required: Same day

Sample Disposal:

[] Dispose as appropriate [] Return

[] Archive:

[] Hold:

Rush:

[] Same Day [] Next Day
[] 2 Day [] 3 Day [] 4 Day [] 5 Day
(Expedite Charges Apply)

Analysis:

* Matrix Codes (Insert in Matrix box below): Drinking Water (DW), Ground Water (GW), Wastewater (WW), Product (P), Soil/Solid (SL), Oil (OL), Wipe (WP), Air (AR), Tissue (TS), Bioassay (B), Vapor (V), Other (OT)

State:	County/City:	Time Zone Collected:
CO		[] PT [] MT [] CT [] ET
Site/Facility ID #:	Compliance Monitoring?	
	[] Yes [] No	
Purchase Order #:	DW PWS ID #:	
Quote #:		
Turnaround Date Required:	Immediately Packed on Ice:	
	[] Yes [] No	
	Field Filtered (if applicable):	
	[] Yes [] No	

Customer Sample ID	Matrix *	Comp / Grab	Collected (or Composite Start)		Res Cl	# of Ctns
			Date	Time		
ASH-06	W	Grab	1/24/19	1005		3
PRS-3	W	Grab	1/24/19	1055		3
BAT-11	W	Grab	1/24/19	1135		3
PRS-2	W	Grab	1/24/19	1310		3
ASH-7	W	Grab	1/24/19	1405		3
DUP-1	W	Grab	1/24/19	1520		3
BAT-12	W	Grab	1/24/19	1610		3
BAT-10	W	Grab	1/24/19	1725		3
EPB-1	W	Grab	1/24/19	1845		3
PRS-5	W	Grab	1/24/19	1845		3

Customer Remarks / Special Conditions / Possible Hazards:

*6020: Sb, As, Ba, Be, Cd, Cr, Co, Pb, Mo, Se, Ti

Type of Ice Used:

Packing Material Used:

Radchem sample(s) screened (<500 cpm):

Y N NA

SHORT HOLDS PRESENT (<72 hours):

Y N/A

Lab Tracking #: 78514958 9240

Samples received via:

FEDEX UPS Client Courier Pace Courier

Date/Time: 1/26/19 0920

Date/Time: 1/26/19 0920

Date/Time: 1/26/19 0920

Date/Time: 1/26/19 0920

Date/Time: 1/26/19 0920

Date/Time: 1/26/19 0920

Date/Time: 1/26/19 0920

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Date/Time: 1/26/19 0920

Date/Time: 1/26/19 0920

Date/Time: 1/26/19 0920

Date/Time: 1/26/19 0920

Analyses

Lab Profile/Line: 11033, 6	Lab Sample Receipt Checklist:
	Custody Seals Present/Intact: <input checked="" type="checkbox"/> Y <input checked="" type="checkbox"/> N
	Custody Signatures Present: <input checked="" type="checkbox"/> Y <input checked="" type="checkbox"/> N
	Collector Signatures Present: <input checked="" type="checkbox"/> Y <input checked="" type="checkbox"/> N
	Bottles Intact: <input checked="" type="checkbox"/> Y <input checked="" type="checkbox"/> N
	Correct Bottles: <input checked="" type="checkbox"/> Y <input checked="" type="checkbox"/> N
	Sufficient Volume: <input checked="" type="checkbox"/> Y <input checked="" type="checkbox"/> N
	Samples Received on Ice: <input checked="" type="checkbox"/> Y <input checked="" type="checkbox"/> N
	VQA - Headspace Acceptable: <input checked="" type="checkbox"/> Y <input checked="" type="checkbox"/> N
	USDA Regulated Soils: <input checked="" type="checkbox"/> Y <input checked="" type="checkbox"/> N
	Samples in Holding Time: <input checked="" type="checkbox"/> Y <input checked="" type="checkbox"/> N
	Residual Chlorine Present: <input checked="" type="checkbox"/> Y <input checked="" type="checkbox"/> N
	Cl Strips: <input checked="" type="checkbox"/> Y <input checked="" type="checkbox"/> N
	Sample pH Acceptable: <input checked="" type="checkbox"/> Y <input checked="" type="checkbox"/> N
	pH Strips: <input checked="" type="checkbox"/> Y <input checked="" type="checkbox"/> N
	Sulfide Present: <input checked="" type="checkbox"/> Y <input checked="" type="checkbox"/> N
	Lead Acetate Strips: <input checked="" type="checkbox"/> Y <input checked="" type="checkbox"/> N
	LAB USE ONLY:
	Lab Sample # / Comments:
	60292862

9040 pH	SM2320B Alkalinity	6020 Total Metals*	7470 Total Mercury	6010 Total B, Ca, Mg, Na, K, Li	9056 Cl, F, SO4	TDs	SHORT HOLDS PRESENT (<72 hours):	Y N/A	LAB Sample Temperature Info:
									Temp Blank: Received: <input checked="" type="checkbox"/> Y <input checked="" type="checkbox"/> N
									Therm ID#:
									Cooler 1 Temp Upon Receipt: 0.5 °C
									Cooler 1 Therm Corr. Factor: 0.0 °C
									Cooler 1 Corrected Temp: 0.5 °C
									Comments: 1.4, 1.6

Relinquished by/Company: (Signature)	Date/Time: 1/25/19 1720	Received by/Company: (Signature)	Date/Time: 1/26/19 0920
Relinquished by/Company: (Signature)	Date/Time: 1/25/19 1720	Received by/Company: (Signature)	Date/Time: 1/26/19 0920
Relinquished by/Company: (Signature)	Date/Time: 1/25/19 1720	Received by/Company: (Signature)	Date/Time: 1/26/19 0920

4 cooler

Platte River Power Authority – Rawhide DATA REVIEW CHECK

Data Package: 60292862Sampling Event: January 24th and 25th, 2019

Data Reviewer: Brian Rothmeyer

Peer Reviewer: Sheri Fling

Date Completed: February 18, 2019

Date Completed: February 26, 2019

This report contains the final results of the data validation conducted for the water samples collected October 10th, 2018. The data review was conducted in accordance with the method and laboratory criteria, as applicable. The data review was conducted in accordance with method requirements and laboratory limits using guidance from USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540-R-2017-001 (January 2017).

General Overall Assessment:

- _____ Data are usable without qualification.
- X Data are usable with qualification (noted below).
- _____ Some or all data are unusable for any purpose (detailed below).

Data Review Checklist

Review Parameter	Criteria	Criteria Met?																				
<i>Sample-specific Parameters</i>	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA																		
Chain of Custody, Sample Identification, & Sample Receipt	Samples were received intact and the cooler temperature was <6 degree Celsius upon arrival at the laboratory.	X																				
Holding Times	<div><div>The samples were analyzed within the method required holding times.</div><table><thead><tr><th>Field ID</th><th>Analyte</th></tr></thead><tbody><tr><td>ASH-06</td><td rowspan="15">pH</td></tr><tr><td>PRS-3</td></tr><tr><td>BAT-11</td></tr><tr><td>PRS-2</td></tr><tr><td>ASH-7</td></tr><tr><td>DUP-1</td></tr><tr><td>BAT-12</td></tr><tr><td>BAT-10</td></tr><tr><td>ERB-1</td></tr><tr><td>PZ-5</td></tr><tr><td>PZ-4</td></tr><tr><td>PZ-3</td></tr><tr><td>PZ-2</td></tr><tr><td>PZ-6</td></tr><tr><td>PZ-1</td></tr></tbody></table><div>ID – Identification</div></div>	Field ID	Analyte	ASH-06	pH	PRS-3	BAT-11	PRS-2	ASH-7	DUP-1	BAT-12	BAT-10	ERB-1	PZ-5	PZ-4	PZ-3	PZ-2	PZ-6	PZ-1		X ¹	
Field ID	Analyte																					
ASH-06	pH																					
PRS-3																						
BAT-11																						
PRS-2																						
ASH-7																						
DUP-1																						
BAT-12																						
BAT-10																						
ERB-1																						
PZ-5																						
PZ-4																						
PZ-3																						
PZ-2																						
PZ-6																						
PZ-1																						
Method Blanks (MB)	No target analytes reported in the associated MB.	X																				
Quality Control Samples: Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD)	The LCS/LCSD recoveries were within the laboratory determined acceptance limits.	X																				

Review Parameter	Criteria	Criteria Met?						
<i>Sample-specific Parameters</i>	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA				
Matrix Spike / Matrix Spike Duplicate (MS/MSD)	The recoveries and relative percent differences for the matrix spike and matrix spike duplicate analyses were within the laboratory-determined acceptance ranges. Results in the native sample greater than four times the concentration of the spike added during digestions/extractions are not considered to be a representative measure of accuracy. Further action with respect to spike recovery evaluation or qualification of data was not considered necessary.	X						
Laboratory Duplicate	The laboratory duplicate samples were within the laboratory determined acceptance limits. The following concentration dependent criteria were used to evaluate laboratory duplicates: <ul style="list-style-type: none">When both the sample and duplicate values are >5x the reporting limit (RL), acceptable sampling and analytical precision is indicated by an relative percent difference (RPD) between the results of ≤20%.Where the result for one or both analytes of the method duplicate pair is <5xRL, satisfactory precision is indicated if the absolute difference between the method duplicate results is <1xRL.	X						
Field Duplicate	The field duplicate sample results satisfied the evaluation criteria below: <table><tr><th>Parent Sample</th><th>Field Duplicate</th></tr><tr><td>ASH-7</td><td>DUP-1</td></tr></table> <ul style="list-style-type: none">When both the sample and duplicate values are >5xRL acceptable sampling and analytical precision is indicated by a RPD between the results of ≤30%.Where the result for one or both analytes of the field duplicate pair is <5xRL, satisfactory precision is indicated if the absolute difference between the field duplicate results is <2xRL.	Parent Sample	Field Duplicate	ASH-7	DUP-1	X		
Parent Sample	Field Duplicate							
ASH-7	DUP-1							
Equipment Blanks	One equipment blank was collected with the samples associated with this sampling event. No target analytes reported in the associated equipment blank.	X						
Reporting Limits Met	No samples performed at dilutions or reported as non-detect at elevated method detection limits/reporting limits.	X						
Reporting	No reporting issues were found and further qualification was not considered necessary.		X ²					
Package Completeness	No results were qualified as unusable and the data are 100% complete.	X						
Comments								
1 – The pH analysis was performed 12-13 days outside the holding time criterion of immediate analysis for the samples associated with this data package. Therefore, the pH results for the samples associated with this data package were qualified as estimated (J h).								
2 – The laboratory noted the sulfate continuing calibration associated with sample ERB-1 was outside the acceptance limits.								

Review Parameter	Criteria	Criteria Met?		
<i>Sample-specific Parameters</i>	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA
As the potential bias was considered to be high and the associated sample result was reported as non-detect, qualification was not considered necessary.				

> – Greater Than

% – Percent

LCS – Laboratory Control Sample

MS/MSD – Matrix Spike/Matrix Spike Duplicate

RPD – Relative Percent Difference

< – Less Than

h – Holding Time

LCSD – Laboratory Control Sample Duplicate

NA – Not Applicable

≤ – Less Than or Equal To

J – Estimated

MB – Method Blank

RL – Reporting Limit

May 17, 2019

Geoff Webb
AECOM
6200 South Quebec St
Greenwood Village, CO 80111


RE: Project: PRPA RAWHIDE
Pace Project No.: 60301786

Dear Geoff Webb:

Enclosed are the analytical results for sample(s) received by the laboratory on May 03, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Trudy Gipson for
Heather Wilson
heather.wilson@pacelabs.com
1(913)563-1407
Project Manager

Enclosures

cc: Brian Rothmeyer, AECOM



REPORT OF LABORATORY ANALYSIS

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CERTIFICATIONS

Project: PRPA RAWHIDE

Pace Project No.: 60301786

Kansas Certification IDs

9608 Loiret Boulevard, Lenexa, KS 66219

Arkansas Drinking Water

Missouri Certification Number: 10090

WY STR Certification #: 2456.01

Arkansas Certification #: 19-016-0

Arkansas Drinking Water

Illinois Certification #: 004455

Iowa Certification #: 118

Kansas/NELAP Certification #: E-10116

Louisiana Certification #: 03055

Nevada Certification #: KS000212018-1

Oklahoma Certification #: 9205/9935

Florida: Cert E871149 SEKS WET

Florida: Cert E871149 SEKS WET

Florida: Cert E871149 SEKS WET

Texas Certification #: T104704407-18-11

Utah Certification #: KS000212018-8

Kansas Field Laboratory Accreditation: # E-92587

Missouri Certification: 10070

Missouri Certification Number: 10090

REPORT OF LABORATORY ANALYSIS

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SAMPLE SUMMARY

Project: PRPA RAWHIDE

Pace Project No.: 60301786

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60301786001	BAT-02	Water	04/30/19 09:35	05/03/19 09:00
60301786002	BAT-05	Water	04/30/19 11:35	05/03/19 09:00
60301786003	BAT-06	Water	04/30/19 13:10	05/03/19 09:00
60301786004	BAT-09	Water	05/01/19 09:25	05/03/19 09:00
60301786005	BAT-08	Water	05/01/19 10:35	05/03/19 09:00
60301786006	BAT-01	Water	05/01/19 12:10	05/03/19 09:00
60301786007	ASH-03	Water	05/02/19 09:20	05/03/19 09:00
60301786008	DUP-1	Water	05/02/19 08:00	05/03/19 09:00
60301786009	ASH-01	Water	05/02/19 10:35	05/03/19 09:00
60301786010	BAT-03	Water	05/01/19 14:10	05/03/19 09:00
60301786011	ASH-07	Water	05/02/19 10:35	05/03/19 09:00
60301786012	BAT-04R	Water	05/01/19 15:40	05/03/19 09:00
60301786013	ASH-04	Water	05/02/19 13:55	05/03/19 09:00
60301786014	ASH-05	Water	05/02/19 15:00	05/03/19 09:00

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SAMPLE ANALYTE COUNT

Project: PRPA RAWHIDE

Pace Project No.: 60301786

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60301786001	BAT-02	EPA 6010	HKC	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	LRS	1	PASI-K
		SM 2540C	ZMH	1	PASI-K
		EPA 9056	MGS	3	PASI-K
60301786002	BAT-05	EPA 6010	HKC	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	LRS	1	PASI-K
		SM 2540C	ZMH	1	PASI-K
		EPA 9056	JDS, MGS	3	PASI-K
60301786003	BAT-06	EPA 6010	HKC	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	LRS	1	PASI-K
		SM 2540C	ZMH	1	PASI-K
		EPA 9056	JDS, MGS	3	PASI-K
60301786004	BAT-09	EPA 6010	HKC	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	LRS	1	PASI-K
		SM 2540C	ZMH	1	PASI-K
		EPA 9056	MGS	3	PASI-K
60301786005	BAT-08	EPA 6010	HKC	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	LRS	1	PASI-K
		SM 2540C	ZMH	1	PASI-K
		EPA 9056	JDS, MGS	3	PASI-K
60301786006	BAT-01	EPA 6010	HKC	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	LRS	1	PASI-K
		SM 2540C	ZMH	1	PASI-K
		EPA 9056	MGS	3	PASI-K
60301786007	ASH-03	EPA 6010	HKC	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	LRS	1	PASI-K
		SM 2540C	ZMH	1	PASI-K
		EPA 9056	JDS, MGS	3	PASI-K
60301786008	DUP-1	EPA 6010	HKC	3	PASI-K
		EPA 6020	JGP	11	PASI-K

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SAMPLE ANALYTE COUNT

Project: PRPA RAWHIDE

Pace Project No.: 60301786

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60301786009	ASH-01	EPA 7470	LRS	1	PASI-K
		SM 2540C	ZMH	1	PASI-K
		EPA 9056	JDS, MGS	3	PASI-K
		EPA 6010	HKC	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	LRS	1	PASI-K
		SM 2540C	ZMH	1	PASI-K
60301786010	BAT-03	EPA 9056	JDS, MGS	3	PASI-K
		EPA 6010	HKC	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	LRS	1	PASI-K
		SM 2540C	ZMH	1	PASI-K
60301786011	ASH-07	EPA 9056	MGS	3	PASI-K
		EPA 6010	HKC	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	LRS	1	PASI-K
		SM 2540C	ZMH	1	PASI-K
60301786012	BAT-04R	EPA 9056	MGS	3	PASI-K
		EPA 6010	HKC	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	LRS	1	PASI-K
		SM 2540C	ZMH	1	PASI-K
60301786013	ASH-04	EPA 9056	MGS	3	PASI-K
		EPA 6010	HKC	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	LRS	1	PASI-K
		SM 2540C	ZMH	1	PASI-K
60301786014	ASH-05	EPA 9056	MGS	3	PASI-K
		EPA 6010	HKC	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	LRS	1	PASI-K
		SM 2540C	ZMH	1	PASI-K
		EPA 9056	MGS	3	PASI-K
		EPA 9056	MGS	3	PASI-K

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE

Pace Project No.: 60301786

Sample: BAT-02		Lab ID: 60301786001	Collected: 04/30/19 09:35	Received: 05/03/19 09:00	Matrix: Water			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010						
Boron	1240	ug/L	100	1	05/14/19 11:40	05/15/19 14:59	7440-42-8	
Calcium	110000	ug/L	200	1	05/14/19 11:40	05/15/19 14:59	7440-70-2	
Lithium	96.9	ug/L	10.0	1	05/14/19 11:40	05/15/19 14:59	7439-93-2	
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010						
Antimony	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:37	7440-36-0	
Arsenic	1.2	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:37	7440-38-2	
Barium	14.2	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:37	7440-39-3	
Beryllium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 15:37	7440-41-7	
Cadmium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 15:37	7440-43-9	
Chromium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:37	7440-47-3	
Cobalt	1.7	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:37	7440-48-4	
Lead	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:37	7439-92-1	
Molybdenum	53.4	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:37	7439-98-7	
Selenium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:37	7782-49-2	
Thallium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:37	7440-28-0	
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470						
Mercury	ND	ug/L	0.20	1	05/13/19 14:05	05/14/19 10:02	7439-97-6	
2540C Total Dissolved Solids		Analytical Method: SM 2540C						
Total Dissolved Solids	1720	mg/L	20.0	1		05/07/19 10:02		
9056 IC Anions		Analytical Method: EPA 9056						
Chloride	62.8	mg/L	20.0	20		05/14/19 14:17	16887-00-6	
Fluoride	0.40	mg/L	0.20	1		05/14/19 14:02	16984-48-8	
Sulfate	816	mg/L	100	100		05/14/19 14:33	14808-79-8	

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE

Pace Project No.: 60301786

Sample: BAT-05		Lab ID: 60301786002	Collected: 04/30/19 11:35	Received: 05/03/19 09:00	Matrix: Water			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010						
Boron	984	ug/L	100	1	05/14/19 11:40	05/15/19 15:01	7440-42-8	
Calcium	448000	ug/L	200	1	05/14/19 11:40	05/15/19 15:01	7440-70-2	
Lithium	187	ug/L	10.0	1	05/14/19 11:40	05/15/19 15:01	7439-93-2	
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010						
Antimony	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:39	7440-36-0	
Arsenic	1.1	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:39	7440-38-2	
Barium	16.4	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:39	7440-39-3	
Beryllium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 15:39	7440-41-7	
Cadmium	0.52	ug/L	0.50	1	05/14/19 14:05	05/15/19 15:39	7440-43-9	
Chromium	1.7	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:39	7440-47-3	
Cobalt	26.1	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:39	7440-48-4	
Lead	5.5	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:39	7439-92-1	
Molybdenum	4.4	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:39	7439-98-7	
Selenium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:39	7782-49-2	
Thallium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:39	7440-28-0	
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470						
Mercury	ND	ug/L	0.20	1	05/13/19 14:05	05/14/19 10:04	7439-97-6	
2540C Total Dissolved Solids		Analytical Method: SM 2540C						
Total Dissolved Solids	3740	mg/L	66.7	1		05/07/19 10:03		
9056 IC Anions		Analytical Method: EPA 9056						
Chloride	14.9	mg/L	1.0	1		05/14/19 14:49	16887-00-6	
Fluoride	ND	mg/L	0.20	1		05/14/19 14:49	16984-48-8	
Sulfate	2470	mg/L	200	200		05/16/19 13:56	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE

Pace Project No.: 60301786

Sample: BAT-06		Lab ID: 60301786003	Collected: 04/30/19 13:10	Received: 05/03/19 09:00	Matrix: Water			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010						
Boron	1940	ug/L	100	1	05/14/19 11:40	05/15/19 15:03	7440-42-8	
Calcium	105000	ug/L	200	1	05/14/19 11:40	05/15/19 15:03	7440-70-2	
Lithium	167	ug/L	10.0	1	05/14/19 11:40	05/15/19 15:03	7439-93-2	
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010						
Antimony	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:40	7440-36-0	
Arsenic	1.7	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:40	7440-38-2	
Barium	18.9	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:40	7440-39-3	
Beryllium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 15:40	7440-41-7	
Cadmium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 15:40	7440-43-9	
Chromium	1.8	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:40	7440-47-3	
Cobalt	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:40	7440-48-4	
Lead	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:40	7439-92-1	
Molybdenum	28.5	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:40	7439-98-7	
Selenium	1.0	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:40	7782-49-2	
Thallium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:40	7440-28-0	
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470						
Mercury	ND	ug/L	0.20	1	05/13/19 14:05	05/14/19 10:06	7439-97-6	
2540C Total Dissolved Solids		Analytical Method: SM 2540C						
Total Dissolved Solids	2790	mg/L	66.7	1		05/07/19 10:03		
9056 IC Anions		Analytical Method: EPA 9056						
Chloride	12.9	mg/L	1.0	1		05/14/19 16:08	16887-00-6	
Fluoride	ND	mg/L	0.20	1		05/14/19 16:08	16984-48-8	
Sulfate	1800	mg/L	200	200		05/16/19 14:13	14808-79-8	

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE

Pace Project No.: 60301786

Sample: BAT-09		Lab ID: 60301786004	Collected: 05/01/19 09:25	Received: 05/03/19 09:00	Matrix: Water			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010						
Boron	2110	ug/L	100	1	05/14/19 11:40	05/15/19 15:05	7440-42-8	
Calcium	199000	ug/L	200	1	05/14/19 11:40	05/15/19 15:05	7440-70-2	
Lithium	209	ug/L	10.0	1	05/14/19 11:40	05/15/19 15:05	7439-93-2	
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010						
Antimony	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:42	7440-36-0	
Arsenic	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:42	7440-38-2	
Barium	19.3	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:42	7440-39-3	
Beryllium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 15:42	7440-41-7	
Cadmium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 15:42	7440-43-9	
Chromium	1.6	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:42	7440-47-3	
Cobalt	1.4	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:42	7440-48-4	
Lead	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:42	7439-92-1	
Molybdenum	9.6	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:42	7439-98-7	
Selenium	1.5	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:42	7782-49-2	
Thallium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:42	7440-28-0	
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470						
Mercury	ND	ug/L	0.20	1	05/13/19 14:05	05/14/19 10:09	7439-97-6	
2540C Total Dissolved Solids		Analytical Method: SM 2540C						
Total Dissolved Solids	3030	mg/L	66.7	1		05/07/19 11:41		
9056 IC Anions		Analytical Method: EPA 9056						
Chloride	29.1	mg/L	10.0	10		05/14/19 16:55	16887-00-6	
Fluoride	ND	mg/L	0.20	1		05/14/19 16:39	16984-48-8	
Sulfate	29.5	mg/L	10.0	10		05/14/19 16:55	14808-79-8	

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE

Pace Project No.: 60301786

Sample: BAT-08		Lab ID: 60301786005	Collected: 05/01/19 10:35	Received: 05/03/19 09:00	Matrix: Water			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010						
Boron	2060	ug/L	100	1	05/14/19 11:40	05/15/19 15:07	7440-42-8	
Calcium	29600	ug/L	200	1	05/14/19 11:40	05/15/19 15:07	7440-70-2	
Lithium	95.1	ug/L	10.0	1	05/14/19 11:40	05/15/19 15:07	7439-93-2	
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010						
Antimony	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:44	7440-36-0	
Arsenic	2.3	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:44	7440-38-2	
Barium	34.8	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:44	7440-39-3	
Beryllium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 15:44	7440-41-7	
Cadmium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 15:44	7440-43-9	
Chromium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:44	7440-47-3	
Cobalt	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:44	7440-48-4	
Lead	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:44	7439-92-1	
Molybdenum	18.8	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:44	7439-98-7	
Selenium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:44	7782-49-2	
Thallium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:44	7440-28-0	
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470						
Mercury	ND	ug/L	0.20	1	05/13/19 14:05	05/14/19 10:16	7439-97-6	
2540C Total Dissolved Solids		Analytical Method: SM 2540C						
Total Dissolved Solids	1300	mg/L	13.3	1		05/07/19 11:42		
9056 IC Anions		Analytical Method: EPA 9056						
Chloride	17.2	mg/L	5.0	5		05/16/19 12:14	16887-00-6	
Fluoride	0.34	mg/L	0.20	1		05/14/19 17:26	16984-48-8	
Sulfate	145	mg/L	50.0	50		05/14/19 17:42	14808-79-8	

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE

Pace Project No.: 60301786

Sample: BAT-01		Lab ID: 60301786006	Collected: 05/01/19 12:10	Received: 05/03/19 09:00	Matrix: Water			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010						
Boron	1580	ug/L	100	1	05/14/19 11:40	05/15/19 15:10	7440-42-8	
Calcium	44100	ug/L	200	1	05/14/19 11:40	05/15/19 15:10	7440-70-2	
Lithium	109	ug/L	10.0	1	05/14/19 11:40	05/15/19 15:10	7439-93-2	
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010						
Antimony	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:46	7440-36-0	
Arsenic	1.5	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:46	7440-38-2	
Barium	32.5	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:46	7440-39-3	
Beryllium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 15:46	7440-41-7	
Cadmium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 15:46	7440-43-9	
Chromium	2.1	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:46	7440-47-3	
Cobalt	2.3	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:46	7440-48-4	
Lead	1.8	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:46	7439-92-1	
Molybdenum	14.4	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:46	7439-98-7	
Selenium	1.8	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:46	7782-49-2	
Thallium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:46	7440-28-0	
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470						
Mercury	ND	ug/L	0.20	1	05/13/19 14:05	05/14/19 10:18	7439-97-6	
2540C Total Dissolved Solids		Analytical Method: SM 2540C						
Total Dissolved Solids	1080	mg/L	13.3	1		05/07/19 11:42		
9056 IC Anions		Analytical Method: EPA 9056						
Chloride	11.9	mg/L	1.0	1		05/14/19 17:58	16887-00-6	
Fluoride	0.47	mg/L	0.20	1		05/14/19 17:58	16984-48-8	
Sulfate	50.3	mg/L	5.0	5		05/14/19 18:14	14808-79-8	

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE

Pace Project No.: 60301786

Sample: ASH-03		Lab ID: 60301786007		Collected: 05/02/19 09:20		Received: 05/03/19 09:00		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	811	ug/L	100	1	05/14/19 11:40	05/15/19 15:12	7440-42-8	M1	
Calcium	431000	ug/L	200	1	05/14/19 11:40	05/15/19 15:12	7440-70-2	M1	
Lithium	390	ug/L	10.0	1	05/14/19 11:40	05/15/19 15:12	7439-93-2		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:48	7440-36-0		
Arsenic	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:48	7440-38-2		
Barium	13.3	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:48	7440-39-3	M1	
Beryllium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 15:48	7440-41-7	M1	
Cadmium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 15:48	7440-43-9		
Chromium	1.8	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:48	7440-47-3		
Cobalt	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:48	7440-48-4		
Lead	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:48	7439-92-1		
Molybdenum	1.2	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:48	7439-98-7		
Selenium	96.6	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:48	7782-49-2	M1	
Thallium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:48	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	05/13/19 14:05	05/14/19 10:20	7439-97-6		
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	4230	mg/L	100	1		05/09/19 14:00		D6	
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	86.8	mg/L	5.0	5		05/15/19 15:30	16887-00-6		
Fluoride	ND	mg/L	0.20	1		05/16/19 12:31	16984-48-8		
Sulfate	3400	mg/L	500	500		05/14/19 20:52	14808-79-8		

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE

Pace Project No.: 60301786

Sample: DUP-1		Lab ID: 60301786008	Collected: 05/02/19 08:00	Received: 05/03/19 09:00	Matrix: Water			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010						
Boron	791	ug/L	100	1	05/14/19 11:40	05/15/19 15:19	7440-42-8	
Calcium	416000	ug/L	200	1	05/14/19 11:40	05/15/19 15:19	7440-70-2	
Lithium	384	ug/L	10.0	1	05/14/19 11:40	05/15/19 15:19	7439-93-2	
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010						
Antimony	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:57	7440-36-0	
Arsenic	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:57	7440-38-2	
Barium	11.9	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:57	7440-39-3	
Beryllium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 15:57	7440-41-7	
Cadmium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 15:57	7440-43-9	
Chromium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:57	7440-47-3	
Cobalt	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:57	7440-48-4	
Lead	ND	ug/L	2.0	2	05/14/19 14:05	05/15/19 16:49	7439-92-1	D3
Molybdenum	1.1	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:57	7439-98-7	
Selenium	99.0	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:57	7782-49-2	
Thallium	ND	ug/L	2.0	2	05/14/19 14:05	05/15/19 16:49	7440-28-0	D3
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470						
Mercury	ND	ug/L	0.20	1	05/13/19 14:05	05/14/19 10:27	7439-97-6	
2540C Total Dissolved Solids		Analytical Method: SM 2540C						
Total Dissolved Solids	5110	mg/L	100	1		05/07/19 11:44		
9056 IC Anions		Analytical Method: EPA 9056						
Chloride	87.4	mg/L	5.0	5		05/14/19 22:27	16887-00-6	
Fluoride	ND	mg/L	0.20	1		05/14/19 22:11	16984-48-8	
Sulfate	3680	mg/L	500	500		05/15/19 13:57	14808-79-8	

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE

Pace Project No.: 60301786

Sample: ASH-01		Lab ID: 60301786009		Collected: 05/02/19 10:35		Received: 05/03/19 09:00		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	489	ug/L	100	1	05/14/19 11:40	05/15/19 15:25	7440-42-8		
Calcium	363000	ug/L	200	1	05/14/19 11:40	05/15/19 15:25	7440-70-2		
Lithium	398	ug/L	10.0	1	05/14/19 11:40	05/15/19 15:25	7439-93-2		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:59	7440-36-0		
Arsenic	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:59	7440-38-2		
Barium	8.3	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:59	7440-39-3		
Beryllium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 15:59	7440-41-7		
Cadmium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 15:59	7440-43-9		
Chromium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:59	7440-47-3		
Cobalt	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:59	7440-48-4		
Lead	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:59	7439-92-1		
Molybdenum	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:59	7439-98-7		
Selenium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:59	7782-49-2		
Thallium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 15:59	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	05/13/19 14:05	05/14/19 10:29	7439-97-6		
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	3250	mg/L	40.0	1		05/07/19 11:44			
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	20.2	mg/L	2.0	2		05/15/19 16:17	16887-00-6		
Fluoride	ND	mg/L	0.20	1		05/14/19 22:59	16984-48-8		
Sulfate	ND	mg/L	1.0	1		05/14/19 22:59	14808-79-8		

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE

Pace Project No.: 60301786

Sample: BAT-03		Lab ID: 60301786010		Collected: 05/01/19 14:10		Received: 05/03/19 09:00		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	1470	ug/L	100	1	05/14/19 11:40	05/15/19 15:28	7440-42-8		
Calcium	452000	ug/L	200	1	05/14/19 11:40	05/15/19 15:28	7440-70-2		
Lithium	289	ug/L	10.0	1	05/14/19 11:40	05/15/19 15:28	7439-93-2		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:01	7440-36-0		
Arsenic	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:01	7440-38-2		
Barium	21.2	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:01	7440-39-3		
Beryllium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 16:01	7440-41-7		
Cadmium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 16:01	7440-43-9		
Chromium	1.7	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:01	7440-47-3		
Cobalt	4.3	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:01	7440-48-4		
Lead	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:01	7439-92-1		
Molybdenum	1.3	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:01	7439-98-7		
Selenium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:01	7782-49-2		
Thallium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:01	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	05/13/19 14:05	05/14/19 10:32	7439-97-6		
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	4520	mg/L	66.7	1		05/07/19 11:43			
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	13.5	mg/L	1.0	1		05/14/19 23:31	16887-00-6		
Fluoride	ND	mg/L	0.20	1		05/14/19 23:31	16984-48-8		
Sulfate	2990	mg/L	200	200		05/14/19 23:47	14808-79-8		

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE

Pace Project No.: 60301786

Sample: ASH-07		Lab ID: 60301786011		Collected: 05/02/19 10:35		Received: 05/03/19 09:00		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	686	ug/L	100	1	05/14/19 11:40	05/15/19 15:30	7440-42-8		
Calcium	421000	ug/L	200	1	05/14/19 11:40	05/15/19 15:30	7440-70-2		
Lithium	549	ug/L	10.0	1	05/14/19 11:40	05/15/19 15:30	7439-93-2		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:03	7440-36-0		
Arsenic	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:03	7440-38-2		
Barium	20.4	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:03	7440-39-3		
Beryllium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 16:03	7440-41-7		
Cadmium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 16:03	7440-43-9		
Chromium	1.5	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:03	7440-47-3		
Cobalt	1.8	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:03	7440-48-4		
Lead	ND	ug/L	2.0	2	05/14/19 14:05	05/15/19 16:27	7439-92-1	D3	
Molybdenum	2.0	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:03	7439-98-7		
Selenium	68.8	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:03	7782-49-2		
Thallium	ND	ug/L	2.0	2	05/14/19 14:05	05/15/19 16:27	7440-28-0	D3	
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	05/13/19 14:05	05/14/19 10:34	7439-97-6		
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	5740	mg/L	100	1		05/07/19 11:44			
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	67.7	mg/L	10.0	10		05/15/19 00:18	16887-00-6		
Fluoride	ND	mg/L	0.20	1		05/15/19 00:03	16984-48-8		
Sulfate	3850	mg/L	200	200		05/15/19 00:34	14808-79-8		

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE

Pace Project No.: 60301786

Sample: BAT-04R		Lab ID: 60301786012	Collected: 05/01/19 15:40	Received: 05/03/19 09:00	Matrix: Water			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010						
Boron	737	ug/L	100	1	05/14/19 11:40	05/15/19 15:33	7440-42-8	
Calcium	485000	ug/L	200	1	05/14/19 11:40	05/15/19 15:33	7440-70-2	
Lithium	167	ug/L	10.0	1	05/14/19 11:40	05/15/19 15:33	7439-93-2	
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010						
Antimony	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:05	7440-36-0	
Arsenic	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:05	7440-38-2	
Barium	26.2	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:05	7440-39-3	
Beryllium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 16:05	7440-41-7	
Cadmium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 16:05	7440-43-9	
Chromium	1.5	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:05	7440-47-3	
Cobalt	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:05	7440-48-4	
Lead	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:05	7439-92-1	
Molybdenum	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:05	7439-98-7	
Selenium	28.4	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:05	7782-49-2	
Thallium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:05	7440-28-0	
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470						
Mercury	ND	ug/L	0.20	1	05/13/19 14:05	05/14/19 10:36	7439-97-6	
2540C Total Dissolved Solids		Analytical Method: SM 2540C						
Total Dissolved Solids	3040	mg/L	40.0	1		05/07/19 11:43		
9056 IC Anions		Analytical Method: EPA 9056						
Chloride	42.0	mg/L	5.0	5		05/15/19 01:38	16887-00-6	
Fluoride	ND	mg/L	0.20	1		05/15/19 01:22	16984-48-8	
Sulfate	1970	mg/L	200	200		05/15/19 01:54	14808-79-8	

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE

Pace Project No.: 60301786

Sample: ASH-04		Lab ID: 60301786013	Collected: 05/02/19 13:55		Received: 05/03/19 09:00		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010						
Boron	623	ug/L	100	1	05/14/19 11:40	05/15/19 15:35	7440-42-8	
Calcium	441000	ug/L	200	1	05/14/19 11:40	05/15/19 15:35	7440-70-2	
Lithium	346	ug/L	10.0	1	05/14/19 11:40	05/15/19 15:35	7439-93-2	
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010						
Antimony	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:07	7440-36-0	
Arsenic	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:07	7440-38-2	
Barium	11.3	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:07	7440-39-3	
Beryllium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 16:07	7440-41-7	
Cadmium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 16:07	7440-43-9	
Chromium	1.2	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:07	7440-47-3	
Cobalt	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:07	7440-48-4	
Lead	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:07	7439-92-1	
Molybdenum	1.4	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:07	7439-98-7	
Selenium	62.8	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:07	7782-49-2	
Thallium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:07	7440-28-0	
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470						
Mercury	ND	ug/L	0.20	1	05/13/19 14:05	05/14/19 10:43	7439-97-6	
2540C Total Dissolved Solids		Analytical Method: SM 2540C						
Total Dissolved Solids	5380	mg/L	100	1		05/07/19 11:45		
9056 IC Anions		Analytical Method: EPA 9056						
Chloride	190	mg/L	20.0	20		05/15/19 02:41	16887-00-6	
Fluoride	0.29	mg/L	0.20	1		05/15/19 02:09	16984-48-8	
Sulfate	3320	mg/L	200	200		05/15/19 03:13	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE

Pace Project No.: 60301786

Sample: ASH-05		Lab ID: 60301786014	Collected: 05/02/19 15:00	Received: 05/03/19 09:00	Matrix: Water			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010						
Boron	784	ug/L	100	1	05/14/19 11:40	05/15/19 15:37	7440-42-8	
Calcium	503000	ug/L	200	1	05/14/19 11:40	05/15/19 15:37	7440-70-2	
Lithium	289	ug/L	10.0	1	05/14/19 11:40	05/15/19 15:37	7439-93-2	
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010						
Antimony	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:09	7440-36-0	
Arsenic	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:09	7440-38-2	
Barium	14.8	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:09	7440-39-3	
Beryllium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 16:09	7440-41-7	
Cadmium	ND	ug/L	0.50	1	05/14/19 14:05	05/15/19 16:09	7440-43-9	
Chromium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:09	7440-47-3	
Cobalt	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:09	7440-48-4	
Lead	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:09	7439-92-1	
Molybdenum	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:09	7439-98-7	
Selenium	81.5	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:09	7782-49-2	
Thallium	ND	ug/L	1.0	1	05/14/19 14:05	05/15/19 16:09	7440-28-0	
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470						
Mercury	ND	ug/L	0.20	1	05/13/19 14:05	05/14/19 10:45	7439-97-6	
2540C Total Dissolved Solids		Analytical Method: SM 2540C						
Total Dissolved Solids	4620	mg/L	66.7	1		05/07/19 11:45		
9056 IC Anions		Analytical Method: EPA 9056						
Chloride	219	mg/L	20.0	20		05/15/19 03:45	16887-00-6	
Fluoride	ND	mg/L	0.20	1		05/15/19 04:32	16984-48-8	
Sulfate	2680	mg/L	200	200		05/15/19 04:48	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE

Pace Project No.: 60301786

QC Batch:	583893	Analysis Method:	EPA 7470
QC Batch Method:	EPA 7470	Analysis Description:	7470 Mercury
Associated Lab Samples:	60301786001, 60301786002, 60301786003, 60301786004, 60301786005, 60301786006, 60301786007, 60301786008, 60301786009, 60301786010, 60301786011, 60301786012, 60301786013, 60301786014		

METHOD BLANK: 2395835 Matrix: Water
Associated Lab Samples: 60301786001, 60301786002, 60301786003, 60301786004, 60301786005, 60301786006, 60301786007, 60301786008, 60301786009, 60301786010, 60301786011, 60301786012, 60301786013, 60301786014

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	05/14/19 09:45	

LABORATORY CONTROL SAMPLE: 2395836

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	5	5.7	113	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2395837 2395838

Parameter	Units	60301786007 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	5	5	5.5	5.5	109	110	75-125	0	20	

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE

Pace Project No.: 60301786

QC Batch:	584388	Analysis Method:	EPA 6010
QC Batch Method:	EPA 3010	Analysis Description:	6010 MET
Associated Lab Samples:	60301786001, 60301786002, 60301786003, 60301786004, 60301786005, 60301786006, 60301786007, 60301786008, 60301786009, 60301786010, 60301786011, 60301786012, 60301786013, 60301786014		

METHOD BLANK:	2398136	Matrix:	Water
Associated Lab Samples:	60301786001, 60301786002, 60301786003, 60301786004, 60301786005, 60301786006, 60301786007, 60301786008, 60301786009, 60301786010, 60301786011, 60301786012, 60301786013, 60301786014		

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	ug/L	ND	100	05/15/19 14:50	
Calcium	ug/L	ND	200	05/15/19 14:50	
Lithium	ug/L	ND	10.0	05/15/19 14:50	

LABORATORY CONTROL SAMPLE: 2398137

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	1000	1000	100	80-120	
Calcium	ug/L	10000	10300	103	80-120	
Lithium	ug/L	1000	1040	104	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2398138 2398139

Parameter	Units	60301786007 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	811	1000	1000	1500	1500	69	69	75-125	0	20	M1
Calcium	ug/L	431000	10000	10000	373000	371000	-576	-599	75-125	1	20	M1
Lithium	ug/L	390	1000	1000	1410	1410	102	102	75-125	0	20	

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE

Pace Project No.: 60301786

MATRIX SPIKE & MATRIX SPIKE DUPLICATE:												
2398394					2398395							
Parameter	Units	60301786007	MS	MSD	MS	MSD	MS	MSD	% Rec	RPD	Max	Qual
		Result	Spike Conc.	Spike Conc.									Result	Result	% Rec	% Rec	Limits
Cobalt	ug/L	ND	40	40	44.2	43.9	109	108	75-125	1	20	
Lead	ug/L	ND	40	40	32.6	32.9	81	81	75-125	1	20	
Molybdenum	ug/L	1.2	40	40	44.6	44.4	108	108	75-125	0	20	
Selenium	ug/L	96.6	40	40	111	114	37	44	75-125	3	20	M1
Thallium	ug/L	ND	40	40	32.0	32.4	80	81	75-125	1	20	

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE

Pace Project No.: 60301786

QC Batch:	582881	Analysis Method:	SM 2540C
QC Batch Method:	SM 2540C	Analysis Description:	2540C Total Dissolved Solids
Associated Lab Samples:	60301786001, 60301786002, 60301786003		

METHOD BLANK: 2392180 Matrix: Water

Associated Lab Samples: 60301786001, 60301786002, 60301786003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	5.0	05/07/19 09:57	

LABORATORY CONTROL SAMPLE: 2392181

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	1000	100	80-120	

SAMPLE DUPLICATE: 2392182

Parameter	Units	60301548001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	559	550	2	10	

SAMPLE DUPLICATE: 2392183

Parameter	Units	60301568002 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	395	397	1	10	

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE

Pace Project No.: 60301786

QC Batch:	583023	Analysis Method:	SM 2540C
QC Batch Method:	SM 2540C	Analysis Description:	2540C Total Dissolved Solids
Associated Lab Samples:	60301786004, 60301786005, 60301786006, 60301786008, 60301786009, 60301786010, 60301786011, 60301786012, 60301786013, 60301786014		

METHOD BLANK: 2392616 Matrix: Water
Associated Lab Samples: 60301786004, 60301786005, 60301786006, 60301786008, 60301786009, 60301786010, 60301786011, 60301786012, 60301786013, 60301786014

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	5.0	05/07/19 11:38	

LABORATORY CONTROL SAMPLE: 2392617

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	1000	100	80-120	

SAMPLE DUPLICATE: 2392618

Parameter	Units	60301676008 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	847	844	0	10	

SAMPLE DUPLICATE: 2392619

Parameter	Units	60301786006 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	1080	1130	4	10	

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE

Pace Project No.: 60301786

QC Batch: 583514

Analysis Method: SM 2540C

QC Batch Method: SM 2540C

Analysis Description: 2540C Total Dissolved Solids

Associated Lab Samples: 60301786007

METHOD BLANK: 2394354

Matrix: Water

Associated Lab Samples: 60301786007

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	5.0	05/09/19 13:57	

LABORATORY CONTROL SAMPLE: 2394355

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	996	100	80-120	

SAMPLE DUPLICATE: 2394356

Parameter	Units	60301670001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	314	308	2	10	

SAMPLE DUPLICATE: 2394357

Parameter	Units	60301786007 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	4230	4720	11	10	D6

SAMPLE DUPLICATE: 2394358

Parameter	Units	60301804001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	664	670	1	10	

SAMPLE DUPLICATE: 2394359

Parameter	Units	60301827001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	2220	2260	2	10	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE

Pace Project No.: 60301786

QC Batch:	584420	Analysis Method:	EPA 9056
QC Batch Method:	EPA 9056	Analysis Description:	9056 IC Anions
Associated Lab Samples:	60301786001, 60301786002, 60301786003, 60301786004, 60301786005, 60301786006, 60301786007, 60301786008, 60301786009, 60301786010, 60301786011, 60301786012, 60301786013, 60301786014		

METHOD BLANK:	2398248	Matrix:	Water
Associated Lab Samples:	60301786001, 60301786002, 60301786003, 60301786004, 60301786005, 60301786006, 60301786007, 60301786008, 60301786009, 60301786010, 60301786011, 60301786012, 60301786013, 60301786014		

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	05/14/19 09:58	
Fluoride	mg/L	ND	0.20	05/14/19 09:58	
Sulfate	mg/L	ND	1.0	05/14/19 09:58	

LABORATORY CONTROL SAMPLE:		2398249				
Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.7	95	80-120	
Fluoride	mg/L	2.5	2.3	91	80-120	
Sulfate	mg/L	5	4.9	97	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE:		2398250		2398251								
Parameter	Units	60301786007 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Sulfate	mg/L	3400	2500	2500	5960	5960	103	103	80-120	0	15	

SAMPLE DUPLICATE: 2398252						
		60301786013	Dup		Max	
Parameter	Units	Result	Result	RPD	RPD	Qualifiers
Chloride	mg/L	190	191	0	15	
Fluoride	mg/L	0.29	0.29	0	15	
Sulfate	mg/L	3320	3550	7	15	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE

Pace Project No.: 60301786

QC Batch:	584699	Analysis Method:	EPA 9056
QC Batch Method:	EPA 9056	Analysis Description:	9056 IC Anions
Associated Lab Samples:	60301786007, 60301786008, 60301786009		

METHOD BLANK: 2399198 Matrix: Water

Associated Lab Samples: 60301786007, 60301786008, 60301786009

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	05/15/19 10:05	
Sulfate	mg/L	ND	1.0	05/15/19 10:05	

LABORATORY CONTROL SAMPLE: 2399199

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	5.0	99	80-120	
Sulfate	mg/L	5	5.4	107	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2399200 2399201

Parameter	Units	60301786007 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	86.8	25	25	108	108	85	84	80-120	0	15	E

MATRIX SPIKE SAMPLE: 2399207

Parameter	Units	60301827001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	44.5	25	71.1	107	80-120	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE

Pace Project No.: 60301786

QC Batch: 584971 Analysis Method: EPA 9056
QC Batch Method: EPA 9056 Analysis Description: 9056 IC Anions
Associated Lab Samples: 60301786002, 60301786003, 60301786005, 60301786007

METHOD BLANK: 2400386 Matrix: Water
Associated Lab Samples: 60301786002, 60301786003, 60301786005, 60301786007

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	05/16/19 09:49	
Fluoride	mg/L	ND	0.20	05/16/19 09:49	
Sulfate	mg/L	ND	1.0	05/16/19 09:49	

LABORATORY CONTROL SAMPLE: 2400387

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.7	94	80-120	
Fluoride	mg/L	2.5	2.4	94	80-120	
Sulfate	mg/L	5	5.1	102	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2400389 2400390

Parameter	Units	60301786007 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	86.8	5	5	99.4	99.5	96	97	80-120	0	15	
Fluoride	mg/L	ND	2.5	2.5	2.3	2.3	88	87	80-120	1	15	

SAMPLE DUPLICATE: 2400388

Parameter	Units	60301786003 Result	Dup Result	RPD	Max RPD	Qualifiers
Chloride	mg/L	10.6	10.6	1	15	
Fluoride	mg/L	ND	.36J		15	
Sulfate	mg/L	1800	1700	5	15	

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REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: PRPA RAWHIDE

Pace Project No.: 60301786

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K Pace Analytical Services - Kansas City

ANALYTE QUALIFIERS

D3 Sample was diluted due to the presence of high levels of non-target analytes or other matrix interference.

D6 The precision between the sample and sample duplicate exceeded laboratory control limits.

E Analyte concentration exceeded the calibration range. The reported result is estimated.

M1 Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: PRPA RAWHIDE

Pace Project No.: 60301786

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60301786001	BAT-02	EPA 3010	584388	EPA 6010	584444
60301786002	BAT-05	EPA 3010	584388	EPA 6010	584444
60301786003	BAT-06	EPA 3010	584388	EPA 6010	584444
60301786004	BAT-09	EPA 3010	584388	EPA 6010	584444
60301786005	BAT-08	EPA 3010	584388	EPA 6010	584444
60301786006	BAT-01	EPA 3010	584388	EPA 6010	584444
60301786007	ASH-03	EPA 3010	584388	EPA 6010	584444
60301786008	DUP-1	EPA 3010	584388	EPA 6010	584444
60301786009	ASH-01	EPA 3010	584388	EPA 6010	584444
60301786010	BAT-03	EPA 3010	584388	EPA 6010	584444
60301786011	ASH-07	EPA 3010	584388	EPA 6010	584444
60301786012	BAT-04R	EPA 3010	584388	EPA 6010	584444
60301786013	ASH-04	EPA 3010	584388	EPA 6010	584444
60301786014	ASH-05	EPA 3010	584388	EPA 6010	584444
60301786001	BAT-02	EPA 3010	584468	EPA 6020	584629
60301786002	BAT-05	EPA 3010	584468	EPA 6020	584629
60301786003	BAT-06	EPA 3010	584468	EPA 6020	584629
60301786004	BAT-09	EPA 3010	584468	EPA 6020	584629
60301786005	BAT-08	EPA 3010	584468	EPA 6020	584629
60301786006	BAT-01	EPA 3010	584468	EPA 6020	584629
60301786007	ASH-03	EPA 3010	584468	EPA 6020	584629
60301786008	DUP-1	EPA 3010	584468	EPA 6020	584629
60301786009	ASH-01	EPA 3010	584468	EPA 6020	584629
60301786010	BAT-03	EPA 3010	584468	EPA 6020	584629
60301786011	ASH-07	EPA 3010	584468	EPA 6020	584629
60301786012	BAT-04R	EPA 3010	584468	EPA 6020	584629
60301786013	ASH-04	EPA 3010	584468	EPA 6020	584629
60301786014	ASH-05	EPA 3010	584468	EPA 6020	584629
60301786001	BAT-02	EPA 7470	583893	EPA 7470	584260
60301786002	BAT-05	EPA 7470	583893	EPA 7470	584260
60301786003	BAT-06	EPA 7470	583893	EPA 7470	584260
60301786004	BAT-09	EPA 7470	583893	EPA 7470	584260
60301786005	BAT-08	EPA 7470	583893	EPA 7470	584260
60301786006	BAT-01	EPA 7470	583893	EPA 7470	584260
60301786007	ASH-03	EPA 7470	583893	EPA 7470	584260
60301786008	DUP-1	EPA 7470	583893	EPA 7470	584260
60301786009	ASH-01	EPA 7470	583893	EPA 7470	584260
60301786010	BAT-03	EPA 7470	583893	EPA 7470	584260
60301786011	ASH-07	EPA 7470	583893	EPA 7470	584260
60301786012	BAT-04R	EPA 7470	583893	EPA 7470	584260
60301786013	ASH-04	EPA 7470	583893	EPA 7470	584260
60301786014	ASH-05	EPA 7470	583893	EPA 7470	584260
60301786001	BAT-02	SM 2540C	582881		
60301786002	BAT-05	SM 2540C	582881		
60301786003	BAT-06	SM 2540C	582881		
60301786004	BAT-09	SM 2540C	583023		
60301786005	BAT-08	SM 2540C	583023		

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: PRPA RAWHIDE

Pace Project No.: 60301786

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60301786006	BAT-01	SM 2540C	583023		
60301786007	ASH-03	SM 2540C	583514		
60301786008	DUP-1	SM 2540C	583023		
60301786009	ASH-01	SM 2540C	583023		
60301786010	BAT-03	SM 2540C	583023		
60301786011	ASH-07	SM 2540C	583023		
60301786012	BAT-04R	SM 2540C	583023		
60301786013	ASH-04	SM 2540C	583023		
60301786014	ASH-05	SM 2540C	583023		
60301786001	BAT-02	EPA 9056	584420		
60301786002	BAT-05	EPA 9056	584420		
60301786002	BAT-05	EPA 9056	584971		
60301786003	BAT-06	EPA 9056	584420		
60301786003	BAT-06	EPA 9056	584971		
60301786004	BAT-09	EPA 9056	584420		
60301786005	BAT-08	EPA 9056	584420		
60301786005	BAT-08	EPA 9056	584971		
60301786006	BAT-01	EPA 9056	584420		
60301786007	ASH-03	EPA 9056	584420		
60301786007	ASH-03	EPA 9056	584699		
60301786007	ASH-03	EPA 9056	584971		
60301786008	DUP-1	EPA 9056	584420		
60301786008	DUP-1	EPA 9056	584699		
60301786009	ASH-01	EPA 9056	584420		
60301786009	ASH-01	EPA 9056	584699		
60301786010	BAT-03	EPA 9056	584420		
60301786011	ASH-07	EPA 9056	584420		
60301786012	BAT-04R	EPA 9056	584420		
60301786013	ASH-04	EPA 9056	584420		
60301786014	ASH-05	EPA 9056	584420		

REPORT OF LABORATORY ANALYSIS

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Sample Condition Upon Receipt

WO#: 60301786



Client Name: Accom

Courier: FedEx ☒ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☐ Client ☐ Other ☐

Tracking #: 2174682451226 Pace Shipping Label Used? Yes ☐ No ☒

Custody Seal on Cooler/Box Present: Yes ☒ No ☐ Seals intact: Yes ☒ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☒ Foam ☐ None ☐ Other ☐

Thermometer Used: 1-296 Type of Ice: Wet ☒ Blue ☐ None ☐

Cooler Temperature (°C): As-read 2.2, 3.5 Corr. Factor 1.0 Corrected 1.2, 2.5

Date and initials of person examining contents: 5/3/19

Temperature should be above freezing to 6°C 2174682451226, 2174682451226

Chain of Custody present:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Chain of Custody relinquished:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Samples arrived within holding time:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Short Hold Time analyses (<72hr):	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	
Rush Turn Around Time requested:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	
Sufficient volume:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Correct containers used:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Pace containers used:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Containers intact:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Filtered volume received for dissolved tests?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Sample labels match COC: Date / time / ID / analyses	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Samples contain multiple phases? Matrix: <u>WFT</u>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	
Containers requiring pH preservation in compliance? (HNO ₃ , H ₂ SO ₄ , HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added.
Cyanide water sample checks:		
Lead acetate strip turns dark? (Record only)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Potassium iodide test strip turns blue/purple? (Preserve)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Trip Blank present:	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Headspace in VOA vials (>6mm):	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Samples from USDA Regulated Area: State:	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	

Client Notification/ Resolution:

Copy COC to Client? Y ☒ N ☐

Field Data Required? Y ☐ N ☐

Person Contacted: _____ Date/Time: _____

Comments/ Resolution: _____

Project Manager Review: _____

Date: _____

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A

Required Client Information:

Company: AECOM
Address: 6200 South Quebec St
Greenwood Village, CO 80111
Email To: brian.rothmeyer@aecom.com
Phone: (303) 740-2614 Fax:
Requested Due Date/TAT: Standard

Section B

Required Project Information:

Report To: Geoff Webb
Copy To: Brian Rothmeyer
Purchase Order No.:
Project Name: PRPA Rawhide
Project Number:

Section C

Invoice Information:

Attention: Accounts Payable
Company Name: AECOM
Address: Same as Section A
Pace Quote Reference: 42700
Pace Project Manager: Heather Wilson
Pace Profile #: 11033, 3

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☒ OTHER CCR

Site Location

STATE: CO

ITEM #	Section D Required Client Information	Valid Matrix Codes MATRIX CODE DRINKING WATER DW WASTE WATER WW WASTE WATER PRODUCT P SOIL/SOLID OIL WIPE AIR OTHER TISSUE	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED				SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives								Analysis Test ↑	Y/N ↑	Requested Analysis Filtered (Y/N)												Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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1	BAT-02		WT G	G			4-30-19	09:35		3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

ADDITIONAL COMMENTS: Guilluff / AECOM
RELINQUISHED BY / AFFILIATION: Guilluff
DATE: 5-2-19 TIME: 1030
ACCEPTED BY / AFFILIATION: ARL
DATE: 5/13/19 TIME: 0900
SAMPLE CONDITIONS: ✓
Temp in °C: 8.2
Received on: 5/13/19
Cooler (Y/N): ✓
Custody Sealed (Y/N): ✓
Samples Intact (Y/N): ✓

SAMPLER NAME AND SIGNATURE: Jessie Woodruff
PRINT Name of SAMPLER: Jessie Woodruff
SIGNATURE of SAMPLER: Jessie Woodruff
DATE Signed (MM/DD/YYYY): 5-2-19

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:	
Company:	AECOM	Report To:	Geoff Webb	Attention:	Accounts Payable
Address:	6200 South Quebec St Greenwood Village, CO 80111	Copy To:	Brian Rothmeyer	Company Name:	AECOM
Email To:	brian.rothmeyer@aecom.com	Purchase Order No.:		Address:	Same as Section A
Phone:	(303) 740-2614	Project Name:	PRPA Rawhide	Pace Quote Reference:	42700
Requested Due Date/TAT:	Standard	Project Number:		Pace Project Manager:	Heather Wilson
				Pace Profile #:	11033, 3

Section D Required Client Information		Valid Matrix Codes		COLLECTED		SAMPLE TYPE (G=GRAB C=COMP)		MATRIX CODE (see valid codes to left)		RELINQUISHED BY / AFFILIATION		DATE		TIME		ACCEPTED BY / AFFILIATION		DATE		TIME		SAMPLE CONDITIONS		
ITEM #	SAMPLE ID (A-Z 0-9 / -)	MATRIX	CODE	COMPOSITE START	COMPOSITE END/GRAB	DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME	
1	ASH-04	DRINKING WATER	DW			5-2-19	1355	WT G		5-2-19	1630	5-2-19	1630	5-2-19	1630	5-2-19	1630	5-2-19	1630	5-2-19	1630	5-2-19	1630	5-2-19
2	ASH-05	WASTE WATER	WW			5-2-19	1500	WT G		5-2-19	1630	5-2-19	1630	5-2-19	1630	5-2-19	1630	5-2-19	1630	5-2-19	1630	5-2-19	1630	5-2-19
3		WASTE WATER PRODUCT	WP																					
4		SOIL/SOLID	SL																					
5		OIL	OL																					
6		WIPE	WP																					
7		AIR	AR																					
8		OTHER	OT																					
9		TISSUE	TS																					
10																								
11																								
12																								

SAMPLER NAME AND SIGNATURE		DATE SIGNED (MM/DD/YY)		DATE SIGNED (MM/DD/YY)		DATE SIGNED (MM/DD/YY)		DATE SIGNED (MM/DD/YY)		DATE SIGNED (MM/DD/YY)		DATE SIGNED (MM/DD/YY)		DATE SIGNED (MM/DD/YY)		DATE SIGNED (MM/DD/YY)		DATE SIGNED (MM/DD/YY)		DATE SIGNED (MM/DD/YY)		DATE SIGNED (MM/DD/YY)		DATE SIGNED (MM/DD/YY)	
PRINT Name of SAMPLER:		5-2-19		5-2-19		5-2-19		5-2-19		5-2-19		5-2-19		5-2-19		5-2-19		5-2-19		5-2-19		5-2-19		5-2-19	
SIGNATURE of SAMPLER:		[Signature]		[Signature]		[Signature]		[Signature]		[Signature]		[Signature]		[Signature]		[Signature]		[Signature]		[Signature]		[Signature]		[Signature]	

Platte River Power Authority – Rawhide DATA REVIEW CHECK

Data Package: 60301786Sampling Event: April 30th – May 2nd, 2019

Data Reviewer: Brian Rothmeyer

Peer Reviewer: Sheri Fling

Date Completed: July 28, 2019

Date Completed: July 31, 2019

This report contains the final results of the data validation conducted for the water samples collected April 30th through May 2nd, 2019. The data review was conducted in accordance with the method and laboratory criteria, as applicable. The data review was conducted in accordance with method requirements and laboratory limits using guidance from USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540-R-2017-001 (January 2017).

General Overall Assessment:

- _____ Data are usable without qualification.
☒ Data are usable with qualification (noted below).
 _____ Some or all data are unusable for any purpose (detailed below).

Data Review Checklist

Review Parameter	Criteria	Criteria Met?																																
<i>Sample-specific Parameters</i>	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA																														
Chain of Custody, Sample Identification, & Sample Receipt	Samples were received intact and the cooler temperature was ≤ 6 degree Celsius upon arrival at the laboratory.	X																																
Holding Times	The samples were analyzed within the method required holding times.	X																																
Method Blanks (MB)	No target analytes reported in the associated MB.	X																																
Quality Control Samples: Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD)	The LCS/LCSD recoveries were within the laboratory determined acceptance limits.	X																																
Matrix Spike / Matrix Spike Duplicate (MS/MSD)	<p>The recoveries and relative percent differences for the matrix spike and matrix spike duplicate analyses were within the laboratory-determined acceptance ranges.</p> <p>Results in the native sample greater than four times the concentration of the spike added during digestions/extractions are not considered to be a representative measure of accuracy. Further action with respect to spike recovery evaluation or qualification of data was not considered necessary.</p> <table border="1"> <thead> <tr> <th>Analyte</th><th>MS/MSD (%)</th><th>Limits (%)</th><th>RPD (%)</th><th>Limits (%)</th></tr> </thead> <tbody> <tr> <td>ASH-03</td><td></td><td></td><td></td><td></td></tr> <tr> <td>Boron</td><td>69/69</td><td>75-125</td><td>0</td><td>20</td></tr> <tr> <td>Barium</td><td>118/129</td><td>75-125</td><td>7</td><td>20</td></tr> <tr> <td>Beryllium</td><td>72/75</td><td>75-125</td><td>4</td><td>20</td></tr> <tr> <td>Selenium</td><td>37/44</td><td>75-125</td><td>3</td><td>20</td></tr> </tbody> </table> <p>% - Percent MS/MSD – Matrix Spike/ Matrix Spike Duplicate RPD – Relative Percent Difference Bold indicates a value that is outside of acceptance limits.</p>	Analyte	MS/MSD (%)	Limits (%)	RPD (%)	Limits (%)	ASH-03					Boron	69/69	75-125	0	20	Barium	118/ 129	75-125	7	20	Beryllium	72/75	75-125	4	20	Selenium	37/44	75-125	3	20		X ¹	
Analyte	MS/MSD (%)	Limits (%)	RPD (%)	Limits (%)																														
ASH-03																																		
Boron	69/69	75-125	0	20																														
Barium	118/ 129	75-125	7	20																														
Beryllium	72/75	75-125	4	20																														
Selenium	37/44	75-125	3	20																														

Review Parameter	Criteria	Criteria Met?						
<i>Sample-specific Parameters</i>	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA				
Laboratory Duplicate	<p>The laboratory duplicate samples were within the laboratory determined acceptance limits. The following concentration dependent criteria were used to evaluate laboratory duplicates:</p> <ul style="list-style-type: none">When both the sample and duplicate values are >5x the reporting limit (RL), acceptable sampling and analytical precision is indicated by an relative percent difference (RPD) between the results of ≤20%.Where the result for one or both analytes of the method duplicate pair is <5xRL, satisfactory precision is indicated if the absolute difference between the method duplicate results is <1xRL.	X						
Field Duplicate	<p>The field duplicate sample results satisfied the evaluation criteria below:</p> <table><tr><th>Sample</th><th>Field Duplicate</th></tr><tr><td>ASH-3</td><td>DUP-1</td></tr></table> <ul style="list-style-type: none">When both the sample and duplicate values are >5xRL acceptable sampling and analytical precision is indicated by a RPD between the results of ≤30%.Where the result for one or both analytes of the field duplicate pair is <5xRL, satisfactory precision is indicated if the absolute difference between the field duplicate results is <2xRL.	Sample	Field Duplicate	ASH-3	DUP-1	X		
Sample	Field Duplicate							
ASH-3	DUP-1							
Equipment Blanks	No target analytes reported in the associated equipment blank.			X				
Reporting Limits Met	No samples performed at dilutions or reported as non-detect at elevated method detection limits/reporting limits.		X ²					
Reporting	No reporting issues were found and further qualification was not considered necessary.	X						
Package Completeness	No results were qualified as unusable and the data are 100% complete.	X						

Comments

1 – As the potential bias was considered to be low, the associated boron, beryllium, and selenium results for sample ASH-03 were qualified as estimated (UJ-/J- m).

As the potential bias was considered to be high, the associated detected barium result for sample ASH-03 was qualified as estimated (J+ m).

2 – Several analytes were reported as non-detect at elevated reporting limits. These non-detect results will need to be evaluated by the end user of the data with respect to project objectives.

> – Greater Than

% – Percent

J – Estimated

LCS – Laboratory Control Sample

MB – Method Blank

RL – Reporting Limit

< – Less Than

µg/L – Microgram per Liter

J+ – Estimated Concentration, Biased High

LCSD – Laboratory Control Sample Duplicate

MS/MSD – Matrix Spike/Matrix Spike Duplicate

RPD – Relative Percent Difference

≤ – Less Than or Equal To

fd – Field Duplicate RPD

J- – Estimated Concentration, Biased Low

m – Matrix Spike Recovery

NA – Not Applicable

UJ- – Undetected, low bias indicated

May 23, 2019

Geoff Webb
AECOM
6200 South Quebec St
Greenwood Village, CO 80111

RE: Project: PRPA Rawhide
Pace Project No.: 60301879

Dear Geoff Webb:

Enclosed are the analytical results for sample(s) received by the laboratory on May 03, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Heather Wilson
heather.wilson@pacelabs.com
1(913)563-1407
Project Manager

Enclosures

cc: Brian Rothmeyer, AECOM



REPORT OF LABORATORY ANALYSIS

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CERTIFICATIONS

Project: PRPA Rawhide

Pace Project No.: 60301879

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601

ANAB DOD-ELAP Rad Accreditation #: L2417

Alabama Certification #: 41590

Arizona Certification #: AZ0734

Arkansas Certification

California Certification #: 04222CA

Colorado Certification #: PA01547

Connecticut Certification #: PH-0694

Delaware Certification

EPA Region 4 DW Rad

Florida/TNI Certification #: E87683

Georgia Certification #: C040

Florida: Cert E871149 SEKS WET

Guam Certification

Hawaii Certification

Idaho Certification

Illinois Certification

Indiana Certification

Iowa Certification #: 391

Kansas/TNI Certification #: E-10358

Kentucky Certification #: KY90133

KY WW Permit #: KY0098221

KY WW Permit #: KY0000221

Louisiana DHH/TNI Certification #: LA180012

Louisiana DEQ/TNI Certification #: 4086

Maine Certification #: 2017020

Maryland Certification #: 308

Massachusetts Certification #: M-PA1457

Michigan/PADEP Certification #: 9991

Missouri Certification #: 235

Montana Certification #: Cert0082

Nebraska Certification #: NE-OS-29-14

Nevada Certification #: PA014572018-1

New Hampshire/TNI Certification #: 297617

New Jersey/TNI Certification #: PA051

New Mexico Certification #: PA01457

New York/TNI Certification #: 10888

North Carolina Certification #: 42706

North Dakota Certification #: R-190

Ohio EPA Rad Approval: #41249

Oregon/TNI Certification #: PA200002-010

Pennsylvania/TNI Certification #: 65-00282

Puerto Rico Certification #: PA01457

Rhode Island Certification #: 65-00282

South Dakota Certification

Tennessee Certification #: 02867

Texas/TNI Certification #: T104704188-17-3

Utah/TNI Certification #: PA014572017-9

USDA Soil Permit #: P330-17-00091

Vermont Dept. of Health: ID# VT-0282

Virgin Island/PADEP Certification

Virginia/VELAP Certification #: 9526

Washington Certification #: C868

West Virginia DEP Certification #: 143

West Virginia DHHR Certification #: 9964C

Wisconsin Approve List for Rad

Wyoming Certification #: 8TMS-L

REPORT OF LABORATORY ANALYSIS

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SAMPLE SUMMARY

Project: PRPA Rawhide

Pace Project No.: 60301879

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60301879001	BAT-02	Water	04/30/19 09:35	05/03/19 09:30
60301879002	BAT-05	Water	04/30/19 11:35	05/03/19 09:30
60301879003	BAT-06	Water	04/30/19 13:10	05/03/19 09:30
60301879004	BAT-09	Water	05/01/19 09:25	05/03/19 09:30
60301879005	BAT-08	Water	05/01/19 10:35	05/03/19 09:30
60301879006	BAT-01	Water	05/01/19 12:10	05/03/19 09:30
60301879007	ASH-03	Water	05/02/19 09:20	05/03/19 09:30
60301879008	DUP-1	Water	05/02/19 08:00	05/03/19 09:30
60301879009	BAT-03	Water	05/01/19 14:10	05/03/19 09:30
60301879010	BAT-04R	Water	05/01/19 15:40	05/03/19 09:30
60301879011	ASH-01	Water	05/02/19 10:35	05/03/19 09:30
60301879012	ASH-07	Water	05/02/19 12:35	05/03/19 09:30
60301879013	ASH-04	Water	05/02/19 13:55	05/03/19 09:30
60301879014	ASH-05	Water	05/02/19 15:00	05/03/19 09:30

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: PRPA Rawhide
Pace Project No.: 60301879

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60301879001	BAT-02	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60301879002	BAT-05	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60301879003	BAT-06	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60301879004	BAT-09	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60301879005	BAT-08	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60301879006	BAT-01	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60301879007	ASH-03	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60301879008	DUP-1	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60301879009	BAT-03	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60301879010	BAT-04R	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60301879011	ASH-01	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60301879012	ASH-07	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60301879013	ASH-04	EPA 903.1	MK1	1	PASI-PA

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SAMPLE ANALYTE COUNT

Project: PRPA Rawhide

Pace Project No.: 60301879

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60301879014	ASH-05	EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60301879

Sample: BAT-02 **Lab ID: 60301879001** Collected: 04/30/19 09:35 Received: 05/03/19 09:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.375 ± 0.526 (0.891) C:NA T:89%	pCi/L	05/21/19 16:23	13982-63-3	
Radium-228	EPA 904.0	0.830 ± 0.388 (0.645) C:81% T:87%	pCi/L	05/15/19 15:18	15262-20-1	
Total Radium	Total Radium Calculation	1.21 ± 0.914 (1.54)	pCi/L	05/22/19 14:11	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60301879

Sample: BAT-05 **Lab ID: 60301879002** Collected: 04/30/19 11:35 Received: 05/03/19 09:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	1.11 ± 0.580 (0.571) C:NA T:84%	pCi/L	05/21/19 16:23	13982-63-3	
Radium-228	EPA 904.0	0.809 ± 0.396 (0.677) C:82% T:82%	pCi/L	05/15/19 15:19	15262-20-1	
Total Radium	Total Radium Calculation	1.92 ± 0.976 (1.25)	pCi/L	05/22/19 14:11	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60301879

Sample: BAT-06 **Lab ID: 60301879003** Collected: 04/30/19 13:10 Received: 05/03/19 09:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.390 ± 0.365 (0.517) C:NA T:90%	pCi/L	05/21/19 16:23	13982-63-3	
Radium-228	EPA 904.0	0.646 ± 0.367 (0.650) C:79% T:78%	pCi/L	05/15/19 15:19	15262-20-1	
Total Radium	Total Radium Calculation	1.04 ± 0.732 (1.17)	pCi/L	05/22/19 14:11	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60301879

Sample: BAT-09		Lab ID: 60301879004	Collected: 05/01/19 09:25	Received: 05/03/19 09:30	Matrix: Water		
PWS:		Site ID:	Sample Type:				
Parameters	Method	Act ± Unc (MDC) Carr Trac		Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.724 ± 0.458 (0.517) C:NA T:81%		pCi/L	05/21/19 16:23	13982-63-3	
Radium-228	EPA 904.0	0.363 ± 0.343 (0.703) C:83% T:88%		pCi/L	05/15/19 15:19	15262-20-1	
Total Radium	Total Radium Calculation	1.09 ± 0.801 (1.22)		pCi/L	05/22/19 14:11	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60301879

Sample: BAT-08 **Lab ID: 60301879005** Collected: 05/01/19 10:35 Received: 05/03/19 09:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.470 ± 0.403 (0.546) C:NA T:86%	pCi/L	05/21/19 16:23	13982-63-3	
Radium-228	EPA 904.0	1.04 ± 0.448 (0.728) C:84% T:78%	pCi/L	05/15/19 15:19	15262-20-1	
Total Radium	Total Radium Calculation	1.51 ± 0.851 (1.27)	pCi/L	05/22/19 14:11	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60301879

Sample: BAT-01		Lab ID: 60301879006	Collected: 05/01/19 12:10	Received: 05/03/19 09:30	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	1.04 ± 0.518 (0.423) C:NA T:85%	pCi/L	05/21/19 16:23	13982-63-3	
Radium-228	EPA 904.0	0.539 ± 0.441 (0.876) C:86% T:60%	pCi/L	05/15/19 15:19	15262-20-1	
Total Radium	Total Radium Calculation	1.58 ± 0.959 (1.30)	pCi/L	05/22/19 14:11	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60301879

Sample: ASH-03		Lab ID: 60301879007	Collected: 05/02/19 09:20	Received: 05/03/19 09:30	Matrix: Water		
PWS:		Site ID:	Sample Type:				
Parameters	Method	Act ± Unc (MDC) Carr Trac		Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.886 ± 0.596 (0.827) C:NA T:94%		pCi/L	05/21/19 16:23	13982-63-3	
Radium-228	EPA 904.0	0.505 ± 0.389 (0.764) C:85% T:74%		pCi/L	05/15/19 15:19	15262-20-1	
Total Radium	Total Radium Calculation	1.39 ± 0.985 (1.59)		pCi/L	05/22/19 14:11	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60301879

Sample: DUP-1		Lab ID: 60301879008	Collected: 05/02/19 08:00	Received: 05/03/19 09:30	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.912 ± 0.486 (0.420) C:NA T:81%	pCi/L	05/21/19 16:37	13982-63-3	
Radium-228	EPA 904.0	1.13 ± 0.423 (0.613) C:84% T:84%	pCi/L	05/15/19 15:19	15262-20-1	
Total Radium	Total Radium Calculation	2.04 ± 0.909 (1.03)	pCi/L	05/22/19 14:11	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60301879

Sample: BAT-03		Lab ID: 60301879009	Collected: 05/01/19 14:10	Received: 05/03/19 09:30	Matrix: Water		
PWS:		Site ID:	Sample Type:				
Parameters	Method	Act ± Unc (MDC) Carr Trac		Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.579 ± 0.430 (0.538) C:NA T:91%		pCi/L	05/21/19 16:37	13982-63-3	
Radium-228	EPA 904.0	0.923 ± 0.383 (0.576) C:85% T:81%		pCi/L	05/15/19 15:19	15262-20-1	
Total Radium	Total Radium Calculation	1.50 ± 0.813 (1.11)		pCi/L	05/22/19 14:11	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60301879

Sample: BAT-04R		Lab ID: 60301879010	Collected: 05/01/19 15:40	Received: 05/03/19 09:30	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	1.28 ± 0.660 (0.732) C:NA T:88%	pCi/L	05/21/19 16:37	13982-63-3	
Radium-228	EPA 904.0	0.614 ± 0.314 (0.537) C:87% T:90%	pCi/L	05/15/19 15:19	15262-20-1	
Total Radium	Total Radium Calculation	1.89 ± 0.974 (1.27)	pCi/L	05/22/19 14:11	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60301879

Sample: ASH-01 **Lab ID: 60301879011** Collected: 05/02/19 10:35 Received: 05/03/19 09:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.947 ± 0.624 (0.835) C:NA T:87%	pCi/L	05/21/19 16:37	13982-63-3	
Radium-228	EPA 904.0	0.676 ± 0.357 (0.625) C:85% T:85%	pCi/L	05/15/19 15:19	15262-20-1	
Total Radium	Total Radium Calculation	1.62 ± 0.981 (1.46)	pCi/L	05/22/19 14:11	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60301879

Sample: ASH-07 **Lab ID: 60301879012** Collected: 05/02/19 12:35 Received: 05/03/19 09:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	1.35 ± 0.628 (0.193) C:NA T:74%	pCi/L	05/21/19 16:37	13982-63-3	
Radium-228	EPA 904.0	1.27 ± 0.551 (0.921) C:84% T:74%	pCi/L	05/15/19 15:34	15262-20-1	
Total Radium	Total Radium Calculation	2.62 ± 1.18 (1.11)	pCi/L	05/22/19 14:11	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60301879

Sample: ASH-04 **Lab ID: 60301879013** Collected: 05/02/19 13:55 Received: 05/03/19 09:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.894 ± 0.476 (0.411) C:NA T:87%	pCi/L	05/21/19 16:49	13982-63-3	
Radium-228	EPA 904.0	1.09 ± 0.491 (0.837) C:86% T:80%	pCi/L	05/15/19 15:34	15262-20-1	
Total Radium	Total Radium Calculation	1.98 ± 0.967 (1.25)	pCi/L	05/22/19 14:11	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60301879

Sample: ASH-05 **Lab ID: 60301879014** Collected: 05/02/19 15:00 Received: 05/03/19 09:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.897 ± 0.547 (0.691) C:NA T:91%	pCi/L	05/21/19 16:49	13982-63-3	
Radium-228	EPA 904.0	0.991 ± 0.433 (0.721) C:89% T:82%	pCi/L	05/15/19 15:17	15262-20-1	
Total Radium	Total Radium Calculation	1.89 ± 0.980 (1.41)	pCi/L	05/22/19 14:11	7440-14-4	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60301879

QC Batch:	341767	Analysis Method:	EPA 904.0
QC Batch Method:	EPA 904.0	Analysis Description:	904.0 Radium 228
Associated Lab Samples:	60301879001, 60301879002, 60301879003, 60301879004, 60301879005, 60301879006, 60301879007, 60301879008, 60301879009, 60301879010, 60301879011, 60301879012, 60301879013, 60301879014		

METHOD BLANK:	1663488	Matrix:	Water
Associated Lab Samples:	60301879001, 60301879002, 60301879003, 60301879004, 60301879005, 60301879006, 60301879007, 60301879008, 60301879009, 60301879010, 60301879011, 60301879012, 60301879013, 60301879014		

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.390 ± 0.282 (0.539) C:85% T:90%	pCi/L	05/15/19 15:18	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALITY CONTROL - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60301879

QC Batch:	341766	Analysis Method:	EPA 903.1
QC Batch Method:	EPA 903.1	Analysis Description:	903.1 Radium-226
Associated Lab Samples:	60301879001, 60301879002, 60301879003, 60301879004, 60301879005, 60301879006, 60301879007, 60301879008, 60301879009, 60301879010, 60301879011, 60301879012, 60301879013, 60301879014		

METHOD BLANK:	1663486	Matrix:	Water
Associated Lab Samples:	60301879001, 60301879002, 60301879003, 60301879004, 60301879005, 60301879006, 60301879007, 60301879008, 60301879009, 60301879010, 60301879011, 60301879012, 60301879013, 60301879014		

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.508 ± 0.426 (0.610) C:NA T:78%	pCi/L	05/21/19 16:23	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALIFIERS

Project: PRPA Rawhide

Pace Project No.: 60301879

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval).

Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-PA Pace Analytical Services - Greensburg

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: PRPA Rawhide

Pace Project No.: 60301879

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60301879001	BAT-02	EPA 903.1	341766		
60301879002	BAT-05	EPA 903.1	341766		
60301879003	BAT-06	EPA 903.1	341766		
60301879004	BAT-09	EPA 903.1	341766		
60301879005	BAT-08	EPA 903.1	341766		
60301879006	BAT-01	EPA 903.1	341766		
60301879007	ASH-03	EPA 903.1	341766		
60301879008	DUP-1	EPA 903.1	341766		
60301879009	BAT-03	EPA 903.1	341766		
60301879010	BAT-04R	EPA 903.1	341766		
60301879011	ASH-01	EPA 903.1	341766		
60301879012	ASH-07	EPA 903.1	341766		
60301879013	ASH-04	EPA 903.1	341766		
60301879014	ASH-05	EPA 903.1	341766		
60301879001	BAT-02	EPA 904.0	341767		
60301879002	BAT-05	EPA 904.0	341767		
60301879003	BAT-06	EPA 904.0	341767		
60301879004	BAT-09	EPA 904.0	341767		
60301879005	BAT-08	EPA 904.0	341767		
60301879006	BAT-01	EPA 904.0	341767		
60301879007	ASH-03	EPA 904.0	341767		
60301879008	DUP-1	EPA 904.0	341767		
60301879009	BAT-03	EPA 904.0	341767		
60301879010	BAT-04R	EPA 904.0	341767		
60301879011	ASH-01	EPA 904.0	341767		
60301879012	ASH-07	EPA 904.0	341767		
60301879013	ASH-04	EPA 904.0	341767		
60301879014	ASH-05	EPA 904.0	341767		
60301879001	BAT-02	Total Radium Calculation	343772		
60301879002	BAT-05	Total Radium Calculation	343772		
60301879003	BAT-06	Total Radium Calculation	343772		
60301879004	BAT-09	Total Radium Calculation	343772		
60301879005	BAT-08	Total Radium Calculation	343772		
60301879006	BAT-01	Total Radium Calculation	343772		
60301879007	ASH-03	Total Radium Calculation	343772		
60301879008	DUP-1	Total Radium Calculation	343772		
60301879009	BAT-03	Total Radium Calculation	343772		
60301879010	BAT-04R	Total Radium Calculation	343772		
60301879011	ASH-01	Total Radium Calculation	343772		
60301879012	ASH-07	Total Radium Calculation	343772		
60301879013	ASH-04	Total Radium Calculation	343772		
60301879014	ASH-05	Total Radium Calculation	343772		

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Chain of Custody

☒ Samples were sent directly to the Subcontracting Laboratory.

State Of Origin: CO
 Cert. Needed: ☐ Yes ☒ No
 Owner Received Date: 5/3/2019 Results Requested By: 5/24/2019

Workorder: 60301879 Subcontract To: PRPA Rawhide

Heather Wilson
 Pace Analytical Kansas
 9608 Loiret Blvd.
 Lenexa, KS 66219
 Phone 1(913)563-1407

Pace Analytical Pittsburgh
 1638 Roseytown Road
 Suites 2,3, & 4
 Greensburg, PA 15601
 Phone (724)850-5600

Requested Analysis

WO#: 30293295



30293295

Report To		Subcontract To		Preserved Containers		Radium-226 & Total Radium		Radium-226		LAB USE ONLY	
Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Other					
1	BAT-02	PS	4/30/2019 09:35	60301879001	Water	1			X		001
2	BAT-05	PS	4/30/2019 11:35	60301879002	Water	1			X		002
3	BAT-06	PS	4/30/2019 13:10	60301879003	Water	1			X		003
4	BAT-09	PS	5/1/2019 09:25	60301879004	Water	1			X		004
5	BAT-08	PS	5/1/2019 10:35	60301879005	Water	1			X		005
6	BAT-01	PS	5/1/2019 12:10	60301879006	Water	1			X		006
7	ASH-03	PS	5/2/2019 09:20	60301879007	Water	1			X		007
8	DUP-1	PS	5/2/2019 08:00	60301879008	Water	1			X		008
9	BAT-03	PS	5/1/2019 14:10	60301879009	Water	1			X		009
10	BAT-04R	PS	5/1/2019 15:40	60301879010	Water	1			X		010
11	ASH-01	PS	5/2/2019 10:35	60301879011	Water	1			X		011
12	ASH-07	PS	5/2/2019 12:35	60301879012	Water	1			X		012
13	ASH-04	PS	5/2/2019 13:55	60301879013	Water	1			X		013
14	ASH-05	PS	5/2/2019 15:00	60301879014	Water	1			X		014

Transfers	Released By	Date/Time	Received By	Date/Time	Received on Ice	Custody Seal	Y or N	Y or N	Y or N	Comments
1			UNAVAILABLE	04/25/19						*Please Provide QC sheets with report.
2				04/25/19						
3				05/08/19						
Cooler Temperature on Receipt 4.6 °C Received on Ice Y Custody Seal Y Samples Intact Y Y or N N										

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC document.
This chain of custody is considered complete as is since this information is available in the owner laboratory.

30293295

Pittsburgh Lab Sample Condition Upon Receipt



Client Name:

AECOM

Project # 30293295

Courier: ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace Other _____

Tracking #: 4746 8746 6542

Label	<u>mg</u>
LIMS Login	<u>ET</u>

Custody Seal on Cooler/Box Present: ☒ yes ☐ no Seals Intact: ☒ yes ☐ no

Thermometer Used 10

Type of Ice: Wet Blue None

Cooler Temperature

Observed Temp

4.6 °C

Correction Factor: 0 °C

Final Temp: 4.6 °C

Temp should be above freezing to 6°C

Comments:

Yes No N/A

pH paper Lot# 1003587

Date and Initials of person examining contents: mg 5/3/19

Chain of Custody Present:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.
Chain of Custody Filled Out:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2.
Chain of Custody Relinquished:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3.
Sampler Name & Signature on COC:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4.
Sample Labels match COC:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5.
-Includes date/time/ID Matrix:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Samples Arrived within Hold Time:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.
Short Hold Time Analysis (<72hr remaining):	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7.
Rush Turn Around Time Requested:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8.
Sufficient Volume:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	9.
Correct Containers Used:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10.
-Pace Containers Used:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Containers Intact:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	11.
Orthophosphate field filtered	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	12.
Hex Cr Aqueous sample field filtered	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	13.
Organic Samples checked for dechlorination:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	14.
Filtered volume received for Dissolved tests	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	15.
All containers have been checked for preservation.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	16.
exceptions: VOA, coliform, TOC, O&G, Phenolics, Radon, Non-aqueous matrix	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
All containers meet method preservation requirements.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Initial when completed <u>mg</u> Date/time of preservation
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Lot # of added preservative
Headspace in VOA Vials (>6mm):	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	17.
Trip Blank Present:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	18.
Trip Blank Custody Seals Present	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Rad Samples Screened < 0.5 mrem/hr	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Initial when completed <u>mg</u> Date: <u>8-3-19</u>

Client Notification/ Resolution:

Person Contacted: _____

Date/Time: _____

Contacted By: _____

Comments/ Resolution: _____

☐ A check in this box indicates that additional information has been stored in ereports.

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)
*PM review is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

Quality Control Sample Performance Assessment



Analyst Must Manually Enter All Fields Highlighted in Yellow.

Test: Ra-226
Analyst: MK1
Date: 5/10/2019
Batch ID: 47549
Matrix: DW

Method Blank Assessment	
MB Sample ID	1663486
MB Concentration:	0.508
MB Counting Uncertainty:	0.422
MB MDC:	0.610
MB Numerical Performance Indicator:	2.36
MB Status vs Numerical Indicator:	N/A
MB Status vs. MDC:	Pass

Laboratory Control Sample Assessment	
LCS47549	Y
Count Date:	5/21/2019
Spike I.D.:	19-022
Spike Concentration (pCi/mL):	32.123
Volume Used (mL):	0.10
Aliquot Volume (L, g, F):	0.654
Target Conc. (pCi/L, g, F):	4.933
Uncertainty (Calculated):	0.232
Result (pCi/L, g, F):	5.558
LCS/LCSD Counting Uncertainty (pCi/L, g, F):	1.041
Numerical Performance Indicator:	1.15
Percent Recovery:	112.66%
Status vs Numerical Indicator:	N/A
Status vs Recovery:	Pass
Upper % Recovery Limits:	135%
Lower % Recovery Limits:	73%

Duplicate Sample Assessment	
Sample I.D.:	LCS47549
Duplicate Sample I.D.:	LCS47549
Sample Result Counting Uncertainty (pCi/L, g, F):	5.558
Sample Duplicate Result (pCi/L, g, F):	1.041
Sample Duplicate Result Counting Uncertainty (pCi/L, g, F):	6.008
Are sample and/or duplicate results below RL?	NO
Duplicate Numerical Performance Indicator:	-0.578
(Based on the LCS/LCSD Percent Recoveries) Duplicate RPD:	8.21%
Duplicate Status vs Numerical Indicator:	N/A
Duplicate Status vs RPD:	Pass
% RPD Limit:	32%

Evaluation of duplicate precision is not applicable if either the sample or duplicate results are below the RL.

Comments:

Sample Matrix Spike Control Assessment	MS/MSD 1	MS/MSD 2
Sample Collection Date: Sample I.D. Sample MS I.D. Sample MSD I.D. Spike I.D.:		
MS/MSD Decay Corrected Spike Concentration (pCi/mL): Spike Volume Used in MS (mL): MS Aliquot (L, g, F): MS Target Conc.(pCi/L, g, F): MSD Aliquot (L, g, F): MSD Target Conc. (pCi/L, g, F): MS Spike Uncertainty (calculated): MSD Spike Uncertainty (calculated):		
Sample Result Counting Uncertainty (pCi/L, g, F): Sample Matrix Spike Result: Matrix Spike Result Counting Uncertainty (pCi/L, g, F): Sample Matrix Spike Duplicate Result: Matrix Spike Duplicate Result Counting Uncertainty (pCi/L, g, F): MS Numerical Performance Indicator: MSD Numerical Performance Indicator: MS Percent Recovery: MSD Percent Recovery: MS Status vs Numerical Indicator: MSD Status vs Numerical Indicator: MS Status vs Recovery: MSD Status vs Recovery: MS/MSD Upper % Recovery Limits: MS/MSD Lower % Recovery Limits:		

Matrix Spike/Matrix Spike Duplicate Sample Assessment	
Sample I.D.:	Sample MS I.D.:
Sample MS I.D.:	Sample MSD I.D.:
Sample Matrix Spike Result: Sample Matrix Spike Result Counting Uncertainty (pCi/L, g, F): Sample Matrix Spike Duplicate Result: Sample Matrix Spike Duplicate Result Counting Uncertainty (pCi/L, g, F): Duplicate Numerical Performance Indicator: (Based on the Percent Recoveries) MS/ MSD Duplicate RPD: MS/ MSD Duplicate Status vs Numerical Indicator: MS/ MSD Duplicate Status vs RPD: % RPD Limit:	

5/10/19

5-21-19 uc

Quality Control Sample Performance Assessment



Analyst Must Manually Enter All Fields Highlighted in Yellow.

Test: Ra-228
Analyst: JLW
Date: 5/13/2019
Worklist: 47550
Matrix: DW

Method Blank Assessment	MB Sample ID 1663488
	MB Concentration: 0.390
	MB Counting Uncertainty: 0.273
	MB MDC: 0.539
	MB Numerical Performance Indicator: 2.80
	MB Status vs Numerical Indicator: N/A
	MB Status vs. MDC: Pass

Laboratory Control Sample Assessment	LCSD (Y or N)?	Y
	LCSD47550	5/15/2019
	Count Date:	5/15/2019
	Spike I.D.:	19-026
	Spike Concentration (pCi/mL):	36.876
	Volume Used (mL):	0.10
	Aliquot Volume (L, g, F):	0.807
	Target Conc. (pCi/L, g, F):	4.570
	Uncertainty (Calculated):	0.224
	Result (pCi/L, g, F):	4.786
	LCSD/LCSD Counting Uncertainty (pCi/L, g, F):	0.619
	Numerical Performance Indicator:	0.64
	Percent Recovery:	104.74%
	Status vs Numerical Indicator:	N/A
	Status vs Recovery:	Pass

Duplicate Sample Assessment	Sample I.D.:	LCSD47550
	Duplicate Sample I.D.:	LCSD47550
	Sample Result (pCi/L, g, F):	4.786
	Sample Result Counting Uncertainty (pCi/L, g, F):	0.619
	Sample Duplicate Result (pCi/L, g, F):	6.020
	Sample Duplicate Result Counting Uncertainty (pCi/L, g, F):	0.673
	Are sample and/or duplicate results below MDC?	NO
	Duplicate Numerical Performance Indicator:	-2.644
	(Based on the LCSD/LCSD Percent Recoveries) Duplicate RPD:	22.12%
	Duplicate Status vs Numerical Indicator:	N/A
	Duplicate Status vs RPD:	Pass

Evaluation of duplicate precision is not applicable if either the sample or duplicate results are below the MDC.

Comments:

Sample Matrix Spike Control Assessment	Sample Collection Date: Sample I.D. Sample MS I.D. Sample MSD I.D.
	Spike I.D.:
	MS/MSD Decay Corrected Spike Concentration (pCi/mL):
	Spike Volume Used in MS (mL):
	Spike Volume Used in MSD (mL):
	MS Aliquot (L, g, F):
	MS Target Conc. (pCi/L, g, F):
	MSD Aliquot (L, g, F):
	MSD Target Conc. (pCi/L, g, F):
	Spike uncertainty (calculated):
	Sample Result:
	Sample Result Counting Uncertainty (pCi/L, g, F):
	Sample Matrix Spike Result:
	Matrix Spike Result Counting Uncertainty (pCi/L, g, F):
	Sample Matrix Spike Duplicate Result:
	Matrix Spike Duplicate Result Counting Uncertainty (pCi/L, g, F):
	MS Numerical Performance Indicator:
	MSD Numerical Performance Indicator:
	MS Percent Recovery:
	MSD Percent Recovery:
	MS Status vs Numerical Indicator:
	MSD Status vs Numerical Indicator:
	MS Status vs Recovery:
	MSD Status vs Recovery:

Matrix Spike/Matrix Spike Duplicate Sample Assessment	Sample I.D. Sample MS I.D. Sample MSD I.D.
	Sample Matrix Spike Result:
	Matrix Spike Result Counting Uncertainty (pCi/L, g, F):
	Sample Matrix Spike Duplicate Result:
	Matrix Spike Duplicate Result Counting Uncertainty (pCi/L, g, F):
	Duplicate Numerical Performance Indicator:
	(Based on the Percent Recoveries) MS/MSD Duplicate RPD:
	MS/MSD Duplicate Status vs Numerical Indicator:
	MS/MSD Duplicate Status vs RPD:

5/13/19
JLW

5/13/19
JLW

Platte River Power Authority – Rawhide DATA REVIEW CHECK

Data Package: 60301879Sampling Event: April 30th-May 2, 2019

Data Reviewer: Brian Rothmeyer

Peer Reviewer: Sheri Fling

Date Completed: July 29, 2019

Date Completed: July 31, 2019

This report contains the final results of the data validation conducted for the water samples collected April 30th through May 2nd, 2019. The data review was conducted in accordance with the method and laboratory criteria, as applicable. The data review was conducted in accordance with method requirements and laboratory limits.

General Overall Assessment:

- X Data are usable without qualification.
 Data are usable with qualification (noted below).
 Some or all data are unusable for any purpose (detailed below).

Data Review Checklist

Review Parameter	Criteria	Criteria Met?						
<i>Sample-specific Parameters</i>	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA				
Chain of Custody, Sample Identification, & Sample Receipt	Samples were received intact and the cooler temperature was ≤6 degree Celsius upon arrival at the laboratory.	X						
Holding Times	The samples were analyzed within the method required holding times.	X						
Method Blanks (MB)	No target analytes reported in the associated MB at concentrations greater than the minimum detectable concentration (MDC).	X						
Quality Control Samples: Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD)	The LCS/LCSD recoveries were within the laboratory determined acceptance limits.	X						
Matrix Spike / Matrix Spike Duplicate (MS/MSD)	The recoveries and relative percent differences for the matrix spike and matrix spike duplicate analyses were within the laboratory-determined acceptance ranges.			X				
Laboratory Duplicate	The laboratory duplicate samples were within the laboratory determined acceptance limits. The following concentration dependent criteria were used to evaluate laboratory duplicates: <ul style="list-style-type: none">The agreement between parent sample results and the lab duplicate sample results were evaluated. The duplicate error ratios (DER) met the criterion of a DER ≤1.			X				
Field Duplicate	The field duplicate sample results satisfied the evaluation criteria below: <table><tr><th>Parent Sample</th><th>Field Duplicate</th></tr><tr><td>ASH-08</td><td>DUP-1</td></tr></table> <ul style="list-style-type: none">The agreement between parent sample results and the lab duplicate sample results were evaluated. The DER met the	Parent Sample	Field Duplicate	ASH-08	DUP-1	X		
Parent Sample	Field Duplicate							
ASH-08	DUP-1							

Review Parameter	Criteria	Criteria Met?								
<i>Sample-specific Parameters</i>	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA						
	criterion of a DER ≤1.									
Equipment Blanks	No target analytes reported in the associated equipment blank at concentrations greater than the MDC. <table border="1"><thead><tr><th>Analyte</th><th>Concentration</th></tr></thead><tbody><tr><td colspan="2">EB-2 (60301882)</td></tr><tr><td>Radium-226</td><td>0.482 ± 0.377 pCi/L</td></tr></tbody></table> ± – Plus or Minus pCi/L – Picocuries Per Liter EB – Equipment Blank	Analyte	Concentration	EB-2 (60301882)		Radium-226	0.482 ± 0.377 pCi/L		X ¹	
Analyte	Concentration									
EB-2 (60301882)										
Radium-226	0.482 ± 0.377 pCi/L									
Detection Limits Mets (Radiochemistry)	For radiochemical results if the associated uncertainty was greater than the reported result, the 2 sigma (σ) uncertainty multiplied by 1.65 was less than or equal to the specified detection limit.	X								
Tracer and/or Carrier Recovery	The sample specific recoveries were within the laboratory limits.	X								
Reporting	No reporting issues were found and further qualification was not considered necessary.	X								
Package Completeness	No results were qualified as unusable and the data are 100% complete.	X								
Comments										
1 – The associated radium-226 sample results reported at concentrations <5x the concentration of the blank contamination were qualified as estimated (J+ be) to reflect the potential high bias indicated by the blank contamination.										

> – Greater Than

 σ – Sigma

± – Plus or Minus

J+ – Estimated Concentration, Biased High

MDC – Minimum Detectable Concentration

< – Less Than

pCi/L – Picocuries per Liter

be – Equipment Blank Contamination

LCS – Laboratory Control Sample

MS/MSD – Matrix Spike/Matrix Spike Duplicate

 \leq – Less Than or Equal To

% – Percent

DER – Duplicate Error Ration

LCSD – Laboratory Control Sample Duplicate

NA – Not Applicable

May 22, 2019

Geoff Webb
AECOM
6200 South Quebec St
Greenwood Village, CO 80111

RE: Project: PRPA Rawhide
Pace Project No.: 60302144

Dear Geoff Webb:

Enclosed are the analytical results for sample(s) received by the laboratory on May 08, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Heather Wilson
heather.wilson@pacelabs.com
1(913)563-1407
Project Manager

Enclosures

cc: Brian Rothmeyer, AECOM



REPORT OF LABORATORY ANALYSIS

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CERTIFICATIONS

Project: PRPA Rawhide

Pace Project No.: 60302144

Kansas Certification IDs

9608 Loiret Boulevard, Lenexa, KS 66219

Arkansas Drinking Water

Missouri Certification Number: 10090

WY STR Certification #: 2456.01

Arkansas Certification #: 19-016-0

Arkansas Drinking Water

Illinois Certification #: 004455

Iowa Certification #: 118

Kansas/NELAP Certification #: E-10116

Louisiana Certification #: 03055

Nevada Certification #: KS000212018-1

Oklahoma Certification #: 9205/9935

Florida: Cert E871149 SEKS WET

Florida: Cert E871149 SEKS WET

Florida: Cert E871149 SEKS WET

Texas Certification #: T104704407-18-11

Utah Certification #: KS000212018-8

Kansas Field Laboratory Accreditation: # E-92587

Missouri Certification: 10070

Missouri Certification Number: 10090

REPORT OF LABORATORY ANALYSIS

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SAMPLE SUMMARY

Project: PRPA Rawhide

Pace Project No.: 60302144

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60302144001	ASH-06	Water	05/06/19 09:20	05/08/19 08:35
60302144002	ASH-02	Water	05/06/19 10:40	05/08/19 08:35
60302144003	ASH-08	Water	05/06/19 12:55	05/08/19 08:35

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: PRPA Rawhide

Pace Project No.: 60302144

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60302144001	ASH-06	EPA 6010	EMR	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	LRS	1	PASI-K
		SM 2540C	LDB	1	PASI-K
		EPA 9056	JDS, MGS	3	PASI-K
60302144002	ASH-02	EPA 6010	EMR	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	LRS	1	PASI-K
		SM 2540C	LDB	1	PASI-K
		EPA 9056	MGS	2	PASI-K
60302144003	ASH-08	EPA 6010	EMR	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	LRS	1	PASI-K
		SM 2540C	LDB	1	PASI-K
		EPA 9056	JDS, MGS	3	PASI-K

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA Rawhide

Pace Project No.: 60302144

Sample: ASH-06		Lab ID: 60302144001		Collected: 05/06/19 09:20		Received: 05/08/19 08:35		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	283	ug/L	100	1	05/18/19 16:00	05/20/19 18:35	7440-42-8		
Calcium	26700	ug/L	200	1	05/18/19 16:00	05/20/19 18:35	7440-70-2		
Lithium	56.0	ug/L	10.0	1	05/18/19 16:00	05/20/19 18:35	7439-93-2		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:19	7440-36-0		
Arsenic	1.2	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:19	7440-38-2		
Barium	67.0	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:19	7440-39-3		
Beryllium	ND	ug/L	0.50	1	05/18/19 19:15	05/21/19 15:19	7440-41-7		
Cadmium	ND	ug/L	0.50	1	05/18/19 19:15	05/21/19 15:19	7440-43-9		
Chromium	3.4	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:19	7440-47-3		
Cobalt	ND	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:19	7440-48-4		
Lead	ND	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:19	7439-92-1		
Molybdenum	29.1	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:19	7439-98-7		
Selenium	22.8	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:19	7782-49-2		
Thallium	ND	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:19	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	05/18/19 14:25	05/20/19 10:41	7439-97-6		
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	384	mg/L	5.0	1		05/13/19 18:03			
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	7.8	mg/L	1.0	1		05/20/19 21:14	16887-00-6		
Fluoride	0.79	mg/L	0.20	1		05/20/19 21:14	16984-48-8		
Sulfate	75.7	mg/L	10.0	10		05/22/19 07:01	14808-79-8		

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA Rawhide

Pace Project No.: 60302144

Sample: ASH-02		Lab ID: 60302144002	Collected: 05/06/19 10:40	Received: 05/08/19 08:35	Matrix: Water			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010						
Boron	1960	ug/L	100	1	05/18/19 16:00	05/20/19 18:37	7440-42-8	
Calcium	167000	ug/L	200	1	05/18/19 16:00	05/20/19 18:37	7440-70-2	
Lithium	304	ug/L	10.0	1	05/18/19 16:00	05/20/19 18:37	7439-93-2	
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010						
Antimony	ND	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:22	7440-36-0	
Arsenic	ND	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:22	7440-38-2	
Barium	15.5	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:22	7440-39-3	
Beryllium	ND	ug/L	0.50	1	05/18/19 19:15	05/21/19 15:22	7440-41-7	
Cadmium	ND	ug/L	0.50	1	05/18/19 19:15	05/21/19 15:22	7440-43-9	
Chromium	ND	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:22	7440-47-3	
Cobalt	ND	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:22	7440-48-4	
Lead	ND	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:22	7439-92-1	
Molybdenum	8.4	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:22	7439-98-7	
Selenium	ND	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:22	7782-49-2	
Thallium	ND	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:22	7440-28-0	
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470						
Mercury	ND	ug/L	0.20	1	05/18/19 14:25	05/20/19 10:44	7439-97-6	
2540C Total Dissolved Solids		Analytical Method: SM 2540C						
Total Dissolved Solids	3050	mg/L	50.0	1		05/13/19 18:03		
9056 IC Anions		Analytical Method: EPA 9056						
Chloride	7.8	mg/L	1.0	1		05/20/19 22:16	16887-00-6	
Fluoride	0.77	mg/L	0.20	1		05/20/19 22:16	16984-48-8	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA Rawhide

Pace Project No.: 60302144

Sample: ASH-08		Lab ID: 60302144003	Collected: 05/06/19 12:55		Received: 05/08/19 08:35		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010						
Boron	856	ug/L	100	1	05/18/19 16:00	05/20/19 18:48	7440-42-8	
Calcium	429000	ug/L	200	1	05/18/19 16:00	05/20/19 18:48	7440-70-2	
Lithium	304	ug/L	10.0	1	05/18/19 16:00	05/20/19 18:48	7439-93-2	
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010						
Antimony	ND	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:29	7440-36-0	
Arsenic	ND	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:29	7440-38-2	
Barium	39.9	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:29	7440-39-3	
Beryllium	ND	ug/L	0.50	1	05/18/19 19:15	05/21/19 15:29	7440-41-7	
Cadmium	ND	ug/L	0.50	1	05/18/19 19:15	05/21/19 15:29	7440-43-9	
Chromium	1.6	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:29	7440-47-3	
Cobalt	2.8	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:29	7440-48-4	
Lead	ND	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:29	7439-92-1	
Molybdenum	10.1	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:29	7439-98-7	
Selenium	7.3	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:29	7782-49-2	
Thallium	ND	ug/L	1.0	1	05/18/19 19:15	05/21/19 15:29	7440-28-0	
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470						
Mercury	ND	ug/L	0.20	1	05/18/19 14:25	05/20/19 10:48	7439-97-6	
2540C Total Dissolved Solids		Analytical Method: SM 2540C						
Total Dissolved Solids	4010	mg/L	66.7	1		05/13/19 18:04		
9056 IC Anions		Analytical Method: EPA 9056						
Chloride	22.3	mg/L	2.0	2		05/22/19 08:25	16887-00-6	
Fluoride	ND	mg/L	0.20	1		05/21/19 01:08	16984-48-8	
Sulfate	2730	mg/L	200	200		05/22/19 09:26	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA Rawhide

Pace Project No.: 60302144

QC Batch: 585292

Analysis Method: EPA 7470

QC Batch Method: EPA 7470

Analysis Description: 7470 Mercury

Associated Lab Samples: 60302144001, 60302144002, 60302144003

METHOD BLANK: 2401636

Matrix: Water

Associated Lab Samples: 60302144001, 60302144002, 60302144003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	05/20/19 10:14	

LABORATORY CONTROL SAMPLE: 2401637

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	5	4.8	95	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2401638 2401639

Parameter	Units	60302081004 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	5	5	4.9	5.0	98	99	75-125	1	20	

MATRIX SPIKE SAMPLE: 2401640

Parameter	Units	60302144002 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	ND	5	4.9	98	75-125	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA Rawhide

Pace Project No.: 60302144

QC Batch:	585383	Analysis Method:	EPA 6010
QC Batch Method:	EPA 3010	Analysis Description:	6010 MET
Associated Lab Samples: 60302144001, 60302144002, 60302144003			

METHOD BLANK: 2401887 Matrix: Water

Associated Lab Samples: 60302144001, 60302144002, 60302144003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	ug/L	ND	100	05/20/19 18:27	
Calcium	ug/L	ND	200	05/20/19 18:27	
Lithium	ug/L	ND	10.0	05/20/19 18:27	

LABORATORY CONTROL SAMPLE: 2401888

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	1000	860	86	80-120	
Calcium	ug/L	10000	9850	98	80-120	
Lithium	ug/L	1000	973	97	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2401889 2401890

Parameter	Units	60302144002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	1960	1000	1000	2880	2900	92	94	75-125	1	20	
Calcium	ug/L	167000	10000	10000	178000	178000	110	101	75-125	1	20	
Lithium	ug/L	304	1000	1000	1370	1360	106	106	75-125	1	20	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA Rawhide
Pace Project No.: 60302144

QC Batch: 585474 Analysis Method: EPA 6020
QC Batch Method: EPA 3010 Analysis Description: 6020 MET
Associated Lab Samples: 60302144001, 60302144002, 60302144003

METHOD BLANK: 2402642 Matrix: Water
Associated Lab Samples: 60302144001, 60302144002, 60302144003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	1.0	05/22/19 10:43	
Arsenic	ug/L	ND	1.0	05/22/19 10:43	
Barium	ug/L	ND	1.0	05/21/19 14:45	
Beryllium	ug/L	ND	0.50	05/21/19 14:45	
Cadmium	ug/L	ND	0.50	05/22/19 10:43	
Chromium	ug/L	ND	1.0	05/22/19 10:43	
Cobalt	ug/L	ND	1.0	05/21/19 14:45	
Lead	ug/L	ND	1.0	05/22/19 10:43	
Molybdenum	ug/L	ND	1.0	05/22/19 10:43	
Selenium	ug/L	ND	1.0	05/22/19 10:43	
Thallium	ug/L	ND	1.0	05/22/19 10:43	

LABORATORY CONTROL SAMPLE: 2402643

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	40	38.6	97	80-120	
Arsenic	ug/L	40	37.8	95	80-120	
Barium	ug/L	40	38.6	96	80-120	
Beryllium	ug/L	40	38.4	96	80-120	
Cadmium	ug/L	40	38.6	97	80-120	
Chromium	ug/L	40	39.9	100	80-120	
Cobalt	ug/L	40	39.6	99	80-120	
Lead	ug/L	40	38.9	97	80-120	
Molybdenum	ug/L	40	36.2	91	80-120	
Selenium	ug/L	40	37.6	94	80-120	
Thallium	ug/L	40	37.2	93	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2402644 2402645

Parameter	Units	60302081004 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	0.00029J mg/L	40	40	37.6	36.7	93	91	75-125	2	20	
Arsenic	ug/L	0.010 mg/L	40	40	47.7	47.4	94	93	75-125	1	20	
Barium	ug/L	0.15 mg/L	40	40	179	182	85	92	75-125	2	20	
Beryllium	ug/L	ND	40	40	36.6	36.1	91	90	75-125	1	20	
Cadmium	ug/L	0.000064J mg/L	40	40	36.5	36.1	91	90	75-125	1	20	

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QUALITY CONTROL DATA

Project: PRPA Rawhide

Pace Project No.: 60302144

MATRIX SPIKE & MATRIX SPIKE DUPLICATE:												2402644	2402645			
Parameter	Units	60302081004 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual				
Chromium	ug/L	0.0014 mg/L	40	40	45.6	45.0	110	109	75-125	1	20					
Cobalt	ug/L	0.0015 mg/L	40	40	41.1	40.9	99	99	75-125	0	20					
Lead	ug/L	0.00078J mg/L	40	40	34.8	34.8	85	85	75-125	0	20					
Molybdenum	ug/L	0.017 mg/L	40	40	57.3	57.7	102	103	75-125	1	20					
Selenium	ug/L	0.0027 mg/L	40	40	37.9	38.0	88	88	75-125	0	20					
Thallium	ug/L	ND	40	40	33.5	33.4	84	84	75-125	0	20					

MATRIX SPIKE SAMPLE: 2402646							
Parameter	Units	60302144002 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	ND	40	37.2	93	75-125	
Arsenic	ug/L	ND	40	38.2	95	75-125	
Barium	ug/L	15.5	40	54.9	99	75-125	
Beryllium	ug/L	ND	40	30.0	75	75-125	
Cadmium	ug/L	ND	40	33.9	85	75-125	
Chromium	ug/L	ND	40	31.4	78	75-125	
Cobalt	ug/L	ND	40	40.4	101	75-125	
Lead	ug/L	ND	40	31.8	79	75-125	
Molybdenum	ug/L	8.4	40	52.7	111	75-125	
Selenium	ug/L	ND	40	38.5	96	75-125	
Thallium	ug/L	ND	40	31.9	80	75-125	

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QUALITY CONTROL DATA

Project: PRPA Rawhide

Pace Project No.: 60302144

QC Batch:	584223	Analysis Method:	SM 2540C
QC Batch Method:	SM 2540C	Analysis Description:	2540C Total Dissolved Solids
Associated Lab Samples:	60302144001, 60302144002, 60302144003		

METHOD BLANK: 2397702 Matrix: Water

Associated Lab Samples: 60302144001, 60302144002, 60302144003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	5.0	05/13/19 17:48	

LABORATORY CONTROL SAMPLE: 2397703

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	1000	100	80-120	

SAMPLE DUPLICATE: 2397704

Parameter	Units	60302144002 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	3050	3250	6	10	

SAMPLE DUPLICATE: 2397705

Parameter	Units	60302293002 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	498	499	0	10	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA Rawhide

Pace Project No.: 60302144

QC Batch: 585667 Analysis Method: EPA 9056
QC Batch Method: EPA 9056 Analysis Description: 9056 IC Anions
Associated Lab Samples: 60302144001, 60302144002, 60302144003

METHOD BLANK: 2403247 Matrix: Water

Associated Lab Samples: 60302144001, 60302144002, 60302144003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	05/20/19 18:54	
Fluoride	mg/L	ND	0.20	05/20/19 18:54	

LABORATORY CONTROL SAMPLE: 2403248

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.8	96	80-120	
Fluoride	mg/L	2.5	2.4	96	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2403249 2403250

Parameter	Units	60302144002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	7.8	5	5	12.6	12.6	95	95	80-120	0	15	
Fluoride	mg/L	0.77	2.5	2.5	3.4	3.5	107	108	80-120	1	15	

SAMPLE DUPLICATE: 2403251

Parameter	Units	60302142001 Result	Dup Result	RPD	Max RPD	Qualifiers
Chloride	mg/L	6.0	6.1	0	15	
Fluoride	mg/L	0.31	0.26	18	15 D6	

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QUALITY CONTROL DATA

Project: PRPA Rawhide

Pace Project No.: 60302144

QC Batch: 586048

Analysis Method: EPA 9056

QC Batch Method: EPA 9056

Analysis Description: 9056 IC Anions

Associated Lab Samples: 60302144001, 60302144003

METHOD BLANK: 2404548

Matrix: Water

Associated Lab Samples: 60302144001, 60302144003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	05/22/19 02:41	
Sulfate	mg/L	ND	1.0	05/22/19 02:41	

LABORATORY CONTROL SAMPLE: 2404549

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.7	93	80-120	
Sulfate	mg/L	5	5.3	107	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2404550 2404551

Parameter	Units	60302144001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	10.7	50	50	56.4	56.5	91	91	80-120	0	15	
Sulfate	mg/L	75.7	50	50	125	126	99	100	80-120	0	15	

SAMPLE DUPLICATE: 2404552

Parameter	Units	60302144003 Result	Dup Result	RPD	Max RPD	Qualifiers
Chloride	mg/L	22.3	21.8	2	15	
Sulfate	mg/L	2730	2750	1	15	

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REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: PRPA Rawhide

Pace Project No.: 60302144

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K Pace Analytical Services - Kansas City

ANALYTE QUALIFIERS

D6 The precision between the sample and sample duplicate exceeded laboratory control limits.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: PRPA Rawhide

Pace Project No.: 60302144

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60302144001	ASH-06	EPA 3010	585383	EPA 6010	585483
60302144002	ASH-02	EPA 3010	585383	EPA 6010	585483
60302144003	ASH-08	EPA 3010	585383	EPA 6010	585483
60302144001	ASH-06	EPA 3010	585474	EPA 6020	585485
60302144002	ASH-02	EPA 3010	585474	EPA 6020	585485
60302144003	ASH-08	EPA 3010	585474	EPA 6020	585485
60302144001	ASH-06	EPA 7470	585292	EPA 7470	585460
60302144002	ASH-02	EPA 7470	585292	EPA 7470	585460
60302144003	ASH-08	EPA 7470	585292	EPA 7470	585460
60302144001	ASH-06	SM 2540C	584223		
60302144002	ASH-02	SM 2540C	584223		
60302144003	ASH-08	SM 2540C	584223		
60302144001	ASH-06	EPA 9056	585667		
60302144001	ASH-06	EPA 9056	586048		
60302144002	ASH-02	EPA 9056	585667		
60302144003	ASH-08	EPA 9056	585667		
60302144003	ASH-08	EPA 9056	586048		

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Sample Condition Upon Receipt

WO#: 60302144

Client Name:

AecomCourier: FedEx ☒ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☐ Client ☐ Other ☐Tracking #: 4740 87456277 Pace Shipping Label Used? Yes ☐ No ☒Custody Seal on Cooler/Box Present: Yes ☒ No ☐ Seals intact: Yes ☒ No ☐Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☐ Other ☒ XPICThermometer Used: T301 Type of Ice: Wet Blue NoneCooler Temperature (°C): As-read 1.3 Corr. Factor 0.0 Corrected 1.3Date and initials of person
examining contents: 5/8/19 HR

Temperature should be above freezing to 6°C

Chain of Custody present:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Chain of Custody relinquished:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Samples arrived within holding time:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Short Hold Time analyses (<72hr):	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	
Rush Turn Around Time requested:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	
Sufficient volume:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Correct containers used:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Pace containers used:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Containers intact:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	
Filtered volume received for dissolved tests?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	
Sample labels match COC: Date / time / ID / analyses	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Samples contain multiple phases? Matrix: <u>WT</u>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	
Containers requiring pH preservation in compliance? (HNO ₃ , H ₂ SO ₄ , HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added.
Cyanide water sample checks:		
Lead acetate strip turns dark? (Record only)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Potassium iodide test strip turns blue/purple? (Preserve)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Trip Blank present:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	
Headspace in VOA vials (>6mm):	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Samples from USDA Regulated Area: State:	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	

Client Notification/ Resolution:

Copy COC to Client? Y / N

Field Data Required? Y / N

Person Contacted: _____

Date/Time: _____

Comments/ Resolution: _____

Project Manager Review: _____

Date: _____

Section A		Section B		Section C	
Required Client Information:		Required Project Information:		Invoice Information:	
Company:	AECOM	Report To:	Geoff Webb	Attention:	Accounts Payable
Address:	6200 South Quebec St	Copy To:	Brian Rothmeyer	Company Name:	AECOM
	Greenwood Village, CO 80111			Address:	Same as Section A
Email To:	brian.rothmeyer@aecom.com	Purchase Order No.:		Pace Quote Reference:	42700
Phone:	(303) 740-2614	Project Name:	PRPA Rawhide	Pace Project Manager:	Heather Wilson
Requested Due Date/TAT:	Standard	Project Number:		Pace Profile #:	11033, 3
				<div> <div>Page: 1 of 1</div> </div>	
				<div> <div>REGULATORY AGENCY</div> <div> <input type="checkbox"/> NPDES <input type="checkbox"/> GROUND WATER <input type="checkbox"/> DRINKING WATER <input type="checkbox"/> UST <input type="checkbox"/> RCRA <input checked="" type="checkbox"/> OTHER <u>CCR</u> </div> </div>	
				<div> <div>Site Location</div> <div>CO</div> </div>	
				<div> <div>STATE:</div> </div>	

[illegible][illegible]

Platte River Power Authority – Rawhide DATA REVIEW CHECK

Data Package: 60302144

Sampling Event: May 6, 2019

Data Reviewer: Brian Rothmeyer

Peer Reviewer: Sheri Fling

Date Completed: July 29, 2019

Date Completed: July 31, 2019

This report contains the final results of the data validation conducted for the water samples collected May 6, 2019. The data review was conducted in accordance with the method and laboratory criteria, as applicable. The data review was conducted in accordance with method requirements and laboratory limits using guidance from USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540-R-2017-001 (January 2017).

General Overall Assessment:

- ☒ Data are usable without qualification.
☐ Data are usable with qualification (noted below).
☐ Some or all data are unusable for any purpose (detailed below).

Data Review Checklist

Review Parameter	Criteria	Criteria Met?		
		Yes	No	NA
<i>Sample-specific Parameters</i>	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.			
Chain of Custody, Sample Identification, & Sample Receipt	Samples were received intact and the cooler temperature was ≤ 6 degree Celsius upon arrival at the laboratory.	X		
Holding Times	The samples were analyzed within the method required holding times.	X		
Method Blanks (MB)	No target analytes reported in the associated MB.	X		
Quality Control Samples: Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD)	The LCS/LCSD recoveries were within the laboratory determined acceptance limits.	X		
Matrix Spike / Matrix Spike Duplicate (MS/MSD)	The recoveries and relative percent differences for the matrix spike and matrix spike duplicate analyses were within the laboratory-determined acceptance ranges. Results in the native sample greater than four times the concentration of the spike added during digestions/extractions are not considered to be a representative measure of accuracy. Further action with respect to spike recovery evaluation or qualification of data was not considered necessary.	X		
Laboratory Duplicate	The laboratory duplicate samples were within the laboratory determined acceptance limits. The following concentration dependent criteria were used to evaluate laboratory duplicates: <ul style="list-style-type: none"> When both the sample and duplicate values are $>5\times$ the reporting limit (RL), acceptable sampling and analytical precision is indicated by an relative percent difference (RPD) between the results of $\leq 20\%$. Where the result for one or both analytes of the method 	X		

Review Parameter	Criteria	Criteria Met?		
<i>Sample-specific Parameters</i>	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA
	duplicate pair is $<5xRL$, satisfactory precision is indicated if the absolute difference between the method duplicate results is $<1xRL$.			
Field Duplicate	<p>The field duplicate sample results satisfied the evaluation criteria below:</p> <ul style="list-style-type: none"> When both the sample and duplicate values are $>5xRL$ acceptable sampling and analytical precision is indicated by a RPD between the results of $\leq 30\%$. Where the result for one or both analytes of the field duplicate pair is $<5xRL$, satisfactory precision is indicated if the absolute difference between the field duplicate results is $<2xRL$. 			X
Equipment Blanks	No target analytes reported in the associated equipment blank.			X
Reporting Limits Met	No samples performed at dilutions or reported as non-detect at elevated method detection limits/reporting limits.	X		
Reporting	No reporting issues were found and further qualification was not considered necessary.	X		
Package Completeness	No results were qualified as unusable and the data are 100% complete.	X		

> – Greater Than

% – Percent

MB – Method Blank

RL – Reporting Limit

< – Less Than

LCS – Laboratory Control Sample

MS/MSD – Matrix Spike/Matrix Spike Duplicate

RPD – Relative Percent Difference

 \leq – Less Than or Equal To

LCSD – Laboratory Control Sample Duplicate

NA – Not Applicable

May 30, 2019

Geoff Webb
AECOM
6200 South Quebec St
Greenwood Village, CO 80111

RE: Project: PRPA Rawhide
Pace Project No.: 60302296

Dear Geoff Webb:

Enclosed are the analytical results for sample(s) received by the laboratory on May 08, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Heather Wilson
heather.wilson@pacelabs.com
1(913)563-1407
Project Manager

Enclosures

cc: Brian Rothmeyer, AECOM



REPORT OF LABORATORY ANALYSIS

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CERTIFICATIONS

Project: PRPA Rawhide

Pace Project No.: 60302296

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601

ANAB DOD-ELAP Rad Accreditation #: L2417

Alabama Certification #: 41590

Arizona Certification #: AZ0734

Arkansas Certification

California Certification #: 04222CA

Colorado Certification #: PA01547

Connecticut Certification #: PH-0694

Delaware Certification

EPA Region 4 DW Rad

Florida/TNI Certification #: E87683

Georgia Certification #: C040

Florida: Cert E871149 SEKS WET

Guam Certification

Hawaii Certification

Idaho Certification

Illinois Certification

Indiana Certification

Iowa Certification #: 391

Kansas/TNI Certification #: E-10358

Kentucky Certification #: KY90133

KY WW Permit #: KY0098221

KY WW Permit #: KY0000221

Louisiana DHH/TNI Certification #: LA180012

Louisiana DEQ/TNI Certification #: 4086

Maine Certification #: 2017020

Maryland Certification #: 308

Massachusetts Certification #: M-PA1457

Michigan/PADEP Certification #: 9991

Missouri Certification #: 235

Montana Certification #: Cert0082

Nebraska Certification #: NE-OS-29-14

Nevada Certification #: PA014572018-1

New Hampshire/TNI Certification #: 297617

New Jersey/TNI Certification #: PA051

New Mexico Certification #: PA01457

New York/TNI Certification #: 10888

North Carolina Certification #: 42706

North Dakota Certification #: R-190

Ohio EPA Rad Approval: #41249

Oregon/TNI Certification #: PA200002-010

Pennsylvania/TNI Certification #: 65-00282

Puerto Rico Certification #: PA01457

Rhode Island Certification #: 65-00282

South Dakota Certification

Tennessee Certification #: 02867

Texas/TNI Certification #: T104704188-17-3

Utah/TNI Certification #: PA014572017-9

USDA Soil Permit #: P330-17-00091

Vermont Dept. of Health: ID# VT-0282

Virgin Island/PADEP Certification

Virginia/VELAP Certification #: 9526

Washington Certification #: C868

West Virginia DEP Certification #: 143

West Virginia DHHR Certification #: 9964C

Wisconsin Approve List for Rad

Wyoming Certification #: 8TMS-L

REPORT OF LABORATORY ANALYSIS

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SAMPLE SUMMARY

Project: PRPA Rawhide

Pace Project No.: 60302296

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60302296001	ASH-06	Water	05/06/19 09:20	05/08/19 09:30
60302296002	ASH-02	Water	05/06/19 10:40	05/08/19 09:30
60302296003	ASH-02 MS	Water	05/06/19 10:40	05/08/19 09:30
60302296004	ASH-02 MSD	Water	05/06/19 10:40	05/08/19 09:30
60302296005	ASH-08	Water	05/06/19 12:55	05/08/19 09:30

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: PRPA Rawhide

Pace Project No.: 60302296

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60302296001	ASH-06	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60302296002	ASH-02	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60302296003	ASH-02 MS	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
60302296004	ASH-02 MSD	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
60302296005	ASH-08	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60302296

Sample: ASH-06 **Lab ID: 60302296001** Collected: 05/06/19 09:20 Received: 05/08/19 09:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.639 ± 0.508 (0.660) C:NA T:85%	pCi/L	05/23/19 11:03	13982-63-3	
Radium-228	EPA 904.0	0.234 ± 0.384 (0.834) C:79% T:79%	pCi/L	05/17/19 12:27	15262-20-1	
Total Radium	Total Radium Calculation	0.873 ± 0.892 (1.49)	pCi/L	05/28/19 11:20	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60302296

Sample: ASH-02 **Lab ID: 60302296002** Collected: 05/06/19 10:40 Received: 05/08/19 09:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.346 ± 0.393 (0.620) C:NA T:90%	pCi/L	05/23/19 11:03	13982-63-3	
Radium-228	EPA 904.0	0.0106 ± 0.351 (0.813) C:83% T:80%	pCi/L	05/17/19 12:27	15262-20-1	
Total Radium	Total Radium Calculation	0.357 ± 0.744 (1.43)	pCi/L	05/28/19 11:20	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60302296

Sample: ASH-02 MS		Lab ID: 60302296003	Collected: 05/06/19 10:40	Received: 05/08/19 09:30	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	88.79 %REC ± NA (NA) C:NA T:NA	pCi/L	05/23/19 11:03	13982-63-3	
Radium-228	EPA 904.0	99.89 %REC ± NA (NA) C:NA T:NA	pCi/L	05/17/19 12:27	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60302296

Sample: ASH-02 MSD **Lab ID:** 60302296004 Collected: 05/06/19 10:40 Received: 05/08/19 09:30 Matrix: Water
PWS: **Site ID:** **Sample Type:**
Comments: • MS of 002

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	106.73 %REC 18.35 RPD ± NA (NA) C:NA T:NA	pCi/L	05/23/19 11:03	13982-63-3	
Radium-228	EPA 904.0	107.61 %REC 7.43 RPD ± NA (NA) C:NA T:NA	pCi/L	05/17/19 12:28	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60302296

Sample: ASH-08 **Lab ID: 60302296005** Collected: 05/06/19 12:55 Received: 05/08/19 09:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.607 ± 0.562 (0.856) C:NA T:85%	pCi/L	05/23/19 11:03	13982-63-3	
Radium-228	EPA 904.0	0.684 ± 0.449 (0.866) C:78% T:84%	pCi/L	05/17/19 12:28	15262-20-1	
Total Radium	Total Radium Calculation	1.29 ± 1.01 (1.72)	pCi/L	05/28/19 11:20	7440-14-4	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60302296

QC Batch:	341988	Analysis Method:	EPA 904.0
QC Batch Method:	EPA 904.0	Analysis Description:	904.0 Radium 228
Associated Lab Samples:	60302296001, 60302296002, 60302296003, 60302296004, 60302296005		

METHOD BLANK:	1664626	Matrix:	Water
---------------	---------	---------	-------

Associated Lab Samples: 60302296001, 60302296002, 60302296003, 60302296004, 60302296005

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.345 ± 0.393 (0.825) C:83% T:75%	pCi/L	05/17/19 12:26	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALITY CONTROL - RADIOCHEMISTRY

Project: PRPA Rawhide

Pace Project No.: 60302296

QC Batch:	341987	Analysis Method:	EPA 903.1
QC Batch Method:	EPA 903.1	Analysis Description:	903.1 Radium-226
Associated Lab Samples:	60302296001, 60302296002, 60302296003, 60302296004, 60302296005		

METHOD BLANK:	1664625	Matrix:	Water
Associated Lab Samples:	60302296001, 60302296002, 60302296003, 60302296004, 60302296005		

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.397 ± 0.433 (0.681) C:NA T:72%	pCi/L	05/23/19 11:03	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: PRPA Rawhide

Pace Project No.: 60302296

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval).

Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-PA Pace Analytical Services - Greensburg

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: PRPA Rawhide

Pace Project No.: 60302296

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60302296001	ASH-06	EPA 903.1	341987		
60302296002	ASH-02	EPA 903.1	341987		
60302296003	ASH-02 MS	EPA 903.1	341987		
60302296004	ASH-02 MSD	EPA 903.1	341987		
60302296005	ASH-08	EPA 903.1	341987		
60302296001	ASH-06	EPA 904.0	341988		
60302296002	ASH-02	EPA 904.0	341988		
60302296003	ASH-02 MS	EPA 904.0	341988		
60302296004	ASH-02 MSD	EPA 904.0	341988		
60302296005	ASH-08	EPA 904.0	341988		
60302296001	ASH-06	Total Radium Calculation	344359		
60302296002	ASH-02	Total Radium Calculation	344359		
60302296005	ASH-08	Total Radium Calculation	344359		

REPORT OF LABORATORY ANALYSIS

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Chain of Custody

☒ Samples were sent directly to the Subcontracting Laboratory.

State Of Origin: CO
Cert. Needed: ☐ Yes ☒ No

Owner Received Date: 5/8/2019 Results Requested By: 5/30/2019

Workorder: 60302296 Workorder Name: PRPA Rawhide

Report To		Subcontract To		Requested Analysis																									
Heather Wilson Pace Analytical Kansas 9608 Loiret Blvd. Lenexa, KS 66219 Phone 1(913)563-1407		Pace Analytical Pittsburgh 1638 Roseytown Road Suites 2,3, & 4 Greensburg, PA 15601 Phone (724)850-5600		NO# : 30293648 																									
Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Preserved Containers	Radium-226 & Total Radium	Radium-228	LAB USE ONLY																				
1	ASH-06	PS	5/6/2019 09:20	60302296001	Water	Other 1	X	X	001																				
2	ASH-02	PS	5/6/2019 10:40	60302296002	Water	1	X	X	002																				
3	ASH-02 MS	PS	5/6/2019 10:40	60302296003	Water	1	X	X	003																				
4	ASH-02 MSD	PS	5/6/2019 10:40	60302296004	Water	1	X	X	004																				
5	ASH-08	PS	5/6/2019 12:55	60302296005	Water	1	X	X	005																				
<table border="1"> <thead> <tr> <th>Transfers</th> <th>Released By</th> <th>Date/Time</th> <th>Received By</th> <th>Date/Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td></td> <td></td> <td>UNRECORDED</td> <td>5.8.19</td> </tr> <tr> <td>2</td> <td></td> <td></td> <td>mg 59.19</td> <td></td> </tr> <tr> <td>3</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>										Transfers	Released By	Date/Time	Received By	Date/Time	1			UNRECORDED	5.8.19	2			mg 59.19		3				
Transfers	Released By	Date/Time	Received By	Date/Time																									
1			UNRECORDED	5.8.19																									
2			mg 59.19																										
3																													
Cooler Temperature on Receipt 2.7 °C Custody Seal <input checked="" type="checkbox"/> or N Received on Ice <input checked="" type="checkbox"/> or N Samples Intact <input checked="" type="checkbox"/> or N																													
Comments: *Please Provide QC sheets with report.																													

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC document.
This chain of custody is considered complete as is since this information is available in the owner laboratory.

Page 15 of 18

Pittsburgh Lab Sample Condition Upon Receipt



Client Name:

AECOM

Project #

#-30293648

Courier: ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace Other

Tracking #: 474687456575

Label	<u>mg</u>
LIMS Login	<u>mg</u>

Custody Seal on Cooler/Box Present: ☒ yes ☐ no Seals intact: ☒ yes ☐ no

Thermometer Used 11 Type of Ice: Wet Blue None

Cooler Temperature Observed Temp 2.7 °C Correction Factor: 0 °C Final Temp: 2.7 °C

Temp should be above freezing to 6°C

Comments:	Yes	No	N/A	pH paper Lot#	Date and Initials of person examining contents:
Chain of Custody Present:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<u>1053587</u>	<u>mg 5/8/19</u>
Chain of Custody Filled Out:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Chain of Custody Relinquished:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Sampler Name & Signature on COC:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Sample Labels match COC:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
-Includes date/time/ID Matrix: <u>WT</u>					
Samples Arrived within Hold Time:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Short Hold Time Analysis (<72hr remaining):	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Rush Turn Around Time Requested:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Sufficient Volume:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Correct Containers Used:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
-Pace Containers Used:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Containers Intact:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Orthophosphate field filtered	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Hex Cr Aqueous sample field filtered	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Organic Samples checked for dechlorination:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Filtered volume received for Dissolved tests	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
All containers have been checked for preservation.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
exceptions: VOA, coliform, TOC, O&G, Phenolics, Radon, Non-aqueous matrix				<u>pH < 2</u>	
All containers meet method preservation requirements.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Initial when completed <u>mg</u>	Date/time of preservation
				Lot # of added preservative	
Headspace in VOA Vials (>6mm):	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Trip Blank Present:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Trip Blank Custody Seals Present	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Rad Samples Screened < 0.5 mrem/hr	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Initial when completed <u>mg</u>	Date: <u>5-8-19</u>

Client Notification/ Resolution:

Person Contacted:

Date/Time:

Contacted By:

Comments/ Resolution:

☐ A check in this box indicates that additional information has been stored in ereports.

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

*PM review is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

Quality Control Sample Performance Assessment



Analyst Must Manually Enter All Fields Highlighted in Yellow.

Test: Ra-226
Analyst: MK1
Date: 5/14/2019
Batch ID: 47586
Matrix: DW

Method Blank Assessment	
MB Sample ID	1664625
MB Concentration:	0.397
MB Counting Uncertainty:	0.430
MB MDC:	0.681
MB Numerical Performance Indicator:	1.81
MB Status vs Numerical Indicator:	N/A
MB Status vs. MDC:	Pass

Laboratory Control Sample Assessment	
Count Date:	5/23/2019
Spike I.D.:	19-022
Spike Concentration (pCi/mL):	32.123
Volume Used (mL):	0.10
Aliquot Volume (L, g, F):	0.655
Target Conc. (pCi/L, g, F):	4.906
Uncertainty (Calculated):	0.231
Result (pCi/L, g, F):	5.082
LCS/LCSD Counting Uncertainty (pCi/L, g, F):	1.057
Numerical Performance Indicator:	0.32
Percent Recovery:	103.57%
Status vs Numerical Indicator:	N/A
Status vs Recovery:	Pass
Upper % Recovery Limits:	135%
Lower % Recovery Limits:	73%

Duplicate Sample Assessment	
Sample I.D.:	See Below ##
Duplicate Sample I.D.:	
Sample Result (pCi/L, g, F):	
Duplicate Result (pCi/L, g, F):	
Sample Result Counting Uncertainty (pCi/L, g, F):	
Duplicate Result Counting Uncertainty (pCi/L, g, F):	
Sample Duplicate Result Counting Uncertainty (pCi/L, g, F):	
Duplicate Duplicate Result Counting Uncertainty (pCi/L, g, F):	
Are sample and/or duplicate results below RL?	
Duplicate Numerical Performance Indicator:	
Duplicate RPD:	
Duplicate Status vs Numerical Indicator:	
Duplicate Status vs RPD:	
% RPD Limit:	

Evaluation of duplicate precision is not applicable if either the sample or duplicate results are below the RL.

Comments:

Sample Matrix Spike Control Assessment	
Sample Collection Date:	5/6/2019
Sample I.D.:	60302296002
Sample MS I.D.:	60302296003
Sample MSD I.D.:	60302296004
MS/MSD Decay Corrected Spike Concentration (pCi/mL):	19-022
Spike I.D.:	32.123
Spike Volume Used in MS (mL):	0.20
Spike Volume Used in MSD (mL):	0.20
MS Aliquot (L, g, F):	0.504
MS Target Conc. (pCi/L, g, F):	12.747
MSD Aliquot (L, g, F):	0.504
MSD Target Conc. (pCi/L, g, F):	12.748
MS Spike Uncertainty (calculated):	0.599
MSD Spike Uncertainty (calculated):	0.599
Sample Result Counting Uncertainty (pCi/L, g, F):	0.346
Sample Matrix Spike Result:	0.391
Matrix Spike Result Counting Uncertainty (pCi/L, g, F):	11.664
Sample Matrix Spike Duplicate Result:	13.952
Matrix Spike Duplicate Result Counting Uncertainty (pCi/L, g, F):	1.754
MS Numerical Performance Indicator:	-1.561
MSD Numerical Performance Indicator:	0.888
MS Percent Recovery:	88.79%
MSD Percent Recovery:	106.73%
MS Status vs Numerical Indicator:	N/A
MSD Status vs Numerical Indicator:	N/A
MS Status vs Recovery:	Pass
MSD Status vs Recovery:	Pass
MS/MSD Upper % Recovery Limits:	136%
MS/MSD Lower % Recovery Limits:	71%

Matrix Spike/Matrix Spike Duplicate Sample Assessment	
Sample I.D.:	60302296002
Sample MS I.D.:	60302296003
Sample MSD I.D.:	60302296004
Sample Matrix Spike Result:	11.664
Matrix Spike Result Counting Uncertainty (pCi/L, g, F):	1.645
Sample Matrix Spike Duplicate Result:	13.952
Matrix Spike Duplicate Result Counting Uncertainty (pCi/L, g, F):	1.754
Duplicate Numerical Performance Indicator:	-1.865
(Based on the Percent Recoveries) MS/ MSD Duplicate RPD:	18.35%
MS/ MSD Duplicate Status vs Numerical Indicator:	N/A
MS/ MSD Duplicate Status vs RPD:	Pass
% RPD Limit:	32%

Handwritten notes:
6/14/19
5-2-19

Quality Control Sample Performance Assessment



Analyst Must Manually Enter All Fields Highlighted in Yellow.

Test: Ra-228
Analyst: JLW
Date: 5/15/2019
Worklist: 47587
Matrix: DW

Method Blank Assessment	MB Sample ID 1664626
MB Concentration: 0.345	
M/B Counting Uncertainty: 0.388	
MB MDC: 0.825	
MB Numerical Performance Indicator: 1.74	
MB Status vs Numerical Indicator: N/A	
MB Status vs. MDC: Pass	

Laboratory Control Sample Assessment	LCSD (Y or N)? LCSD47587	N LCSD47587
Count Date: 5/17/2019		
Spike I.D.: 19-026		
Spike Concentration (pCi/mL): 36.854		
Volume Used (mL): 0.10		
Aliquot Volume (L, g, F): 0.803		
Target Conc. (pCi/L, g, F): 4.589		
Uncertainty (Calculated): 0.225		
Result (pCi/L, g, F): 3.358		
LCSD/LCSD Counting Uncertainty (pCi/L, g, F): 0.609		
Numerical Performance Indicator: -3.72		
Percent Recovery: 73.17%		
Status vs Numerical Indicator: N/A		
Status vs Recovery: Pass		

Duplicate Sample Assessment	Enter Duplicate sample IDs if other than LCS/LCSD in the space below.
Sample I.D.: Duplicate Sample I.D. Sample Result (pCi/L, g, F): Sample Result Counting Uncertainty (pCi/L, g, F): Sample Duplicate Result (pCi/L, g, F): Sample Duplicate Result Counting Uncertainty (pCi/L, g, F): Are sample and/or duplicate results below MDC? Duplicate Numerical Performance Indicator: Duplicate RPD: Duplicate Status vs Numerical Indicator: Duplicate Status vs RPD:	See Below ##

Evaluation of duplicate precision is not applicable if either the sample or duplicate results are below the MDC.

Comments:

5/15/19
JLW

6/10/2019
JLW

Sample Matrix Spike Control Assessment	Sample Collection Date: Sample I.D. Sample MS I.D. Sample MSD I.D.	5/1/2019 3029293001 3029293001MS 19-026	5/6/2019 60302296002 60302296003 60302296004
MS/MSD Decay Corrected Spike Concentration (pCi/mL): Spike Volume Used in MS (mL): Spike Volume Used in MSD (mL): MS Aliquot (L, g, F): MS Target Conc.(pCi/L, g, F): MSD Aliquot (L, g, F): MSD Target Conc. (pCi/L, g, F): Spike uncertainty (calculated): Sample Result Counting Uncertainty (pCi/L, g, F): Sample Matrix Spike Result: Matrix Spike Result Counting Uncertainty (pCi/L, g, F): Sample Matrix Spike Duplicate Result: Matrix Spike Duplicate Result Counting Uncertainty (pCi/L, g, F): MS Numerical Performance Indicator: MSD Numerical Performance Indicator: MS Percent Recovery: MSD Percent Recovery: MS Status vs Numerical Indicator: MSD Status vs Numerical Indicator: MS Status vs Recovery: MSD Status vs Recovery:	19-026 37.049 0.20 0.20 0.804 9.217 0.802 9.238 0.452 0.011 0.351 9.217 0.846 9.951 0.873 -0.019 1.319 99.89% 107.61% N/A N/A Pass Pass		

Matrix Spike/Matrix Spike Duplicate Sample Assessment	Sample I.D. Sample MS I.D. Sample MSD I.D. Sample Matrix Spike Result: Matrix Spike Result Counting Uncertainty (pCi/L, g, F): Sample Matrix Spike Duplicate Result: Matrix Spike Duplicate Result Counting Uncertainty (pCi/L, g, F): Duplicate Numerical Performance Indicator: (Based on the Percent Recoveries) MS/MSD Duplicate RPD: MS/MSD Duplicate Status vs Numerical Indicator: MS/MSD Duplicate Status vs RPD:	60302296003 60302296004 19-026 9.217 0.846 9.951 0.873 -1.183 7.43% N/A Pass
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Platte River Power Authority – Rawhide DATA REVIEW CHECK

Data Package: 60302296

Sampling Event: May 6, 2019

Data Reviewer: Brian Rothmeyer

Peer Reviewer: Sheri Fling

Date Completed: July 29, 2019

Date Completed: July 31, 2019

This report contains the final results of the data validation conducted for the water samples collected May 6, 2019. The data review was conducted in accordance with the method and laboratory criteria, as applicable. The data review was conducted in accordance with method requirements and laboratory limits.

General Overall Assessment:

- _____ Data are usable without qualification.
 X Data are usable with qualification (noted below).
 _____ Some or all data are unusable for any purpose (detailed below).

Data Review Checklist

Review Parameter	Criteria	Criteria Met?		
		Yes	No	NA
<i>Sample-specific Parameters</i>	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.			
Chain of Custody, Sample Identification, & Sample Receipt	Samples were received intact and the cooler temperature was ≤ 6 degree Celsius upon arrival at the laboratory.	X		
Holding Times	The samples were analyzed within the method required holding times.	X		
Method Blanks (MB)	No target analytes reported in the associated MB at concentrations greater than the minimum detectable concentration (MDC).	X		
Quality Control Samples: Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD)	The LCS/LCSD recoveries were within the laboratory determined acceptance limits.	X		
Matrix Spike / Matrix Spike Duplicate (MS/MSD)	The recoveries and relative percent differences for the matrix spike and matrix spike duplicate analyses were within the laboratory-determined acceptance ranges.	X		
Laboratory Duplicate	The laboratory duplicate samples were within the laboratory determined acceptance limits. The following concentration dependent criteria were used to evaluate laboratory duplicates: <ul style="list-style-type: none"> The agreement between parent sample results and the lab duplicate sample results were evaluated. The duplicate error ratios (DER) met the criterion of a $DER \leq 1$. 			X
Field Duplicate	The field duplicate sample results satisfied the evaluation criteria below: <ul style="list-style-type: none"> The agreement between parent sample results and the lab duplicate sample results were evaluated. The DER met the criterion of a $DER \leq 1$. 			X

Review Parameter	Criteria	Criteria Met?												
Sample-specific Parameters	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA										
Equipment Blanks	No target analytes reported in the associated equipment blank at concentrations greater than the MDC. <table><tr><th>Analyte</th><th>Concentration</th></tr><tr><td>EB-2 (60301882)</td><td></td></tr><tr><td>Radium-226</td><td>0.482 ± 0.377 pCi/L</td></tr></table> ± – Plus or Minus pCi/L – Picocuries Per Liter EB – Equipment Blank	Analyte	Concentration	EB-2 (60301882)		Radium-226	0.482 ± 0.377 pCi/L		X ¹					
Analyte	Concentration													
EB-2 (60301882)														
Radium-226	0.482 ± 0.377 pCi/L													
Detection Limits Mets (Radiochemistry)	For radiochemical results if the associated uncertainty was greater than the reported result, the 2 sigma (σ) uncertainty multiplied by 1.65 was less than or equal to the specified detection limit. <table><tr><th>Sample</th><th>Analyte</th><th>Result (pCi/L)</th><th>2 Sigma (σ) Uncertainty</th><th>MDC (pCi/L)</th></tr><tr><td>ASH-02</td><td>Ra-226</td><td>0.346</td><td>±0.393</td><td>0.620</td></tr></table> ± – Plus or Minus pCi/L – Picocuries per Liter MDC – Minimum Detectable Concentration Ra – Radium	Sample	Analyte	Result (pCi/L)	2 Sigma (σ) Uncertainty	MDC (pCi/L)	ASH-02	Ra-226	0.346	±0.393	0.620		X ²	
Sample	Analyte	Result (pCi/L)	2 Sigma (σ) Uncertainty	MDC (pCi/L)										
ASH-02	Ra-226	0.346	±0.393	0.620										
Tracer and/or Carrier Recovery	The sample specific recoveries were within the laboratory limits.	X												
Reporting	No reporting issues were found and further qualification was not considered necessary.	X												
Package Completeness	No results were qualified as unusable and the data are 100% complete.	X												
Comments														
1 – The associated radium-226 sample results reported at concentrations <5x the concentration of the blank contamination were qualified as estimated (J+ be) to reflect the potential high bias indicated by the blank contamination. 2 – The associated detected results where the 2 sigma (σ) uncertainty multiplied by 1.65 was greater than the reported minimum detectable concentration (MDC) were qualified as estimated (J v) indicating the detection limit criteria was not met.														

> – Greater Than

σ – Sigma

± – Plus or Minus

J – Estimated

LCSD – Laboratory Control Sample Duplicate

NA – Not Applicable

< – Less Than

pCi/L – Picocuries per Liter

be – Equipment Blank Contamination

J+ – Estimated Concentration, Biased High

MDC – Minimum Detectable Concentration

Ra – Radium

≤ – Less Than or Equal To

% – Percent

DER – Duplicate Error Ration

LCS – Laboratory Control Sample

MS/MSD – Matrix Spike/Matrix Spike Duplicate

v – Compound Identification Issue

August 08, 2019

Geoff Webb
AECOM
6200 South Quebec St
Greenwood Village, CO 80111

RE: Project: PRPA RAWHIDE CCR
Pace Project No.: 60309149

Dear Geoff Webb:

Enclosed are the analytical results for sample(s) received by the laboratory on July 18, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Heather Wilson
heather.wilson@pacelabs.com
1(913)563-1407
Project Manager

Enclosures

cc: Brian Rothmeyer, AECOM



REPORT OF LABORATORY ANALYSIS

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CERTIFICATIONS

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601

ANAB DOD-ELAP Rad Accreditation #: L2417

Alabama Certification #: 41590

Arizona Certification #: AZ0734

Arkansas Certification

California Certification #: 04222CA

Colorado Certification #: PA01547

Connecticut Certification #: PH-0694

Delaware Certification

EPA Region 4 DW Rad

Florida/TNI Certification #: E87683

Georgia Certification #: C040

Florida: Cert E871149 SEKS WET

Guam Certification

Hawaii Certification

Idaho Certification

Illinois Certification

Indiana Certification

Iowa Certification #: 391

Kansas/TNI Certification #: E-10358

Kentucky Certification #: KY90133

KY WW Permit #: KY0098221

KY WW Permit #: KY0000221

Louisiana DHH/TNI Certification #: LA180012

Louisiana DEQ/TNI Certification #: 4086

Maine Certification #: 2017020

Maryland Certification #: 308

Massachusetts Certification #: M-PA1457

Michigan/PADEP Certification #: 9991

Missouri Certification #: 235

Montana Certification #: Cert0082

Nebraska Certification #: NE-OS-29-14

Nevada Certification #: PA014572018-1

New Hampshire/TNI Certification #: 297617

New Jersey/TNI Certification #: PA051

New Mexico Certification #: PA01457

New York/TNI Certification #: 10888

North Carolina Certification #: 42706

North Dakota Certification #: R-190

Ohio EPA Rad Approval: #41249

Oregon/TNI Certification #: PA200002-010

Pennsylvania/TNI Certification #: 65-00282

Puerto Rico Certification #: PA01457

Rhode Island Certification #: 65-00282

South Dakota Certification

Tennessee Certification #: 02867

Texas/TNI Certification #: T104704188-17-3

Utah/TNI Certification #: PA014572017-9

USDA Soil Permit #: P330-17-00091

Vermont Dept. of Health: ID# VT-0282

Virgin Island/PADEP Certification

Virginia/VELAP Certification #: 9526

Washington Certification #: C868

West Virginia DEP Certification #: 143

West Virginia DHHR Certification #: 9964C

Wisconsin Approve List for Rad

Wyoming Certification #: 8TMS-L

Kansas Certification IDs

9608 Loiret Boulevard, Lenexa, KS 66219

Missouri Inorganic Drinking Water Certification #: 10090

Arkansas Drinking Water

Arkansas Certification #: 19-016-0

Arkansas Drinking Water

Illinois Certification #: 004455

Iowa Certification #: 118

Kansas/NELAP Certification #: E-10116

Louisiana Certification #: 03055

Nevada Certification #: KS000212018-1

Oklahoma Certification #: 9205/9935

Florida: Cert E871149 SEKS WET

Texas Certification #: T104704407-18-11

Utah Certification #: KS000212018-8

Illinois Certification #: 004592

Kansas Field Laboratory Accreditation: # E-92587

Missouri SEKS Micro Certification: 10070

REPORT OF LABORATORY ANALYSIS

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SAMPLE SUMMARY

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60309149001	BAT-12	Water	07/17/19 09:00	07/18/19 08:20
60309149002	DUP-3	Water	07/17/19 09:00	07/18/19 08:20
60309149003	MW-2	Water	07/17/19 11:30	07/18/19 08:20
60309149004	ASH-08	Water	07/17/19 14:00	07/18/19 08:20
60309149005	EB-1	Water	07/17/19 15:30	07/18/19 08:20
60309149006	BAT-12	Water	07/17/19 09:00	07/18/19 09:30
60309149007	DUP-3	Water	07/17/19 09:00	07/18/19 09:30
60309149008	MW-2	Water	07/17/19 11:30	07/18/19 09:30
60309149009	ASH-08	Water	07/17/19 14:00	07/18/19 09:30
60309149010	EB-1	Water	07/17/19 15:30	07/18/19 09:30

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60309149001	BAT-12	EPA 6010	EMR	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	JDE	1	PASI-K
		SM 2540C	AJS	1	PASI-K
		EPA 9056	MGS	3	PASI-K
60309149002	DUP-3	EPA 6010	EMR	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	JDE	1	PASI-K
		SM 2540C	AJS	1	PASI-K
		EPA 9056	MGS	3	PASI-K
60309149003	MW-2	EPA 6010	EMR	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	JDE	1	PASI-K
		SM 2540C	AJS	1	PASI-K
		EPA 9056	MGS	3	PASI-K
60309149004	ASH-08	EPA 6010	EMR	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	JDE	1	PASI-K
		SM 2540C	AJS	1	PASI-K
		EPA 9056	MGS	3	PASI-K
60309149005	EB-1	EPA 6010	EMR	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	JDE	1	PASI-K
		SM 2540C	AJS	1	PASI-K
		EPA 9056	MGS	3	PASI-K
60309149006	BAT-12	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60309149007	DUP-3	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60309149008	MW-2	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60309149009	ASH-08	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60309149010	EB-1	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

Sample: BAT-12		Lab ID: 60309149001	Collected: 07/17/19 09:00	Received: 07/18/19 08:20	Matrix: Water			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010						
Boron	515	ug/L	100	1	07/26/19 11:26	07/30/19 13:13	7440-42-8	
Calcium	256000	ug/L	200	1	07/26/19 11:26	07/30/19 13:13	7440-70-2	
Lithium	117	ug/L	10.0	1	07/26/19 11:26	07/30/19 13:13	7439-93-2	
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010						
Antimony	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 14:58	7440-36-0	
Arsenic	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 14:58	7440-38-2	
Barium	23.6	ug/L	1.0	1	07/22/19 14:43	07/23/19 14:58	7440-39-3	
Beryllium	ND	ug/L	0.50	1	07/22/19 14:43	07/23/19 14:58	7440-41-7	
Cadmium	ND	ug/L	0.50	1	07/22/19 14:43	07/23/19 14:58	7440-43-9	
Chromium	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 14:58	7440-47-3	
Cobalt	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 14:58	7440-48-4	
Lead	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 14:58	7439-92-1	
Molybdenum	4.8	ug/L	1.0	1	07/22/19 14:43	07/23/19 14:58	7439-98-7	
Selenium	1.7	ug/L	1.0	1	07/22/19 14:43	07/23/19 14:58	7782-49-2	
Thallium	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 14:58	7440-28-0	
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470						
Mercury	ND	ug/L	0.20	1	07/19/19 10:40	07/22/19 11:58	7439-97-6	
2540C Total Dissolved Solids		Analytical Method: SM 2540C						
Total Dissolved Solids	1880	mg/L	20.0	1		07/23/19 10:15		
9056 IC Anions		Analytical Method: EPA 9056						
Chloride	84.7	mg/L	5.0	5		07/19/19 04:40	16887-00-6	
Fluoride	0.44	mg/L	0.20	1		07/19/19 04:25	16984-48-8	
Sulfate	1350	mg/L	200	200		07/19/19 04:56	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

Sample: DUP-3		Lab ID: 60309149002	Collected: 07/17/19 09:00	Received: 07/18/19 08:20	Matrix: Water			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010						
Boron	490	ug/L	100	1	07/26/19 11:26	07/30/19 13:16	7440-42-8	
Calcium	248000	ug/L	200	1	07/26/19 11:26	07/30/19 13:16	7440-70-2	
Lithium	113	ug/L	10.0	1	07/26/19 11:26	07/30/19 13:16	7439-93-2	
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010						
Antimony	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:02	7440-36-0	
Arsenic	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:02	7440-38-2	
Barium	23.0	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:02	7440-39-3	
Beryllium	ND	ug/L	0.50	1	07/22/19 14:43	07/23/19 15:02	7440-41-7	
Cadmium	ND	ug/L	0.50	1	07/22/19 14:43	07/23/19 15:02	7440-43-9	
Chromium	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:02	7440-47-3	
Cobalt	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:02	7440-48-4	
Lead	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:02	7439-92-1	
Molybdenum	4.7	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:02	7439-98-7	
Selenium	1.6	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:02	7782-49-2	
Thallium	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:02	7440-28-0	
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470						
Mercury	ND	ug/L	0.20	1	07/19/19 10:40	07/22/19 12:00	7439-97-6	
2540C Total Dissolved Solids		Analytical Method: SM 2540C						
Total Dissolved Solids	1860	mg/L	20.0	1		07/23/19 10:15		
9056 IC Anions		Analytical Method: EPA 9056						
Chloride	86.8	mg/L	5.0	5		07/19/19 05:27	16887-00-6	
Fluoride	0.47	mg/L	0.20	1		07/19/19 05:11	16984-48-8	
Sulfate	1290	mg/L	200	200		07/19/19 05:43	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

Sample: MW-2		Lab ID: 60309149003		Collected: 07/17/19 11:30		Received: 07/18/19 08:20		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	2000	ug/L	100	1	07/26/19 11:26	07/30/19 13:18	7440-42-8		
Calcium	174000	ug/L	200	1	07/26/19 11:26	07/30/19 13:18	7440-70-2		
Lithium	300	ug/L	10.0	1	07/26/19 11:26	07/30/19 13:18	7439-93-2		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:07	7440-36-0		
Arsenic	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:07	7440-38-2		
Barium	18.4	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:07	7440-39-3		
Beryllium	ND	ug/L	0.50	1	07/22/19 14:43	07/23/19 15:07	7440-41-7		
Cadmium	ND	ug/L	0.50	1	07/22/19 14:43	07/23/19 15:07	7440-43-9		
Chromium	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:07	7440-47-3		
Cobalt	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:07	7440-48-4		
Lead	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:07	7439-92-1		
Molybdenum	6.9	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:07	7439-98-7		
Selenium	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:07	7782-49-2		
Thallium	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:07	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/19/19 10:40	07/22/19 12:02	7439-97-6		
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	3390	mg/L	66.7	1		07/23/19 10:15			
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	22.4	mg/L	5.0	5		07/19/19 08:12	16887-00-6		
Fluoride	ND	mg/L	0.20	1		07/19/19 05:58	16984-48-8		
Sulfate	2330	mg/L	200	200		07/19/19 08:28	14808-79-8		

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

Sample: ASH-08		Lab ID: 60309149004		Collected: 07/17/19 14:00		Received: 07/18/19 08:20		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	914	ug/L	100	1	07/26/19 11:26	07/30/19 13:20	7440-42-8		
Calcium	430000	ug/L	200	1	07/26/19 11:26	07/30/19 13:20	7440-70-2		
Lithium	294	ug/L	10.0	1	07/26/19 11:26	07/30/19 13:20	7439-93-2		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	2.0	2	07/22/19 14:43	07/23/19 15:34	7440-36-0	D3	
Arsenic	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:11	7440-38-2		
Barium	22.1	ug/L	2.0	2	07/22/19 14:43	07/23/19 15:34	7440-39-3		
Beryllium	ND	ug/L	0.50	1	07/22/19 14:43	07/23/19 15:11	7440-41-7		
Cadmium	ND	ug/L	0.50	1	07/22/19 14:43	07/23/19 15:11	7440-43-9		
Chromium	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:11	7440-47-3		
Cobalt	1.7	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:11	7440-48-4		
Lead	ND	ug/L	2.0	2	07/22/19 14:43	07/23/19 15:34	7439-92-1	D3	
Molybdenum	2.6	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:11	7439-98-7		
Selenium	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:11	7782-49-2		
Thallium	ND	ug/L	2.0	2	07/22/19 14:43	07/23/19 15:34	7440-28-0	D3	
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/19/19 10:40	07/22/19 12:04	7439-97-6		
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	4190	mg/L	66.7	1		07/23/19 10:15			
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	19.0	mg/L	1.0	1		07/19/19 09:46	16887-00-6		
Fluoride	ND	mg/L	0.20	1		07/19/19 09:46	16984-48-8		
Sulfate	2980	mg/L	200	200		07/19/19 08:44	14808-79-8		

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

Sample: EB-1		Lab ID: 60309149005		Collected: 07/17/19 15:30		Received: 07/18/19 08:20		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	ND	ug/L	100	1	07/26/19 11:26	07/30/19 13:23	7440-42-8		
Calcium	ND	ug/L	200	1	07/26/19 11:26	07/30/19 13:23	7440-70-2		
Lithium	ND	ug/L	10.0	1	07/26/19 11:26	07/30/19 13:23	7439-93-2		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:16	7440-36-0		
Arsenic	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:16	7440-38-2		
Barium	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:16	7440-39-3		
Beryllium	ND	ug/L	0.50	1	07/22/19 14:43	07/23/19 15:16	7440-41-7		
Cadmium	ND	ug/L	0.50	1	07/22/19 14:43	07/23/19 15:16	7440-43-9		
Chromium	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:16	7440-47-3		
Cobalt	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:16	7440-48-4		
Lead	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:16	7439-92-1		
Molybdenum	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:16	7439-98-7		
Selenium	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:16	7782-49-2		
Thallium	ND	ug/L	1.0	1	07/22/19 14:43	07/23/19 15:16	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/19/19 10:40	07/22/19 12:07	7439-97-6		
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	ND	mg/L	5.0	1		07/23/19 10:15			
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	ND	mg/L	1.0	1		07/19/19 10:02	16887-00-6		
Fluoride	ND	mg/L	0.20	1		07/19/19 10:02	16984-48-8		
Sulfate	ND	mg/L	1.0	1		07/19/19 10:02	14808-79-8		

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

QC Batch: 597645 Analysis Method: EPA 7470
QC Batch Method: EPA 7470 Analysis Description: 7470 Mercury
Associated Lab Samples: 60309149001, 60309149002, 60309149003, 60309149004, 60309149005

METHOD BLANK: 2447554 Matrix: Water
Associated Lab Samples: 60309149001, 60309149002, 60309149003, 60309149004, 60309149005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	07/22/19 11:42	

LABORATORY CONTROL SAMPLE: 2447555

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	5	4.5	91	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2447556 2447557

Parameter	Units	60309025003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	5	5	5.0	5.0	99	100	75-125	1	20	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2447599 2447600

Parameter	Units	60308984001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	5	5	4.8	4.9	96	97	75-125	1	20	

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

QC Batch: 599220 Analysis Method: EPA 6010
QC Batch Method: EPA 3010 Analysis Description: 6010 MET
Associated Lab Samples: 60309149001, 60309149002, 60309149003, 60309149004, 60309149005

METHOD BLANK: 2452932 Matrix: Water
Associated Lab Samples: 60309149001, 60309149002, 60309149003, 60309149004, 60309149005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	ug/L	ND	100	07/30/19 13:09	
Calcium	ug/L	ND	200	07/30/19 13:09	
Lithium	ug/L	ND	10.0	07/30/19 13:09	

LABORATORY CONTROL SAMPLE: 2452933

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	1000	987	99	80-120	
Calcium	ug/L	10000	10700	107	80-120	
Lithium	ug/L	1000	958	96	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2452934 2452935

Parameter	Units	60308805002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	741	1000	1000	1750	1780	101	104	75-125	2	20	
Calcium	ug/L	487000	10000	10000	510000	532000	227	449	75-125	4	20	M1
Lithium	ug/L	286	1000	1000	1350	1340	106	105	75-125	1	20	

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

QC Batch: 598096 Analysis Method: EPA 6020
QC Batch Method: EPA 3010 Analysis Description: 6020 MET
Associated Lab Samples: 60309149001, 60309149002, 60309149003, 60309149004, 60309149005

METHOD BLANK: 2449293 Matrix: Water
Associated Lab Samples: 60309149001, 60309149002, 60309149003, 60309149004, 60309149005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	1.0	07/23/19 14:17	
Arsenic	ug/L	ND	1.0	07/23/19 14:17	
Barium	ug/L	ND	1.0	07/23/19 14:17	
Beryllium	ug/L	ND	0.50	07/23/19 14:17	
Cadmium	ug/L	ND	0.50	07/23/19 14:17	
Chromium	ug/L	ND	1.0	07/23/19 14:17	
Cobalt	ug/L	ND	1.0	07/23/19 14:17	
Lead	ug/L	ND	1.0	07/23/19 14:17	
Molybdenum	ug/L	ND	1.0	07/23/19 14:17	
Selenium	ug/L	ND	1.0	07/23/19 14:17	
Thallium	ug/L	ND	1.0	07/23/19 14:17	

LABORATORY CONTROL SAMPLE: 2449294

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	40	36.9	92	80-120	
Arsenic	ug/L	40	39.7	99	80-120	
Barium	ug/L	40	36.9	92	80-120	
Beryllium	ug/L	40	38.6	97	80-120	
Cadmium	ug/L	40	40.0	100	80-120	
Chromium	ug/L	40	39.4	98	80-120	
Cobalt	ug/L	40	39.8	99	80-120	
Lead	ug/L	40	38.9	97	80-120	
Molybdenum	ug/L	40	35.1	88	80-120	
Selenium	ug/L	40	40.3	101	80-120	
Thallium	ug/L	40	37.5	94	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2449295 2449296

Parameter	Units	60308632003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	ND	40	40	34.2	35.0	85	87	75-125	2	20	
Arsenic	ug/L	ND	40	40	38.3	38.1	95	94	75-125	0	20	
Barium	ug/L	36.1	40	40	73.7	74.4	94	96	75-125	1	20	
Beryllium	ug/L	ND	40	40	34.6	34.9	86	87	75-125	1	20	
Cadmium	ug/L	ND	40	40	33.5	33.8	84	85	75-125	1	20	
Chromium	ug/L	1.3	40	40	43.0	44.0	104	107	75-125	2	20	
Cobalt	ug/L	ND	40	40	38.9	38.7	97	96	75-125	0	20	

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2449295 2449296											
Parameter	Units	60308632003 Result	MS		MSD		MS		MSD		Max
			Spike Conc.	Spike Conc.	Result	Result	% Rec	% Rec	% Rec	RPD	
Lead	ug/L	ND	40	40	34.1	34.7	85	86	75-125	2	20
Molybdenum	ug/L	3.7	40	40	38.9	39.0	88	88	75-125	0	20
Selenium	ug/L	33.3	40	40	69.4	68.3	90	88	75-125	2	20
Thallium	ug/L	ND	40	40	33.8	34.3	84	86	75-125	2	20

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

QC Batch: 598316 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60309149001, 60309149002, 60309149003, 60309149004, 60309149005

METHOD BLANK: 2449785 Matrix: Water
Associated Lab Samples: 60309149001, 60309149002, 60309149003, 60309149004, 60309149005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	5.0	07/23/19 10:14	

LABORATORY CONTROL SAMPLE: 2449786

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	1020	102	80-120	

SAMPLE DUPLICATE: 2449787

Parameter	Units	60309136003 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	453	453	0	10	

SAMPLE DUPLICATE: 2449788

Parameter	Units	60309149005 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	ND	ND		10	

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

QC Batch:	597469	Analysis Method:	EPA 9056
QC Batch Method:	EPA 9056	Analysis Description:	9056 IC Anions
Associated Lab Samples:	60309149001, 60309149002, 60309149003, 60309149004, 60309149005		

METHOD BLANK:	2446782	Matrix:	Water
Associated Lab Samples:	60309149001, 60309149002, 60309149003, 60309149004, 60309149005		

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	07/18/19 20:52	
Fluoride	mg/L	ND	0.20	07/18/19 20:52	
Sulfate	mg/L	ND	1.0	07/18/19 20:52	

LABORATORY CONTROL SAMPLE: 2446783

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	5.0	99	80-120	
Fluoride	mg/L	2.5	2.5	98	80-120	
Sulfate	mg/L	5	4.9	99	80-120	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

Sample: BAT-12 **Lab ID: 60309149006** Collected: 07/17/19 09:00 Received: 07/18/19 09:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	1.05 ± 0.617 (0.711) C:NA T:90%	pCi/L	07/29/19 12:56	13982-63-3	
Radium-228	EPA 904.0	0.958 ± 0.439 (0.744) C:83% T:77%	pCi/L	07/29/19 13:02	15262-20-1	
Total Radium	Total Radium Calculation	2.01 ± 1.06 (1.46)	pCi/L	07/30/19 13:57	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

Sample: DUP-3		Lab ID: 60309149007	Collected: 07/17/19 09:00	Received: 07/18/19 09:30	Matrix: Water		
PWS:		Site ID:	Sample Type:				
Parameters	Method	Act ± Unc (MDC) Carr Trac		Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.885 ± 0.560 (0.633) C:NA T:88%		pCi/L	07/31/19 10:56	13982-63-3	
Radium-228	EPA 904.0	0.957 ± 0.515 (0.961) C:81% T:82%		pCi/L	07/30/19 12:44	15262-20-1	
Total Radium	Total Radium Calculation	1.84 ± 1.08 (1.59)		pCi/L	08/01/19 14:05	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

Sample: MW-2		Lab ID: 60309149008	Collected: 07/17/19 11:30	Received: 07/18/19 09:30	Matrix: Water		
PWS:		Site ID:	Sample Type:				
Parameters	Method	Act ± Unc (MDC) Carr Trac		Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.381 ± 0.497 (0.820) C:NA T:84%		pCi/L	07/31/19 10:56	13982-63-3	
Radium-228	EPA 904.0	0.365 ± 0.420 (0.887) C:79% T:85%		pCi/L	07/30/19 12:44	15262-20-1	
Total Radium	Total Radium Calculation	0.746 ± 0.917 (1.71)		pCi/L	08/01/19 14:05	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

Sample: ASH-08 **Lab ID: 60309149009** Collected: 07/17/19 14:00 Received: 07/18/19 09:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.193 ± 0.334 (0.596) C:NA T:91%	pCi/L	07/31/19 10:56	13982-63-3	
Radium-228	EPA 904.0	0.557 ± 0.389 (0.766) C:83% T:94%	pCi/L	07/30/19 12:44	15262-20-1	
Total Radium	Total Radium Calculation	0.750 ± 0.723 (1.36)	pCi/L	08/01/19 14:05	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

Sample: EB-1		Lab ID: 60309149010	Collected: 07/17/19 15:30	Received: 07/18/19 09:30	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.652 ± 0.412 (0.466) C:NA T:105%	pCi/L	07/31/19 10:56	13982-63-3	
Radium-228	EPA 904.0	-0.0235 ± 0.353 (0.814) C:85% T:91%	pCi/L	07/30/19 12:44	15262-20-1	
Total Radium	Total Radium Calculation	0.652 ± 0.765 (1.28)	pCi/L	08/01/19 14:05	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL - RADIOCHEMISTRY

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

QC Batch: 353244

Analysis Method: EPA 903.1

QC Batch Method: EPA 903.1

Analysis Description: 903.1 Radium-226

Associated Lab Samples: 60309149006

METHOD BLANK: 1716115

Matrix: Water

Associated Lab Samples: 60309149006

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.406 ± 0.362 (0.486) C:NA T:87%	pCi/L	07/29/19 12:38	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL - RADIOCHEMISTRY

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

QC Batch: 353245

Analysis Method: EPA 904.0

QC Batch Method: EPA 904.0

Analysis Description: 904.0 Radium 228

Associated Lab Samples: 60309149006

METHOD BLANK: 1716116

Matrix: Water

Associated Lab Samples: 60309149006

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.674 ± 0.370 (0.658) C:80% T:79%	pCi/L	07/29/19 13:02	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALITY CONTROL - RADIOCHEMISTRY

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

QC Batch:	353043	Analysis Method:	EPA 903.1
QC Batch Method:	EPA 903.1	Analysis Description:	903.1 Radium-226
Associated Lab Samples:	60309149007, 60309149008, 60309149009, 60309149010		

METHOD BLANK:	1715076	Matrix:	Water
Associated Lab Samples:	60309149007, 60309149008, 60309149009, 60309149010		

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.357 ± 0.390 (0.613) C:NA T:90%	pCi/L	07/31/19 10:56	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALITY CONTROL - RADIOCHEMISTRY

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

QC Batch:	353049	Analysis Method:	EPA 904.0
QC Batch Method:	EPA 904.0	Analysis Description:	904.0 Radium 228
Associated Lab Samples: 60309149007, 60309149008, 60309149009, 60309149010			

METHOD BLANK:	1715088	Matrix:	Water
Associated Lab Samples: 60309149007, 60309149008, 60309149009, 60309149010			

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	1.15 ± 0.415 (0.582) C:81% T:84%	pCi/L	07/30/19 11:07	1e

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: PRPA RAWHIDE CCR
Pace Project No.: 60309149

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.
 ND - Not Detected at or above adjusted reporting limit.
 TNTC - Too Numerous To Count
 J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.
 MDL - Adjusted Method Detection Limit.
 PQL - Practical Quantitation Limit.
 RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.
 S - Surrogate
 1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.
 Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.
 LCS(D) - Laboratory Control Sample (Duplicate)
 MS(D) - Matrix Spike (Duplicate)
 DUP - Sample Duplicate
 RPD - Relative Percent Difference
 NC - Not Calculable.
 SG - Silica Gel - Clean-Up
 U - Indicates the compound was analyzed for, but not detected.
 N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.
 Act - Activity
 Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval).
 Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)
 (MDC) - Minimum Detectable Concentration
 Trac - Tracer Recovery (%)
 Carr - Carrier Recovery (%)
 Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.
 TNI - The NELAC Institute.

LABORATORIES

PASI-K Pace Analytical Services - Kansas City
 PASI-PA Pace Analytical Services - Greensburg

ANALYTE QUALIFIERS

1e Analyte detected in Method Blank above the Ra-228 RL of 1.0 pCi/L. Samples with activity results below RDL of 1.0 pCi/L or greater than 10x the MB activity do not require qualification.
 D3 Sample was diluted due to the presence of high levels of non-target analytes or other matrix interference.
 M1 Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: PRPA RAWHIDE CCR

Pace Project No.: 60309149

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60309149001	BAT-12	EPA 3010	599220	EPA 6010	599370
60309149002	DUP-3	EPA 3010	599220	EPA 6010	599370
60309149003	MW-2	EPA 3010	599220	EPA 6010	599370
60309149004	ASH-08	EPA 3010	599220	EPA 6010	599370
60309149005	EB-1	EPA 3010	599220	EPA 6010	599370
60309149001	BAT-12	EPA 3010	598096	EPA 6020	598242
60309149002	DUP-3	EPA 3010	598096	EPA 6020	598242
60309149003	MW-2	EPA 3010	598096	EPA 6020	598242
60309149004	ASH-08	EPA 3010	598096	EPA 6020	598242
60309149005	EB-1	EPA 3010	598096	EPA 6020	598242
60309149001	BAT-12	EPA 7470	597645	EPA 7470	597727
60309149002	DUP-3	EPA 7470	597645	EPA 7470	597727
60309149003	MW-2	EPA 7470	597645	EPA 7470	597727
60309149004	ASH-08	EPA 7470	597645	EPA 7470	597727
60309149005	EB-1	EPA 7470	597645	EPA 7470	597727
60309149006	BAT-12	EPA 903.1	353244		
60309149007	DUP-3	EPA 903.1	353043		
60309149008	MW-2	EPA 903.1	353043		
60309149009	ASH-08	EPA 903.1	353043		
60309149010	EB-1	EPA 903.1	353043		
60309149006	BAT-12	EPA 904.0	353245		
60309149007	DUP-3	EPA 904.0	353049		
60309149008	MW-2	EPA 904.0	353049		
60309149009	ASH-08	EPA 904.0	353049		
60309149010	EB-1	EPA 904.0	353049		
60309149006	BAT-12	Total Radium Calculation	354233		
60309149007	DUP-3	Total Radium Calculation	354720		
60309149008	MW-2	Total Radium Calculation	354720		
60309149009	ASH-08	Total Radium Calculation	354720		
60309149010	EB-1	Total Radium Calculation	354720		
60309149001	BAT-12	SM 2540C	598316		
60309149002	DUP-3	SM 2540C	598316		
60309149003	MW-2	SM 2540C	598316		
60309149004	ASH-08	SM 2540C	598316		
60309149005	EB-1	SM 2540C	598316		
60309149001	BAT-12	EPA 9056	597469		
60309149002	DUP-3	EPA 9056	597469		
60309149003	MW-2	EPA 9056	597469		
60309149004	ASH-08	EPA 9056	597469		
60309149005	EB-1	EPA 9056	597469		

REPORT OF LABORATORY ANALYSIS

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Sample Condition Upon Receipt

WO#: 60309149

60309149

Client Name: AlcomCourier: FedEx ☒ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☐ Client ☐ Other ☐Tracking #: 100768510978 Pace Shipping Label Used? Yes ☐ No ☒Custody Seal on Cooler/Box Present: Yes ☒ No ☐ Seals intact: Yes ☒ No ☐Packing Material: Bubble Wrap ☐ Bubble Bags ☒ Foam ☐ None ☐ Other ☐Thermometer Used: A-301 Type of Ice: Wet ☒ Blue ☐ None ☐Cooler Temperature (°C): As-read 3.9 Corr. Factor 0.0 Corrected 3.9Date and initials of person
examining contents: 7/18/19

Temperature should be above freezing to 6°C

Chain of Custody present:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Chain of Custody relinquished:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Samples arrived within holding time:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Short Hold Time analyses (<72hr):	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	
Rush Turn Around Time requested:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	
Sufficient volume:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Correct containers used:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Pace containers used:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Containers intact:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Filtered volume received for dissolved tests?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Sample labels match COC: Date / time / ID / analyses	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Samples contain multiple phases? Matrix: <u>Wet</u>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	
Containers requiring pH preservation in compliance? (HNO ₃ , H ₂ SO ₄ , HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added.
Cyanide water sample checks:		
Lead acetate strip turns dark? (Record only)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Potassium iodide test strip turns blue/purple? (Preserve)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Trip Blank present:	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Headspace in VOA vials (>6mm):	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Samples from USDA Regulated Area: State:	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	

Client Notification/ Resolution:

Copy COC to Client? Y / N

Field Data Required? Y / N

Person Contacted: _____

Date/Time: _____

Comments/ Resolution: _____

Project Manager Review: _____

Date: _____

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information: Company: AECOM Address: 6200 South Quebec St Greenwood Village, CO 80111 Email To: brian.rothmeyer@aecom.com Phone: (303) 740-2614 Fax: Requested Due Date/TAT: 15 day		Section B Required Project Information: Report To: Geoff Webb Copy To: Brian Rothmeyer Purchase Order No.: Project Name: PRPA Rawhide Project Number:		Section C Invoice Information: Attention: Accounts Payable Company Name: AECOM Address: Same as Section A Pace Quote Reference: 42700 Pace Project Manager: Heather Wilson Pace Profile #: 11033, 3	
Section D Required Client Information Valid Matrix Codes MATRIX CODE DRINKING WATER DW WASTE WATER WT WASTE WATER PRODUCT P SOIL/SOLID SL OIL OI WIPE WI AIR AR OTHER OT TISSUE TS		REGULATORY AGENCY <input type="checkbox"/> NPDES <input type="checkbox"/> GROUND WATER <input type="checkbox"/> DRINKING WATER <input type="checkbox"/> UST <input type="checkbox"/> RCRA <input type="checkbox"/> OTHER CCR			
SAMPLE ID (A-Z, 0-9 / -) Sample IDs MUST BE UNIQUE		Site Location STATE: CO			

ITEM #	Section D Required Client Information	Valid Matrix Codes MATRIX CODE DRINKING WATER DW WATER WT WASTE WATER WW PRODUCT P SOIL/SOLID SL OIL OL WIPE WP AIR AR OTHER OT TISSUE TS	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED				SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives								Analysis Test ↑ Y/N ↓	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.					
					COMPOSITE START	COMPOSITE END/GRAB	DATE	TIME			DATE	TIME	Unpreserved	H ₂ SO ₄	HNO ₃	HCl	NaOH	Na ₂ S ₂ O ₃				Methanol	Other			
1	BAT-12		WT	G	7.17.19	9:00	—	—		3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	001
2	DUP-3		WT	G	7.17.19	—	—	—		3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	002
3	MW-2		WT	G	7.17.19	11:30	—	—		3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	003
4	ASH-08		WT	G	7.17.19	14:00	—	—		3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	004
5	EB-1		WT	G	7.17.19	15:30	—	—		3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	005
6																										
7																										
8																										
9																										
10																										
11																										
12																										

ADDITIONAL COMMENTS *Be, Cr, Co, As, Se, Mo, Cd, Sb, Ba, Ti, Pb **B, Ca, Li		RELINQUISHED BY / AFFILIATION Wk Wund	DATE 7.17.19	TIME 15:35	ACCEPTED BY / AFFILIATION Wes Weichert	DATE 7/17/19	TIME 0820	SAMPLE CONDITIONS Ice (Y/N) <input checked="" type="checkbox"/> Received on (Y/N) <input checked="" type="checkbox"/> Custody Sealed (Y/N) <input checked="" type="checkbox"/> Cooler (Y/N) <input checked="" type="checkbox"/> Samples Intact (Y/N) <input checked="" type="checkbox"/>
SAMPLER NAME AND SIGNATURE PRINT Name of SAMPLER: Wes Weichert SIGNATURE of SAMPLER: Wk Wund		DATE Signed (MM/DD/YY): 07/17/19		Temp in °C				



CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:	
Company:	AECOM	Report To:	Geoff Webb	Attention:	Accounts Payable
Address:	6200 South Quebec St Greenwood Village, CO 80111	Copy To:	Brian Rothmeyer	Company Name:	AECOM
Email To:	brian.rothmeyer@aecom.com	Purchase Order No.:		Address:	Same as Section A
Phone:	(303) 740-2614	Project Name:	PRPA Rawhide	Pace Quote Reference:	42700
Requested Due Date/TAT:	15 day	Project Number:		Pace Project Manager:	Heather Wilson
				Pace Profile #:	11033, 3

Page: 1 of 1

REGULATORY AGENCY	
<input type="checkbox"/> NPDES	<input type="checkbox"/> GROUND WATER
<input type="checkbox"/> UST	<input type="checkbox"/> RCRA
<input type="checkbox"/> OTHER	<input type="checkbox"/> DRINKING WATER
Site Location: CO	
STATE: 11033, 3	

ITEM #	Section D Required Client Information	Valid Matrix Codes MATRIX CODE DRINKING WATER DW WASTE WATER WW PRODUCT P SOIL/SOLID SL OIL OL WIPE WP AIR AR OTHER OT TISSUE TS	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED				SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives										Analysis Test Y/N	Requested Analysis Filtered (Y/N)												Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
					COMPOSITE START	COMPOSITE END/GRAB	DATE	TIME			Unpreserved	H ₂ SO ₄	HNO ₃	HCl	NaOH	Na ₂ S ₂ O ₃	Methanol	Other	Radium-226	Radium-228		Total Radium																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
1	BAT-12		WT	G	7.17.19	9:00			2		X																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS	
	Wu Wunest	7.17.19	15:35	Wu Wunest	7/18/19	9:30	Y	Y

SAMPLER NAME AND SIGNATURE		Temp in °C	Received on	Custody Sealed	Cooler (Y/N)	Samples Intact (Y/N)
PRINT Name of SAMPLER: Wes Weighant						
SIGNATURE of SAMPLER: Wu Wunest						
DATE Signed (MM/DD/YY): 07/17/19						

Pittsburgh Lab Sample Condition Upon Receipt



Client Name:

AECOM

Project #

Courier: ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace Other

Tracking #: 1007 8250 8614

Label

LIMS Login

Custody Seal on Cooler/Box Present: ☒ yes ☐ no Seals intact: ☒ yes ☐ no

Thermometer Used

11

Type of Ice: Wet Blue None

Cooler Temperature

Observed Temp

4.8 °C

Correction Factor: 0 °C

Final Temp: 4.8 °C

Temp should be above freezing to 6°C

Comments:	Yes	No	N/A	pH paper Lot#	Date and Initials of person examining contents:
Chain of Custody Present:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<u>1004281</u>	<u>mg 7/18/19</u>
Chain of Custody Filled Out:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Chain of Custody Relinquished:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Sampler Name & Signature on COC:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Sample Labels match COC:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
-Includes date/time/ID Matrix: <u>WT</u>					
Samples Arrived within Hold Time:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Short Hold Time Analysis (<72hr remaining):	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Rush Turn Around Time Requested:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Sufficient Volume:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Correct Containers Used:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
-Pace Containers Used:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Containers Intact:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Orthophosphate field filtered	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Hex Cr Aqueous sample field filtered	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Organic Samples checked for dechlorination:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Filtered volume received for Dissolved tests	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
All containers have been checked for preservation.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
exceptions: VOA, coliform, TOC, O&G, Phenolics, Radon, Non-aqueous matrix					
All containers meet method preservation requirements.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Initial when completed <u>mg</u>	Date/time of preservation
				Lot # of added preservative	
Headspace in VOA Vials (>6mm):	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Trip Blank Present:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Trip Blank Custody Seals Present	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Rad Samples Screened < 0.5 mrem/hr	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Initial when completed <u>mg</u>	Date: <u>7/18/19</u>

Client Notification/ Resolution:

Person-Contacted:

Date/Time:

Contacted By:

Comments/ Resolution:

☐ A check in this box indicates that additional information has been stored in ereports.

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

*PM review is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

Quality Control Sample Performance Assessment



Test: Ra-226
Analyst: MK1
Date: 7/24/2019
Batch ID: 48833
Matrix: DW

Method Blank Assessment	
MB Sample ID	1716115
MB Concentration:	0.406
MB Counting Uncertainty:	0.359
MB MDC:	0.486
MB Numerical Performance Indicator:	2.22
MB Status vs Numerical Indicator:	N/A
MB Status vs. MDC:	Pass

Laboratory Control Sample Assessment	
LCS48833	N
Count Date:	7/29/2019
Spike I.D.:	19-022
Spike Concentration (pCi/mL):	32.120
Volume Used (mL):	0.10
Aliquot Volume (L, g, F):	0.653
Target Conc. (pCi/L, g, F):	4.922
Uncertainty (Calculated):	0.231
Result (pCi/L, g, F):	4.980
LCS/LCSD Counting Uncertainty (pCi/L, g, F):	1.027
Numerical Performance Indicator:	101.17%
Status vs Numerical Indicator:	N/A
Status vs Recovery:	Pass
Upper % Recovery Limits:	135%
Lower % Recovery Limits:	73%

Duplicate Sample Assessment	
Sample I.D.:	30315220001
Duplicate Sample I.D.:	30315220001DUP
Sample Result Counting Uncertainty (pCi/L, g, F):	0.191
Sample Duplicate Result Counting Uncertainty (pCi/L, g, F):	0.529
Sample Duplicate Result Counting Uncertainty (pCi/L, g, F):	0.344
Are sample and/or duplicate results below RL?	0.367
Duplicate Numerical Performance Indicator:	See Below #
Duplicate RPD:	-0.467
Duplicate Status vs Numerical Indicator:	57.36%
Duplicate Status vs RPD:	N/A
% RPD Limit:	Fail*** 32%

*** Evaluation of duplicate precision is not applicable if either the sample or duplicate results are below the RL.

Comments:

***Batch must be re-prepped due to unacceptable precision.

Analyst Must Manually Enter All Fields Highlighted in Yellow.

Sample Matrix Spike Control Assessment	
Sample Collection Date:	7/17/2019
Sample I.D.:	35482946001
Sample MS I.D.:	35482946001MS
Sample MSD I.D.:	
Spike I.D.:	19-022
MS/MSD Decay Corrected Spike Concentration (pCi/mL):	32.121
Spike Volume Used in MS (mL):	0.20
Spike Volume Used in MSD (mL):	0.656
MS Aliquot (L, g, F):	9.787
MSD Aliquot (L, g, F):	
MS Target Conc. (pCi/L, g, F):	
MSD Target Conc. (pCi/L, g, F):	0.460
MS Spike Uncertainty (calculated):	
MSD Spike Uncertainty (calculated):	
Sample Result Counting Uncertainty (pCi/L, g, F):	0.226
Sample Matrix Spike Result:	0.198
Matrix Spike Result Counting Uncertainty (pCi/L, g, F):	10.891
Sample Matrix Spike Duplicate Result:	1.515
Matrix Spike Duplicate Result Counting Uncertainty (pCi/L, g, F):	
MS Numerical Performance Indicator:	0.833
MSD Numerical Performance Indicator:	
MS Percent Recovery:	106.93%
MSD Percent Recovery:	
MS Status vs Numerical Indicator:	N/A
MSD Status vs Numerical Indicator:	
MS Status vs Recovery:	Pass
MSD Status vs Recovery:	
MS/MSD Upper % Recovery Limits:	136%
MS/MSD Lower % Recovery Limits:	71%

Matrix Spike/Matrix Spike Duplicate Sample Assessment	
Sample I.D.:	
Sample MS I.D.:	
Sample MSD I.D.:	
Sample Matrix Spike Result:	
Matrix Spike Result Counting Uncertainty (pCi/L, g, F):	
Sample Matrix Spike Duplicate Result:	
Matrix Spike Duplicate Result Counting Uncertainty (pCi/L, g, F):	
Duplicate Numerical Performance Indicator:	
(Based on the Percent Recoveries) MS/MSD Duplicate RPD:	
MS/MSD Duplicate Status vs Numerical Indicator:	
MS/MSD Duplicate Status vs RPD:	
% RPD Limit:	

Quality Control Sample Performance Assessment



Analyst Must Manually Enter All Fields Highlighted in Yellow.

Test: Ra-226
Analyst: MK1
Date: 7/23/2019
Batch ID: 48813
Matrix: DW

Method Blank Assessment	
MB Sample ID	1715076
MB Concentration:	0.357
MB Counting Uncertainty:	0.388
MB MDC:	0.613
MB Numerical Performance Indicator:	1.81
MB Status vs Numerical Indicator:	N/A
MB Status vs. MDC:	Pass

Laboratory Control Sample Assessment	
LCSD (Y or N)?	N
LCSD48813	LCSD48813
Count Date:	7/31/2019
Spike I.D.:	19-022
Spike Concentration (pCi/mL):	32.120
Volume Used (mL):	0.10
Aliquot Volume (L, g, F):	0.654
Target Conc. (pCi/L, g, F):	4.913
Uncertainty (Calculated):	0.231
Result (pCi/L, g, F):	4.124
LCSD/LCSD Counting Uncertainty (pCi/L, g, F):	0.838
Numerical Performance Indicator:	-1.78
Percent Recovery:	83.95%
Status vs Numerical Indicator:	N/A
Status vs Recovery:	Pass
Upper % Recovery Limits:	135%
Lower % Recovery Limits:	73%

Duplicate Sample Assessment	
Sample I.D.:	30314963001
Duplicate Sample I.D.:	30314963001DUP
Sample Result Counting Uncertainty (pCi/L, g, F):	0.299
Sample Duplicate Result Counting Uncertainty (pCi/L, g, F):	0.351
Sample Duplicate Result Counting Uncertainty (pCi/L, g, F):	0.620
Are sample and/or duplicate results below RL?	0.455
Duplicate Numerical Performance Indicator:	See Below #
Duplicate RPD:	-1.095
Duplicate Status vs Numerical Indicator:	69.85%
Duplicate Status vs RPD:	N/A
% RPD Limit:	Fail
	32%

Evaluation of duplicate precision is not applicable if either the sample or duplicate results are below the RL.

Comments:

Batch must be re-prepped due to unacceptable precision.

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Sample Matrix Spike Control Assessment	
Sample Collection Date:	7/15/2019
Sample I.D.:	30314966001
Sample MS I.D.:	30314966001MS
Sample MSD I.D.:	
MS/MSD Decay Corrected Spike Concentration (pCi/mL):	19-022
Spike Volume Used in MS (mL):	32.121
Spike Volume Used in MSD (mL):	0.20
MS Aliquot (L, g, F):	0.654
MS Target Conc. (pCi/L, g, F):	9.823
MSD Aliquot (L, g, F):	
MSD Target Conc. (pCi/L, g, F):	
MSD Spike Uncertainty (calculated):	0.462
MS Spike Uncertainty (calculated):	
MSD Spike Uncertainty (calculated):	
Sample Result Counting Uncertainty (pCi/L, g, F):	0.048
Sample Matrix Spike Result:	0.248
Matrix Spike Result Counting Uncertainty (pCi/L, g, F):	10.410
Sample Matrix Spike Duplicate Result:	1.530
Matrix Spike Duplicate Result Counting Uncertainty (pCi/L, g, F):	
MS Numerical Performance Indicator:	0.654
MSD Numerical Performance Indicator:	
MS Percent Recovery:	105.49%
MSD Percent Recovery:	
MS Status vs Numerical Indicator:	N/A
MSD Status vs Numerical Indicator:	
MS Status vs Recovery:	Pass
MSD Status vs Recovery:	
MS/MSD Upper % Recovery Limits:	136%
MS/MSD Lower % Recovery Limits:	71%

Matrix Spike/Matrix Spike Duplicate Sample Assessment	
Sample I.D.:	
Sample MS I.D.:	
Sample MSD I.D.:	
Sample Matrix Spike Result:	
Matrix Spike Result Counting Uncertainty (pCi/L, g, F):	
Sample Matrix Spike Duplicate Result:	
Sample Matrix Spike Duplicate Result Counting Uncertainty (pCi/L, g, F):	
Duplicate Numerical Performance Indicator:	
(Based on the Percent Recoveries) MS/MSD Duplicate RPD:	
MS/MSD Duplicate Status vs Numerical Indicator:	
MS/MSD Duplicate Status vs RPD:	
% RPD Limit:	

7-31-19 uc

Platte River Power Authority – Rawhide DATA REVIEW CHECK

Data Package: 60309149Sampling Event: July 17th, 2019

Data Reviewer: Joel MacKinney

Data Reviewer: Brian Rothmeyer

Peer Reviewer: Steve Szocik

Date Completed: September 25, 2019

Date Completed: October 17, 2019

Date Completed: October 22, 2019

This report contains the final results of the data validation conducted for the water samples collected July 17th, 2019. The data review was conducted in accordance with the method and laboratory criteria, as applicable. The data review was conducted in accordance with method requirements and laboratory limits using guidance from USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540-R-2017-001 (January 2017).

General Overall Assessment:

- _____ Data are usable without qualification.
 X Data are usable with qualification (noted below).
 _____ Some or all data are unusable for any purpose (detailed below).

Data Review Checklist

Review Parameter	Criteria	Criteria Met?																				
<i>Sample-specific Parameters</i>	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA																		
Chain of Custody, Sample Identification, & Sample Receipt	Samples were received intact and the cooler temperature was <6 degree Celsius upon arrival at the laboratory.	X																				
Holding Times	The samples were analyzed within the method required holding times.	X																				
Method Blanks (MB)	No target analytes reported in the associated MB. <table><tr><th>Analyte</th><th>Concentration</th></tr><tr><td colspan="2">MB 1716115</td></tr><tr><td>Ra-226</td><td>0.406 ± 0.362 pCi/L</td></tr><tr><td colspan="2">MB 1716116</td></tr><tr><td>Ra-228</td><td>0.674 ± 0.370 pCi/L</td></tr><tr><td colspan="2">MB 1715076</td></tr><tr><td>Ra-226</td><td>0.357 ± 0.390 pCi/L</td></tr><tr><td colspan="2">MB 1716116</td></tr><tr><td>Ra-228</td><td>1.15 ± 0.415 pCi/L</td></tr></table> ± – Plus or Minus pCi/L – Picocuries Per Liter MB – Method Blank Ra – Radium	Analyte	Concentration	MB 1716115		Ra-226	0.406 ± 0.362 pCi/L	MB 1716116		Ra-228	0.674 ± 0.370 pCi/L	MB 1715076		Ra-226	0.357 ± 0.390 pCi/L	MB 1716116		Ra-228	1.15 ± 0.415 pCi/L		X ¹	
Analyte	Concentration																					
MB 1716115																						
Ra-226	0.406 ± 0.362 pCi/L																					
MB 1716116																						
Ra-228	0.674 ± 0.370 pCi/L																					
MB 1715076																						
Ra-226	0.357 ± 0.390 pCi/L																					
MB 1716116																						
Ra-228	1.15 ± 0.415 pCi/L																					
Quality Control Samples: Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD)	The LCS/LCSD recoveries were within the laboratory determined acceptance limits.	X																				
Matrix Spike / Matrix Spike Duplicate (MS/MSD)	The recoveries and relative percent differences for the matrix spike and matrix spike duplicate analyses were within the laboratory-determined acceptance ranges. Results in the native sample greater than four times the concentration of the spike added during digestions/extractions are not considered to be a representative measure of accuracy.	X																				

Review Parameter	Criteria	Criteria Met?										
Sample-specific Parameters	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA								
	Further action with respect to spike recovery evaluation or qualification of data was not considered necessary.											
Laboratory Duplicate	The laboratory duplicate samples were within the laboratory determined acceptance limits. The following concentration dependent criteria were used to evaluate laboratory duplicates: <ul style="list-style-type: none">When both the sample and duplicate values are >5x the reporting limit (RL), acceptable sampling and analytical precision is indicated by an relative percent difference (RPD) between the results of ≤20%.Where the result for one or both analytes of the method duplicate pair is <5xRL, satisfactory precision is indicated if the absolute difference between the method duplicate results is <1xRL.The agreement between parent sample results and the lab duplicate sample results were evaluated. The duplicate error ratios (DER) met the criterion of a DER ≤1.	X										
Field Duplicate	The field duplicate sample results satisfied the evaluation criteria below: <table><tr><th>Parent Sample</th><th>Field Duplicate</th></tr><tr><td>BAT-12</td><td>DUP-3</td></tr></table> <ul style="list-style-type: none">When both the sample and duplicate values are >5xRL acceptable sampling and analytical precision is indicated by a relative percent difference (RPD) between the results of ≤30%.Where the result for one or both analytes of the field duplicate pair is <5xRL, satisfactory precision is indicated if the absolute difference between the field duplicate results is <2xRL.The agreement between parent sample results and the field duplicate sample results were evaluated. The DER met the criterion of a DER ≤1.	Parent Sample	Field Duplicate	BAT-12	DUP-3	X						
Parent Sample	Field Duplicate											
BAT-12	DUP-3											
Equipment Blanks	No target analytes reported in the associated equipment blank. <table><tr><th>Analyte</th><th>Concentration</th></tr><tr><td>EB-1</td><td></td></tr><tr><td>Radium-226</td><td>0.652 ± 0.412 pCi/L</td></tr><tr><td>Radium, Total</td><td>0.652 ± 0.765 pCi/L</td></tr></table> ± – Plus or Minus pCi/L – Picocuries Per Liter	Analyte	Concentration	EB-1		Radium-226	0.652 ± 0.412 pCi/L	Radium, Total	0.652 ± 0.765 pCi/L		X ²	
Analyte	Concentration											
EB-1												
Radium-226	0.652 ± 0.412 pCi/L											
Radium, Total	0.652 ± 0.765 pCi/L											
Reporting Limits Met (Non –Radiochemistry)	No samples performed at dilutions or reported as non-detect at elevated method detection limits/reporting limits.		X ³									
Detection Limits Mets (Radiochemistry)	For radiochemical results if the associated uncertainty was greater than the reported result, the 2 sigma (σ) uncertainty multiplied by 1.65 was less than or equal to the specified detection limit.		X ⁴									

Review Parameter	Criteria	Criteria Met?												
<i>Sample-specific Parameters</i>	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA										
	<table border="1"> <thead> <tr> <th>Sample</th><th>Analyte</th><th>Result (pCi/L)</th><th>2 Sigma (σ) Uncertainty</th><th>MDC (pCi/L)</th></tr> </thead> <tbody> <tr> <td>MW-2</td><td>Ra-226</td><td>0.381</td><td>± 0.497</td><td>0.820</td></tr> </tbody> </table> <p> \pm – Plus or Minus pCi/L – Picocuries Per Liter MDC – Minimum Detectable Concentration Ra – Radium </p>	Sample	Analyte	Result (pCi/L)	2 Sigma (σ) Uncertainty	MDC (pCi/L)	MW-2	Ra-226	0.381	± 0.497	0.820			
Sample	Analyte	Result (pCi/L)	2 Sigma (σ) Uncertainty	MDC (pCi/L)										
MW-2	Ra-226	0.381	± 0.497	0.820										
Tracer and/or Carrier Recovery	The sample specific recoveries were within the laboratory limits.	X												
Package Completeness	No results were qualified as unusable and the data are 100% complete.	X												
Comments														
<p>1 – The associated radium-226, radium-228 and total radium sample results reported at concentrations $<5x$ the concentration of the blank contamination were qualified as estimated (J+ bl) to reflect the potential high bias indicated by the blank contamination.</p> <p>2 – The associated radium-226 and total radium sample results reported at concentrations $>5x$ the concentration of the blank contamination were qualified as estimated (J+ be) to reflect the potential high bias indicated by the blank contamination.</p> <p>3 – Several analytes were reported as non-detect at elevated reporting limits. These non-detect results will need to be evaluated by the end user of the data with respect to project objectives.</p> <p>4 – For the associated detected radium-226 result for sample MW-2, the 2 sigma (σ) uncertainty multiplied by 1.65 was greater than the reported minimum detectable concentration (MDC) and was qualified as estimated (J v) indicating the detection limit criteria was not met.</p>														

$>$ – Greater Than
 $\mu\text{g/L}$ – Microgram per Liter
 $\%$ – Percent

bl – Laboratory Blank Contamination
LCS – Laboratory Control Sample
MS/MSD – Matrix Spike/Matrix Spike Duplicate
RL – Reporting Limit
v – Compound Identification Issue

$<$ – Less Than

σ – Sigma
 \pm – Plus or Minus
DER – Duplicate Error Ratio
LCS – Laboratory Control Sample Duplicate
NA – Not Applicable
RPD – Relative Percent Difference

\leq – Less Than or Equal To
pCi/L – Picocuries Per Liter
be – Equipment Blank

J – Estimated
MDC – Minimum Detectable Concentration
Ra – Radium
U – Non-detect

August 08, 2019

Geoff Webb
AECOM
6200 South Quebec St
Greenwood Village, CO 80111

RE: Project: PRPA Rawhide CCR
Pace Project No.: 60309345

Dear Geoff Webb:

Enclosed are the analytical results for sample(s) received by the laboratory on July 19, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

Revised Report_rev.1 Added Radchem QC.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Heather Wilson
heather.wilson@pacelabs.com
1(913)563-1407
Project Manager

Enclosures

cc: Brian Rothmeyer, AECOM



REPORT OF LABORATORY ANALYSIS

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CERTIFICATIONS

Project: PRPA Rawhide CCR

Pace Project No.: 60309345

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601

ANAB DOD-ELAP Rad Accreditation #: L2417

Alabama Certification #: 41590

Arizona Certification #: AZ0734

Arkansas Certification

California Certification #: 04222CA

Colorado Certification #: PA01547

Connecticut Certification #: PH-0694

Delaware Certification

EPA Region 4 DW Rad

Florida/TNI Certification #: E87683

Georgia Certification #: C040

Florida: Cert E871149 SEKS WET

Guam Certification

Hawaii Certification

Idaho Certification

Illinois Certification

Indiana Certification

Iowa Certification #: 391

Kansas/TNI Certification #: E-10358

Kentucky Certification #: KY90133

KY WW Permit #: KY0098221

KY WW Permit #: KY0000221

Louisiana DHH/TNI Certification #: LA180012

Louisiana DEQ/TNI Certification #: 4086

Maine Certification #: 2017020

Maryland Certification #: 308

Massachusetts Certification #: M-PA1457

Michigan/PADEP Certification #: 9991

Missouri Certification #: 235

Montana Certification #: Cert0082

Nebraska Certification #: NE-OS-29-14

Nevada Certification #: PA014572018-1

New Hampshire/TNI Certification #: 297617

New Jersey/TNI Certification #: PA051

New Mexico Certification #: PA01457

New York/TNI Certification #: 10888

North Carolina Certification #: 42706

North Dakota Certification #: R-190

Ohio EPA Rad Approval: #41249

Oregon/TNI Certification #: PA200002-010

Pennsylvania/TNI Certification #: 65-00282

Puerto Rico Certification #: PA01457

Rhode Island Certification #: 65-00282

South Dakota Certification

Tennessee Certification #: 02867

Texas/TNI Certification #: T104704188-17-3

Utah/TNI Certification #: PA014572017-9

USDA Soil Permit #: P330-17-00091

Vermont Dept. of Health: ID# VT-0282

Virgin Island/PADEP Certification

Virginia/VELAP Certification #: 9526

Washington Certification #: C868

West Virginia DEP Certification #: 143

West Virginia DHHR Certification #: 9964C

Wisconsin Approve List for Rad

Wyoming Certification #: 8TMS-L

Kansas Certification IDs

9608 Loiret Boulevard, Lenexa, KS 66219

Missouri Inorganic Drinking Water Certification #: 10090

Arkansas Drinking Water

Arkansas Certification #: 19-016-0

Arkansas Drinking Water

Illinois Certification #: 004455

Iowa Certification #: 118

Kansas/NELAP Certification #: E-10116

Louisiana Certification #: 03055

Nevada Certification #: KS000212018-1

Oklahoma Certification #: 9205/9935

Florida: Cert E871149 SEKS WET

Texas Certification #: T104704407-18-11

Utah Certification #: KS000212018-8

Illinois Certification #: 004592

Kansas Field Laboratory Accreditation: # E-92587

Missouri SEKS Micro Certification: 10070

REPORT OF LABORATORY ANALYSIS

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SAMPLE SUMMARY

Project: PRPA Rawhide CCR

Pace Project No.: 60309345

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60309345001	ASH-07	Water	07/18/19 09:00	07/19/19 08:45
60309345002	ASH-06	Water	07/18/19 11:45	07/19/19 08:45
60309345003	ASH-07	Water	07/18/19 09:00	07/19/19 09:30
60309345004	ASH-07 MS	Water	07/18/19 09:00	07/19/19 09:30
60309345005	ASH-06	Water	07/18/19 11:45	07/19/19 09:30

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: PRPA Rawhide CCR

Pace Project No.: 60309345

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60309345001	ASH-07	EPA 6010	EMR	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	JDE	1	PASI-K
		SM 2540C	AJS	1	PASI-K
		EPA 9056	JDS	3	PASI-K
60309345002	ASH-06	EPA 6010	EMR	3	PASI-K
		EPA 6020	JGP	11	PASI-K
		EPA 7470	JDE	1	PASI-K
		SM 2540C	AJS	1	PASI-K
		EPA 9056	JDS	3	PASI-K
60309345003	ASH-07	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60309345004	ASH-07 MS	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
60309345005	ASH-06	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA Rawhide CCR

Pace Project No.: 60309345

Sample: ASH-07		Lab ID: 60309345001		Collected: 07/18/19 09:00		Received: 07/19/19 08:45		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	602	ug/L	100	1	07/25/19 10:20	07/31/19 11:46	7440-42-8	M1	
Calcium	431000	ug/L	200	1	07/25/19 10:20	07/31/19 11:46	7440-70-2		
Lithium	510	ug/L	10.0	1	07/25/19 10:20	07/31/19 11:46	7439-93-2		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	07/29/19 11:42	07/30/19 13:48	7440-36-0	D3	
Arsenic	ND	ug/L	1.0	1	07/29/19 11:42	07/30/19 13:48	7440-38-2		
Barium	13.3	ug/L	5.0	5	07/29/19 11:42	07/31/19 12:26	7440-39-3		
Beryllium	ND	ug/L	0.50	1	07/29/19 11:42	07/30/19 13:48	7440-41-7		
Cadmium	ND	ug/L	0.50	1	07/29/19 11:42	07/30/19 13:48	7440-43-9		
Chromium	ND	ug/L	1.0	1	07/29/19 11:42	07/30/19 13:48	7440-47-3		
Cobalt	ND	ug/L	1.0	1	07/29/19 11:42	07/30/19 13:48	7440-48-4		
Lead	ND	ug/L	2.0	2	07/29/19 11:42	07/30/19 16:30	7439-92-1		
Molybdenum	1.4	ug/L	1.0	1	07/29/19 11:42	07/30/19 13:48	7439-98-7		
Selenium	153	ug/L	1.0	1	07/29/19 11:42	07/30/19 13:48	7782-49-2		M1
Thallium	ND	ug/L	2.0	2	07/29/19 11:42	07/30/19 16:30	7440-28-0	D3	
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/30/19 15:54	07/31/19 13:09	7439-97-6		
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	6380	mg/L	125	1		07/25/19 09:37			
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	106	mg/L	10.0	10		07/23/19 01:09	16887-00-6	M1,R1	
Fluoride	ND	mg/L	0.20	1		07/22/19 23:55	16984-48-8		
Sulfate	3850	mg/L	200	200		07/23/19 01:54	14808-79-8		M1

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA Rawhide CCR

Pace Project No.: 60309345

Sample: ASH-06		Lab ID: 60309345002		Collected: 07/18/19 11:45		Received: 07/19/19 08:45		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	326	ug/L	100	1	07/25/19 10:20	07/31/19 12:00	7440-42-8		
Calcium	28900	ug/L	200	1	07/25/19 10:20	07/31/19 12:00	7440-70-2		
Lithium	63.9	ug/L	10.0	1	07/25/19 10:20	07/31/19 12:00	7439-93-2		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	07/26/19 15:44	07/29/19 15:44	7440-36-0		
Arsenic	ND	ug/L	1.0	1	07/26/19 15:44	07/29/19 15:44	7440-38-2		
Barium	66.6	ug/L	1.0	1	07/26/19 15:44	07/29/19 15:44	7440-39-3		
Beryllium	ND	ug/L	0.50	1	07/26/19 15:44	07/29/19 15:44	7440-41-7		
Cadmium	ND	ug/L	0.50	1	07/26/19 15:44	07/29/19 15:44	7440-43-9		
Chromium	ND	ug/L	1.0	1	07/26/19 15:44	07/29/19 15:44	7440-47-3		
Cobalt	ND	ug/L	1.0	1	07/26/19 15:44	07/29/19 15:44	7440-48-4		
Lead	ND	ug/L	1.0	1	07/26/19 15:44	07/29/19 15:44	7439-92-1		
Molybdenum	55.8	ug/L	1.0	1	07/26/19 15:44	07/29/19 15:44	7439-98-7		
Selenium	24.2	ug/L	1.0	1	07/26/19 15:44	07/29/19 15:44	7782-49-2		
Thallium	ND	ug/L	1.0	1	07/26/19 15:44	07/29/19 15:44	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	07/30/19 15:54	07/31/19 13:21	7439-97-6		
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	634	mg/L	10.0	1		07/25/19 09:38			
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	9.7	mg/L	1.0	1		07/23/19 02:38	16887-00-6		
Fluoride	0.69	mg/L	0.20	1		07/23/19 02:38	16984-48-8		
Sulfate	197	mg/L	50.0	50		07/23/19 02:53	14808-79-8		

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA Rawhide CCR

Pace Project No.: 60309345

QC Batch: 599976

Analysis Method: EPA 7470

QC Batch Method: EPA 7470

Analysis Description: 7470 Mercury

Associated Lab Samples: 60309345001, 60309345002

METHOD BLANK: 2455950

Matrix: Water

Associated Lab Samples: 60309345001, 60309345002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	07/31/19 12:53	

LABORATORY CONTROL SAMPLE: 2455956

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	5	5.0	99	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2455957 2455958

Parameter	Units	60309345001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	5	5	5.0	5.1	101	102	75-125	1	20	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA Rawhide CCR

Pace Project No.: 60309345

QC Batch:	598882	Analysis Method:	EPA 6010
QC Batch Method:	EPA 3010	Analysis Description:	6010 MET
Associated Lab Samples: 60309345001, 60309345002			

METHOD BLANK: 2451748 Matrix: Water

Associated Lab Samples: 60309345001, 60309345002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	ug/L	ND	100	07/31/19 11:44	
Calcium	ug/L	ND	200	07/31/19 11:44	
Lithium	ug/L	ND	10.0	07/31/19 11:44	

LABORATORY CONTROL SAMPLE: 2451749

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	1000	962	96	80-120	
Calcium	ug/L	10000	9980	100	80-120	
Lithium	ug/L	1000	996	100	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2451750 2451751

Parameter	Units	60309345001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	602	1000	1000	1570	1550	97	95	75-125	1	20	
Calcium	ug/L	431000	10000	10000	447000	439000	154	74	75-125	2	20	M1
Lithium	ug/L	510	1000	1000	1520	1530	101	102	75-125	1	20	

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QUALITY CONTROL DATA

Project: PRPA Rawhide CCR
Pace Project No.: 60309345

QC Batch: 599263 Analysis Method: EPA 6020
QC Batch Method: EPA 3010 Analysis Description: 6020 MET
Associated Lab Samples: 60309345002

METHOD BLANK: 2453110 Matrix: Water
Associated Lab Samples: 60309345002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	1.0	07/29/19 15:39	
Arsenic	ug/L	ND	1.0	07/29/19 15:39	
Barium	ug/L	ND	1.0	07/29/19 15:39	
Beryllium	ug/L	ND	0.50	07/29/19 15:39	
Cadmium	ug/L	ND	0.50	07/29/19 15:39	
Chromium	ug/L	ND	1.0	07/29/19 15:39	
Cobalt	ug/L	ND	1.0	07/29/19 15:39	
Lead	ug/L	ND	1.0	07/29/19 15:39	
Molybdenum	ug/L	ND	1.0	07/29/19 15:39	
Selenium	ug/L	ND	1.0	07/29/19 15:39	
Thallium	ug/L	ND	1.0	07/29/19 15:39	

LABORATORY CONTROL SAMPLE: 2453111

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	40	39.0	97	80-120	
Arsenic	ug/L	40	39.9	100	80-120	
Barium	ug/L	40	37.9	95	80-120	
Beryllium	ug/L	40	39.8	100	80-120	
Cadmium	ug/L	40	39.9	100	80-120	
Chromium	ug/L	40	40.1	100	80-120	
Cobalt	ug/L	40	38.7	97	80-120	
Lead	ug/L	40	38.6	96	80-120	
Molybdenum	ug/L	40	36.3	91	80-120	
Selenium	ug/L	40	41.9	105	80-120	
Thallium	ug/L	40	37.0	93	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2453112 2453113

Parameter	Units	60309025003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	ND	40	40	34.9	34.5	87	86	75-125	1	20	
Arsenic	ug/L	ND	40	40	38.3	37.5	95	93	75-125	2	20	
Barium	ug/L	12.7	40	40	49.0	48.3	91	89	75-125	1	20	
Beryllium	ug/L	ND	40	40	33.5	33.7	84	84	75-125	1	20	
Cadmium	ug/L	ND	40	40	32.5	32.3	81	81	75-125	1	20	
Chromium	ug/L	ND	40	40	43.2	42.7	108	106	75-125	1	20	
Cobalt	ug/L	1.0	40	40	38.8	38.2	94	93	75-125	1	20	

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QUALITY CONTROL DATA

Project: PRPA Rawhide CCR

Pace Project No.: 60309345

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2453112 2453113												
Parameter	Units	60309025003	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
		Result										
Lead	ug/L	ND	40	40	32.5	31.8	81	79	75-125	2	20	
Molybdenum	ug/L	1.7	40	40	38.5	38.0	92	91	75-125	1	20	
Selenium	ug/L	172	40	40	209	201	92	72	75-125	4	20	M1
Thallium	ug/L	ND	40	40	32.6	32.0	82	80	75-125	2	20	

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QUALITY CONTROL DATA

Project: PRPA Rawhide CCR
Pace Project No.: 60309345

QC Batch:	599535	Analysis Method:	EPA 6020
QC Batch Method:	EPA 3010	Analysis Description:	6020 MET
Associated Lab Samples:	60309345001		

METHOD BLANK: 2454659 Matrix: Water
Associated Lab Samples: 60309345001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	1.0	07/30/19 13:43	
Arsenic	ug/L	ND	1.0	07/30/19 13:43	
Barium	ug/L	ND	1.0	07/31/19 12:24	
Beryllium	ug/L	ND	0.50	07/30/19 13:43	
Cadmium	ug/L	ND	0.50	07/30/19 13:43	
Chromium	ug/L	ND	1.0	07/30/19 13:43	
Cobalt	ug/L	ND	1.0	07/30/19 13:43	
Lead	ug/L	ND	1.0	07/30/19 13:43	
Molybdenum	ug/L	ND	1.0	07/30/19 13:43	
Selenium	ug/L	ND	1.0	07/30/19 13:43	
Thallium	ug/L	ND	1.0	07/30/19 13:43	

LABORATORY CONTROL SAMPLE: 2454660

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	40	38.9	97	80-120	
Arsenic	ug/L	40	40.0	100	80-120	
Barium	ug/L	40	37.6	94	80-120	
Beryllium	ug/L	40	39.4	98	80-120	
Cadmium	ug/L	40	39.5	99	80-120	
Chromium	ug/L	40	39.5	99	80-120	
Cobalt	ug/L	40	38.4	96	80-120	
Lead	ug/L	40	38.8	97	80-120	
Molybdenum	ug/L	40	35.7	89	80-120	
Selenium	ug/L	40	41.1	103	80-120	
Thallium	ug/L	40	37.3	93	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2454661 2454662

Parameter	Units	60309345001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	ND	40	40	35.7	36.4	89	91	75-125	2	20	
Arsenic	ug/L	ND	40	40	40.1	40.6	99	100	75-125	1	20	
Barium	ug/L	13.3	40	40	51.5	51.5	96	96	75-125	0	20	
Beryllium	ug/L	ND	40	40	31.5	32.7	79	82	75-125	4	20	
Cadmium	ug/L	ND	40	40	31.6	32.4	79	81	75-125	3	20	
Chromium	ug/L	ND	40	40	39.3	40.5	98	101	75-125	3	20	
Cobalt	ug/L	ND	40	40	39.5	40.2	96	98	75-125	2	20	

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QUALITY CONTROL DATA

Project: PRPA Rawhide CCR

Pace Project No.: 60309345

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2454661 2454662												
Parameter	Units	60309345001	MS	MSD	MS	MSD	MS	MSD	% Rec	Max	Qual	
		Result	Spike	Spike								Result	Result	% Rec	% Rec	Limits	RPD	RPD
Lead	ug/L	ND	40	40	32.9	33.0	82	82	75-125	0	20	
Molybdenum	ug/L	1.4	40	40	47.9	40.6	116	98	75-125	17	20	
Selenium	ug/L	153	40	40	199	204	116	129	75-125	2	20 M1	
Thallium	ug/L	ND	40	40	33.3	33.4	83	83	75-125	1	20	

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QUALITY CONTROL DATA

Project: PRPA Rawhide CCR

Pace Project No.: 60309345

QC Batch:	598910	Analysis Method:	SM 2540C
QC Batch Method:	SM 2540C	Analysis Description:	2540C Total Dissolved Solids
Associated Lab Samples: 60309345001, 60309345002			

METHOD BLANK: 2451828 Matrix: Water

Associated Lab Samples: 60309345001, 60309345002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	5.0	07/25/19 09:36	

LABORATORY CONTROL SAMPLE: 2451829

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	1070	107	80-120	

SAMPLE DUPLICATE: 2451830

Parameter	Units	60309303002 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	874	879	1	10	

SAMPLE DUPLICATE: 2451831

Parameter	Units	60309345001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	6380	6320	1	10	

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QUALITY CONTROL DATA

Project: PRPA Rawhide CCR

Pace Project No.: 60309345

QC Batch:	598194	Analysis Method:	EPA 9056
QC Batch Method:	EPA 9056	Analysis Description:	9056 IC Anions
Associated Lab Samples: 60309345001, 60309345002			

METHOD BLANK: 2449502 Matrix: Water

Associated Lab Samples: 60309345001, 60309345002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	07/22/19 19:13	
Fluoride	mg/L	ND	0.20	07/22/19 19:13	
Sulfate	mg/L	ND	1.0	07/22/19 19:13	

LABORATORY CONTROL SAMPLE: 2449503

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.7	94	80-120	
Fluoride	mg/L	2.5	2.4	95	80-120	
Sulfate	mg/L	5	4.9	97	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2449505 2449506

Parameter	Units	60309345001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	106	50	50	162	162	112	112	80-120	0	15	
Fluoride	mg/L	ND	2.5	2.5	1.9	2.4	73	94	80-120	24	15	M1, R1
Sulfate	mg/L	3850	1000	1000	5080	4970	123	112	80-120	2	15	E, M1

SAMPLE DUPLICATE: 2449504

Parameter	Units	20112846002 Result	Dup Result	RPD	Max RPD	Qualifiers
Fluoride	mg/L	<0.20	ND		15	
Sulfate	mg/L	643	633	2	15	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide CCR

Pace Project No.: 60309345

Sample: ASH-07 **Lab ID: 60309345003** Collected: 07/18/19 09:00 Received: 07/19/19 09:30 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.812 ± 0.530 (0.543) C:NA T:90%	pCi/L	07/31/19 14:50	13982-63-3	
Radium-228	EPA 904.0	0.202 ± 0.403 (0.889) C:70% T:74%	pCi/L	07/31/19 12:49	15262-20-1	
Total Radium	Total Radium Calculation	1.01 ± 0.933 (1.43)	pCi/L	08/01/19 14:07	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide CCR

Pace Project No.: 60309345

Sample: ASH-07 MS		Lab ID: 60309345004	Collected: 07/18/19 09:00	Received: 07/19/19 09:30	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	136.64 %REC ± NA (NA) C:NA T:NA	pCi/L	07/31/19 14:50	13982-63-3	
Radium-228	EPA 904.0	123.14 %REC ± NA (NA) C:NA T:NA	pCi/L	07/31/19 12:52	15262-20-1	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide CCR

Pace Project No.: 60309345

Sample: ASH-06		Lab ID: 60309345005	Collected: 07/18/19 11:45	Received: 07/19/19 09:30	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	1.71 ± 1.52 (2.02) C:NA T:84%	pCi/L	07/31/19 15:04	13982-63-3	
Radium-228	EPA 904.0	1.03 ± 0.655 (1.25) C:67% T:81%	pCi/L	07/31/19 12:50	15262-20-1	
Total Radium	Total Radium Calculation	2.74 ± 2.18 (3.27)	pCi/L	08/01/19 14:07	7440-14-4	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: PRPA Rawhide CCR

Pace Project No.: 60309345

QC Batch:	353489	Analysis Method:	EPA 903.1
QC Batch Method:	EPA 903.1	Analysis Description:	903.1 Radium-226
Associated Lab Samples:	60309345003, 60309345004, 60309345005		

METHOD BLANK:	1717136	Matrix:	Water
Associated Lab Samples:	60309345003, 60309345004, 60309345005		

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.814 ± 0.543 (0.674) C:NA T:84%	pCi/L	07/31/19 14:36	

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QUALITY CONTROL - RADIOCHEMISTRY

Project: PRPA Rawhide CCR

Pace Project No.: 60309345

QC Batch:	353497	Analysis Method:	EPA 904.0
QC Batch Method:	EPA 904.0	Analysis Description:	904.0 Radium 228
Associated Lab Samples:	60309345003, 60309345004, 60309345005		

METHOD BLANK:	1717147	Matrix:	Water
---------------	---------	---------	-------

Associated Lab Samples: 60309345003, 60309345004, 60309345005

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.227 ± 0.330 (0.712) C:79% T:86%	pCi/L	07/31/19 12:49	

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QUALIFIERS

Project: PRPA Rawhide CCR

Pace Project No.: 60309345

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval).

Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K Pace Analytical Services - Kansas City

PASI-PA Pace Analytical Services - Greensburg

ANALYTE QUALIFIERS

D3 Sample was diluted due to the presence of high levels of non-target analytes or other matrix interference.

E Analyte concentration exceeded the calibration range. The reported result is estimated.

M1 Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

R1 RPD value was outside control limits.

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: PRPA Rawhide CCR

Pace Project No.: 60309345

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60309345001	ASH-07	EPA 3010	598882	EPA 6010	599059
60309345002	ASH-06	EPA 3010	598882	EPA 6010	599059
60309345001	ASH-07	EPA 3010	599535	EPA 6020	599653
60309345002	ASH-06	EPA 3010	599263	EPA 6020	599501
60309345001	ASH-07	EPA 7470	599976	EPA 7470	600012
60309345002	ASH-06	EPA 7470	599976	EPA 7470	600012
60309345003	ASH-07	EPA 903.1	353489		
60309345004	ASH-07 MS	EPA 903.1	353489		
60309345005	ASH-06	EPA 903.1	353489		
60309345003	ASH-07	EPA 904.0	353497		
60309345004	ASH-07 MS	EPA 904.0	353497		
60309345005	ASH-06	EPA 904.0	353497		
60309345003	ASH-07	Total Radium Calculation	354722		
60309345005	ASH-06	Total Radium Calculation	354722		
60309345001	ASH-07	SM 2540C	598910		
60309345002	ASH-06	SM 2540C	598910		
60309345001	ASH-07	EPA 9056	598194		
60309345002	ASH-06	EPA 9056	598194		

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Sample Condition Upon Receipt

WO#: 60309345



60309345

Client Name:

Farcom

Courier: FedEx ☒ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☐ Client ☐ Other ☐

Tracking #:

100762510967

Pace Shipping Label Used? Yes ☐ No ☒

Custody Seal on Cooler/Box Present:

Yes ☒

No ☐

Seals intact: Yes ☒

No ☐

Packing Material:

Bubble Wrap ☐

Bubble Bags ☒

Foam ☐

None ☐

Other ☐

Thermometer Used:

T-501

Type of Ice: Wet ☒ Blue ☐ None ☐

Cooler Temperature (°C):

As-read 2.3

Corr. Factor 0.0

Corrected 2.3

Date and initials of person
examining contents: 7/19/14

Temperature should be above freezing to 6°C

Chain of Custody present:

☒ Yes ☐ No ☐ N/A

Chain of Custody relinquished:

☒ Yes ☐ No ☐ N/A

Samples arrived within holding time:

☒ Yes ☐ No ☐ N/A

Short Hold Time analyses (<72hr):

☒ Yes ☐ No ☐ N/A

Rush Turn Around Time requested:

☒ Yes ☐ No ☐ N/A

Sufficient volume:

☒ Yes ☐ No ☐ N/A

Correct containers used:

☒ Yes ☐ No ☐ N/A

Pace containers used:

☒ Yes ☐ No ☐ N/A

Containers intact:

☒ Yes ☐ No ☐ N/A

Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?

☐ Yes ☐ No ☒ N/A

Filtered volume received for dissolved tests?

☐ Yes ☐ No ☒ N/A

Sample labels match COC: Date / time / ID / analyses

☒ Yes ☐ No ☐ N/A

Samples contain multiple phases?

Matrix: WST

☒ Yes ☐ No ☐ N/A

Containers requiring pH preservation in compliance?

☒ Yes ☐ No ☐ N/A

(HNO₃, H₂SO₄, HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide)

(Exceptions: VOA, Micro, O&G, KS TPH, CK-DRO)

Cyanide water sample checks:

Lead acetate strip turns dark? (Record only)

☐ Yes ☐ No

Potassium iodide test strip turns blue/purple? (Preserve)

☐ Yes ☐ No

Trip Blank present:

☐ Yes ☐ No ☒ N/A

Headspace in VOA vials (>6mm):

☐ Yes ☐ No ☒ N/A

Samples from USDA Regulated Area:

State:

☐ Yes ☐ No ☒ N/A

Additional labels attached to 5035A / TX1005 vials in the field?

☐ Yes ☐ No ☒ N/A

List sample IDs, volumes, ranges of preservation and the date/time added.

Client Notification/ Resolution:

Copy COC to Client? Y ☒ N ☐

Field Data Required? Y ☐ N ☐

Person Contacted:

Date/Time:

Comments/ Resolution:

Project Manager Review:

Date:

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information: Company: AECOM		Section B Required Project Information: Report To: Geoff Webb		Section C Invoice Information: Attention: Accounts Payable	
Address: 6200 South Quebec St Greenwood Village, CO 80111		Copy To: Brian Rothmeyer		Company Name: AECOM	
Email To: brian.rothmeyer@aecom.com		Purchase Order No.:		Address: Same as Section A	
Phone: (303) 740-2614 Fax:		Project Name: PRPA Rawhide		Pace Quote Reference: 42700	
Requested Due Date/TAT: 15 day		Project Number:		Pace Project Manager: Heather Wilson	
				Site Location: CO STATE:	

Page: 1 of 1

REGULATORY AGENCY <input type="checkbox"/> NPDES <input type="checkbox"/> GROUND WATER <input type="checkbox"/> DRINKING WATER <input type="checkbox"/> UST <input type="checkbox"/> RCRA <input type="checkbox"/> OTHER	
---	--

ITEM #	Section D Required Client Information	Valid Matrix Codes MATRIX CODE DW WT WW P SL OL WP AR OT TS	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED		SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives	Y/N	Requested Analysis Filtered (Y/N)											
					COMPOSITE START	COMPOSITE END/GRAB																
1	ASH-07 BRILW, BRINW		WT G	7.18.19 09:00	7.18.19 11:45			9	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	ASH-06 BRIN, BRIN, BRIN		WT G	7.18.19 11:45				3	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3																						
4																						
5																						
6																						
7																						
8																						
9																						
10																						
11																						
12																						

ADDITIONAL COMMENTS *Be, Cr, Co, As, Se, Mo, Cd, Sb, Ba, Ti, Pb **B, Ca, U		RELINQUISHED BY / AFFILIATION Wm Winiart	DATE 7.18.19	TIME 16:00	ACCEPTED BY / AFFILIATION Heather Wilson	DATE 7.18.19	TIME 08:15	SAMPLE CONDITIONS Received on Ice (Y/N) 2 Custody Sealed (Y/N) 1 Samples Intact (Y/N) 1
---	--	---	-----------------	---------------	---	-----------------	---------------	--

SAMPLER NAME AND SIGNATURE PRINT Name of SAMPLER: Wes Weichert SIGNATURE of SAMPLER: Wm Winiart		DATE Signed (MM/DD/YY): 7.18.19
--	--	---------------------------------

REGULATORY AGENCY

Pace Project No./ Lab I.D.
MS/MSD
* See Comments

SIGNATURE OF SAMPLER:

Pittsburgh Lab Sample Condition Upon Receipt



Client Name:

ATCOM

Project #

Courier: ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace Other

Tracking #: 1007 8250 8025

Custody Seal on Cooler/Box Present: ☒ yes ☐ no Seals intact: ☒ yes ☐ no

Thermometer Used 11 Type of Ice: Wet Blue None

Cooler Temperature Observed Temp 3.2 °C Correction Factor: ± 0 °C Final Temp: 3.2 °C

Temp should be above freezing to 6°C

Label
LIMS Login

Comments:	Yes	No	N/A	pH paper Lot#	Date and Initials of person examining contents:
Chain of Custody Present:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<u>1004287</u>	<u>mg 7/19/19</u>
Chain of Custody Filled Out:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Chain of Custody Relinquished:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Sampler Name & Signature on COC:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Sample Labels match COC:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
-Includes date/time/ID Matrix: <u>WT</u>					
Samples Arrived within Hold Time:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Short Hold Time Analysis (<72hr remaining):	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Rush Turn Around Time Requested:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Sufficient Volume:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Correct Containers Used:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
-Pace Containers Used:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Containers Intact:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Orthophosphate field filtered	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Hex Cr Aqueous sample field filtered	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Organic Samples checked for dechlorination:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Filtered volume received for Dissolved tests	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
All containers have been checked for preservation.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
exceptions: VOA, coliform, TOC, O&G, Phenolics, Radon, Non-aqueous matrix				<u>pH 2</u>	
All containers meet method preservation requirements.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Initial when completed <u>mg</u>	Date/time of preservation
				Lot # of added preservative	
Headspace in VOA Vials (>6mm):	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Trip Blank Present:	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
Trip Blank Custody Seals Present	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Rad Samples Screened < 0.5 mrem/hr	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Initial when completed <u>mg</u>	Date: <u>7/19/19</u>

Client Notification/ Resolution:

Person-Contacted: _____ Date/Time: _____ Contacted By: _____

Comments/ Resolution: _____

☐ A check in this box indicates that additional information has been stored in ereports.

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

*PM review is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

Quality Control Sample Performance Assessment

Analyst Must Manually Enter All Fields Highlighted in Yellow.



Test: Ra-226
Analyst: MK1
Date: 7/25/2019
Batch ID: 48865
Matrix: DW

Method Blank Assessment	
MB Sample ID	1717136
MB Concentration:	0.814
MB Counting Uncertainty:	0.535
MB MDC:	0.674
MB Numerical Performance Indicator:	2.98
MB Status vs Numerical Indicator:	N/A
MB Status vs. MDC:	#N/A

Laboratory Control Sample Assessment	
LCS48865	N
Count Date:	7/31/2019
Spike I.D.:	19-022
Spike Concentration (pCi/mL):	32.121
Volume Used (mL):	0.10
Aliquot Volume (L, g, F):	0.658
Target Conc. (pCi/L, g, F):	4.884
Uncertainty (Calculated):	0.230
Result (pCi/L, g, F):	4.859
LCS/LCSD Counting Uncertainty (pCi/L, g, F):	1.569
Numerical Performance Indicator:	-0.04
Percent Recovery:	99.49%
Status vs Numerical Indicator:	N/A
Status vs Recovery:	Pass
Upper % Recovery Limits:	135%
Lower % Recovery Limits:	73%

Duplicate Sample Assessment	
Sample I.D.:	30315266002
Duplicate Sample I.D.:	30315266002DUP
Sample Result Counting Uncertainty (pCi/L, g, F):	0.630
Sample Duplicate Result (pCi/L, g, F):	0.578
Sample Duplicate Result Counting Uncertainty (pCi/L, g, F):	0.585
Are sample and/or duplicate results below RL?	0.496
Duplicate Numerical Performance Indicator:	0.117
Duplicate RPD:	7.47%
Duplicate Status vs Numerical Indicator:	N/A
Duplicate Status vs RPD:	Pass
% RPD Limit:	32%

Evaluation of duplicate precision is not applicable if either the sample or duplicate results are below the RL.

Comments: #N/A

Sample Matrix Spike Control Assessment	
Sample Collection Date:	7/18/2019
Sample I.D.:	30315266003
Sample MS I.D.:	30315266003MS
Sample MSD I.D.:	19-022
MS/MSD Decay Corrected Spike Concentration (pCi/mL):	32.121
Spike Volume Used in MS (mL):	0.20
Spike Volume Used in MSD (mL):	0.850
MS Aliquot (L, g, F):	9.879
MSD Aliquot (L, g, F):	0.464
MS Target Conc. (pCi/L, g, F):	3.739
MSD Target Conc. (pCi/L, g, F):	0.902
MS Spike Uncertainty (calculated):	16.672
MSD Spike Uncertainty (calculated):	2.067
Sample Result Counting Uncertainty (pCi/L, g, F):	2.600
Sample Matrix Spike Duplicate Result:	130.91%
Matrix Spike Result Counting Uncertainty (pCi/L, g, F):	N/A
Sample Matrix Spike Duplicate Result:	Pass
MS Numerical Performance Indicator:	136%
MSD Numerical Performance Indicator:	71%
MS Percent Recovery:	
MS Status vs Numerical Indicator:	
MS Status vs Recovery:	
MS/MSD Upper % Recovery Limits:	
MS/MSD Lower % Recovery Limits:	

Matrix Spike/Matrix Spike Duplicate Sample Assessment	
Sample I.D.:	Sample I.D.:
Sample MS I.D.:	Sample MS I.D.:
Sample MSD I.D.:	Sample MSD I.D.:
Matrix Spike Result Counting Uncertainty (pCi/L, g, F):	Matrix Spike Result Counting Uncertainty (pCi/L, g, F):
Sample Matrix Spike Duplicate Result:	Sample Matrix Spike Duplicate Result:
Duplicate Numerical Performance Indicator:	Duplicate Numerical Performance Indicator:
(Based on the Percent Recoveries) MS/MSD Duplicate RPD:	(Based on the Percent Recoveries) MS/MSD Duplicate RPD:
MS/MSD Duplicate Status vs Numerical Indicator:	MS/MSD Duplicate Status vs Numerical Indicator:
% RPD Limit:	% RPD Limit:

Quality Control Sample Performance Assessment



Analyst Must Manually Enter All Fields Highlighted in Yellow.

Test: Ra-228
Analyst: JLW
Date: 7/26/2019
Worklist: 48872
Matrix: DW

Method Blank Assessment	
MB Sample ID	1717147
MB Concentration:	0.227
MB Counting Uncertainty:	0.328
MB MDC:	0.712
MB Numerical Performance Indicator:	1.36
MB Status vs Numerical Indicator:	N/A
MB Status vs. MDC:	Pass

Laboratory Control Sample Assessment		N
LCS48872		LCS48872
Count Date:	7/31/2019	
Spike I.D.:	19-026	
Spike Concentration (pCi/mL):	35.952	
Volume Used (mL):	0.10	
Aliquot Volume (L, g, F):	0.811	
Target Conc. (pCi/L, g, F):	4.431	
Uncertainty (Calculated):	0.217	
Result (pCi/L, g, F):	4.927	
LCS/LCSD Counting Uncertainty (pCi/L, g, F):	0.678	
Numerical Performance Indicator:	1.36	
Percent Recovery:	111.18%	
Status vs Numerical Indicator:	N/A	
Status vs Recovery:	Pass	

Duplicate Sample Assessment	
Sample I.D.:	30315266001
Duplicate Sample I.D.:	30315266001DUP
Sample Result (pCi/L, g, F):	2.468
Sample Result Counting Uncertainty (pCi/L, g, F):	0.465
Sample Duplicate Result (pCi/L, g, F):	2.350
Sample Duplicate Result Counting Uncertainty (pCi/L, g, F):	0.480
Are sample and/or duplicate results below MDC?	See Below ##
Duplicate Numerical Performance Indicator:	0.346
Duplicate RPD:	4.90%
Duplicate Status vs Numerical Indicator:	N/A
Duplicate Status vs RPD:	Pass

Evaluation of duplicate precision is not applicable if either the sample or duplicate results are below the MDC.

Comments:

VAL
8/1/19

Sample Matrix Spike Control Assessment		7/18/2019	7/18/2019
Sample Collection Date:	Sample I.D.	30315266002	60309345003
Sample MS I.D.	Sample MS I.D.	30315266002MS	60309345004
Sample MSD I.D.	Spike I.D.:	19-026	19-026
MS/MSD Decay Corrected Spike Concentration (pCi/mL):	Spike Volume Used in MS (mL):	36.110	36.110
MS Aliquot (L, g, F):	MS Target Conc. (pCi/L, g, F):	0.20	0.20
MSD Aliquot (L, g, F):	MSD Target Conc. (pCi/L, g, F):	0.820	0.811
Spike uncertainty (calculated):	Spike uncertainty (calculated):	8.803	8.901
Sample Result Counting Uncertainty (pCi/L, g, F):	Sample Result:	0.431	0.436
Sample Matrix Spike Result:	Sample Matrix Spike Result:	0.744	0.202
Matrix Spike Result Counting Uncertainty (pCi/L, g, F):	Matrix Spike Result:	0.365	0.402
Matrix Spike Duplicate Result Counting Uncertainty (pCi/L, g, F):	Matrix Spike Duplicate Result:	9.468	11.162
MS Numerical Performance Indicator:	MS Numerical Performance Indicator:	0.878	0.966
MSD Numerical Performance Indicator:	MSD Numerical Performance Indicator:	-0.148	3.562
MS Percent Recovery:	MS Percent Recovery:	99.11%	123.14%
MS Status vs Numerical Indicator:	MS Status vs Numerical Indicator:	N/A	N/A
MSD Status vs Numerical Indicator:	MSD Status vs Numerical Indicator:	Pass	Pass
MSD Status vs Recovery:	MSD Status vs Recovery:		

Matrix Spike/Matrix Spike Duplicate Sample Assessment	
Sample I.D.	Sample MS I.D.
Sample MS I.D.	Sample MSD I.D.
Sample Matrix Spike Result:	Sample Matrix Spike Result:
Sample Matrix Spike Duplicate Result:	Sample Matrix Spike Duplicate Result:
Matrix Spike Duplicate Result Counting Uncertainty (pCi/L, g, F):	Duplicate Numerical Performance Indicator:
(Based on the Percent Recoveries) MS/MSD Duplicate RPD:	MS/MSD Duplicate Status vs Numerical Indicator:
MS/MSD Duplicate Status vs RPD:	

Platte River Power Authority – Rawhide DATA REVIEW CHECK

Data Package: 60309345Sampling Event: July 18th, 2019

Data Reviewer: Joel Mackinney

Data Reviewer: Brian Rothmeyer

Peer Reviewer: Steve Szocik

Date Completed: September 25, 2019

Date Completed: October 17, 2019

Date Completed: October 22, 2019

This report contains the final results of the data validation conducted for the water samples collected July 18th, 2019. The data review was conducted in accordance with the method and laboratory criteria, as applicable. The data review was conducted in accordance with method requirements and laboratory limits using guidance from USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540-R-2017-001 (January 2017).

General Overall Assessment:

_____ Data are usable without qualification.

 X Data are usable with qualification (noted below).

_____ Some or all data are unusable for any purpose (detailed below).

Data Review Checklist

Review Parameter	Criteria	Criteria Met?												
<i>Sample-specific Parameters</i>	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA										
Chain of Custody, Sample Identification, & Sample Receipt	Samples were received intact and the cooler temperature was <6 degree Celsius upon arrival at the laboratory.	X												
Holding Times	The samples were analyzed within the method required holding times.	X												
Method Blanks (MB)	No target analytes reported in the associated MB. <table border="1"><thead><tr><th>Analyte</th><th>Concentration</th></tr></thead><tbody><tr><td colspan="2">MB 1717136</td></tr><tr><td>Ra-226</td><td>0.814 ± 0.543 pCi/L</td></tr><tr><td colspan="2">MB 1717147</td></tr><tr><td>Ra-228</td><td>0.227 ± 0.330 pCi/L</td></tr></tbody></table> ± – Plus or Minus pCi/L – Picocuries Per Liter MB – Method Blank Ra – Radium	Analyte	Concentration	MB 1717136		Ra-226	0.814 ± 0.543 pCi/L	MB 1717147		Ra-228	0.227 ± 0.330 pCi/L		X ¹	
Analyte	Concentration													
MB 1717136														
Ra-226	0.814 ± 0.543 pCi/L													
MB 1717147														
Ra-228	0.227 ± 0.330 pCi/L													
Quality Control Samples: Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD)	The LCS/LCSD recoveries were within the laboratory determined acceptance limits.	X												
Matrix Spike / Matrix Spike Duplicate (MS/MSD)	The recoveries and relative percent differences for the matrix spike and matrix spike duplicate analyses were within the laboratory-determined acceptance ranges. Results in the native sample greater than four times the concentration of the spike added during digestions/extractions are not considered to be a representative measure of accuracy. Further action with respect to spike recovery evaluation or qualification of data was not considered necessary.		X ²											

Review Parameter	Criteria	Criteria Met?																																										
<i>Sample-specific Parameters</i>	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA																																								
	<table border="1"> <thead> <tr> <th>Analyte</th><th>MS/MSD (%)</th><th>Limits (%)</th><th>RPD (%)</th><th>Limits (%)</th></tr> </thead> <tbody> <tr> <td colspan="5">ASH-07</td></tr> <tr> <td>Selenium</td><td>116/129</td><td>75-125</td><td>4</td><td>20</td></tr> <tr> <td>Fluoride</td><td>73/94</td><td>80-120</td><td>24</td><td>15</td></tr> <tr> <td>Sulfate</td><td>123/112</td><td>80-120</td><td>2</td><td>15</td></tr> </tbody> </table> <p>% - Percent MS/MSD – Matrix Spike/ Matrix Spike Duplicate RPD – Relative Percent Difference Bold indicates a value that is outside of acceptance limits.</p> <table border="1"> <thead> <tr> <th>Analyte</th><th>MS (%)</th><th>Limits (%)</th><th>DER</th><th>Limits</th></tr> </thead> <tbody> <tr> <td colspan="5">ASH-07</td></tr> <tr> <td>Ra-226</td><td>136.64</td><td>71-136</td><td>NA</td><td>NA</td></tr> </tbody> </table> <p>% – Percent DER – Duplicate Error Ratio NA – Not Applicable MS/MSD – Matrix Spike/ Matrix Spike Duplicate Bold indicates a value that is outside of acceptance limits.</p>	Analyte	MS/MSD (%)	Limits (%)	RPD (%)	Limits (%)	ASH-07					Selenium	116/ 129	75-125	4	20	Fluoride	73 /94	80-120	24	15	Sulfate	123 /112	80-120	2	15	Analyte	MS (%)	Limits (%)	DER	Limits	ASH-07					Ra-226	136.64	71-136	NA	NA			
Analyte	MS/MSD (%)	Limits (%)	RPD (%)	Limits (%)																																								
ASH-07																																												
Selenium	116/ 129	75-125	4	20																																								
Fluoride	73 /94	80-120	24	15																																								
Sulfate	123 /112	80-120	2	15																																								
Analyte	MS (%)	Limits (%)	DER	Limits																																								
ASH-07																																												
Ra-226	136.64	71-136	NA	NA																																								
Laboratory Duplicate	<p>The laboratory duplicate samples were within the laboratory determined acceptance limits. The following concentration dependent criteria were used to evaluate laboratory duplicates:</p> <ul style="list-style-type: none"> When both the sample and duplicate values are >5x the reporting limit (RL), acceptable sampling and analytical precision is indicated by an relative percent difference (RPD) between the results of ≤20%. Where the result for one or both analytes of the method duplicate pair is <5xRL, satisfactory precision is indicated if the absolute difference between the method duplicate results is <1xRL. The agreement between parent sample results and the lab duplicate sample results were evaluated. The duplicate error ratios (DER) met the criterion of a DER ≤1. 	X																																										
Field Duplicate	<p>The field duplicate sample results satisfied the evaluation criteria below:</p> <ul style="list-style-type: none"> When both the sample and duplicate values are >5xRL acceptable sampling and analytical precision is indicated by a relative percent difference (RPD) between the results of ≤30%. Where the result for one or both analytes of the field duplicate pair is <5xRL, satisfactory precision is indicated if the absolute difference between the field duplicate results is <2xRL. The agreement between parent sample results and the field duplicate sample results were evaluated. The DER met the criterion of a DER ≤1. 			X																																								
Equipment Blanks	No target analytes reported in the associated equipment blank.		X ³																																									

Review Parameter	Criteria	Criteria Met?										
Sample-specific Parameters	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA								
	<table><tr><th>Analyte</th><th>Concentration</th></tr><tr><td>EB-1</td><td></td></tr><tr><td>Radium-226</td><td>0.652 ± 0.412 pCi/L</td></tr><tr><td>Radium, Total</td><td>0.652 ± 0.765 pCi/L</td></tr></table> <p>± – Plus or Minus pCi/L – Picocuries Per Liter</p>	Analyte	Concentration	EB-1		Radium-226	0.652 ± 0.412 pCi/L	Radium, Total	0.652 ± 0.765 pCi/L			
Analyte	Concentration											
EB-1												
Radium-226	0.652 ± 0.412 pCi/L											
Radium, Total	0.652 ± 0.765 pCi/L											
Reporting Limits Met (Non –Radiochemistry)	No samples performed at dilutions or reported as non-detect at elevated method detection limits/reporting limits.		X ⁴									
Detection Limits Mets (Radiochemistry)	For radiochemical results if the associated uncertainty was greater than the reported result, the 2 sigma (σ) uncertainty multiplied by 1.65 was less than or equal to the specified detection limit.	X										
Tracer and/or Carrier Recovery	The sample specific recoveries were within the laboratory limits.	X										
Package Completeness	No results were qualified as unusable and the data are 100% complete.	X										
Comments												
<p>1 – The associated radium-226, radium-228 and total radium sample results reported at concentrations <5x the concentration of the blank contamination were qualified as estimated (J+ bl) to reflect the potential high bias indicated by the blank contamination.</p> <p>2 – As the potential bias was considered to be high, the associated detected selenium, sulfate and Ra-226 results for sample ASH-07 were qualified as estimated (J+ m).</p> <p>As the potential bias was considered to be low and the RPD was outside the control limits, the associated fluoride result for sample ASH-07 was qualified as estimated (UJ- m,ld).</p> <p>3 – The associated radium-226 and total radium sample results reported at concentrations >5x the concentration of the blank contamination were qualified as estimated (J+ be) to reflect the potential high bias indicated by the blank contamination.</p> <p>4 –The thallium and lead results for ASH-7 were reported as non-detect at elevated reporting limits. These non-detect results will need to be evaluated by the end user of the data with respect to project objectives.</p>												
<div><div><p>> – Greater Than µg/L – Microgram per Liter % – Percent bl – Laboratory Blank Contamination LCS – Laboratory Control Sample m – Matrix Spike Recovery NA – Not Applicable RPD – Relative Percent Difference</p></div><div><p>< –Less Than σ - Sigma ± –Plus or Minus DER – Duplicate Error Ration LCSD – Laboratory Control Sample Duplicate MDC – Minimum Detectable Concentration Ra – Radium UJ – Estimated</p></div><div><p>≤ – Less Than or Equal To pCi/L – Picocuries Per Liter be – Equipment Blank J – Estimated ld – Laboratory Duplicate RPD MS/MSD – Matrix Spike/Matrix Spike Duplicate RL – Reporting Limit</p></div></div>												

October 23, 2019

Vasanta Kalluri
AECOM
6200 South Quebec Street
Greenwood Village, CO 80111

RE: Project: PRPA RAWHIDE CCR
Pace Project No.: 60317489

Dear Vasanta Kalluri:

Enclosed are the analytical results for sample(s) received by the laboratory on October 09, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Heather Wilson
heather.wilson@pacelabs.com
1(913)563-1407
Project Manager

Enclosures

cc: Jeremy Hurshman, AECOM
Jeff Mott, AECOM
Brian Rothmeyer, AECOM



REPORT OF LABORATORY ANALYSIS

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CERTIFICATIONS

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317489

Kansas Certification IDs

9608 Loiret Boulevard, Lenexa, KS 66219

Missouri Inorganic Drinking Water Certification #: 10090

Arkansas Drinking Water

Arkansas Certification #: 19-016-0

Arkansas Drinking Water

Illinois Certification #: 004455

Iowa Certification #: 118

Kansas/NELAP Certification #: E-10116

Louisiana Certification #: 03055

Nevada Certification #: KS000212020-2

Oklahoma Certification #: 9205/9935

Florida: Cert E871149 SEKS WET

Texas Certification #: T104704407-19-12

Utah Certification #: KS000212018-8

Illinois Certification #: 004592

Kansas Field Laboratory Accreditation: # E-92587

Missouri SEKS Micro Certification: 10070

REPORT OF LABORATORY ANALYSIS

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SAMPLE SUMMARY

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317489

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60317489001	ASH-01 (MW-1)	Water	10/08/19 09:00	10/09/19 09:15
60317489002	ASH-06	Water	10/08/19 11:00	10/09/19 09:15
60317489003	ASH-02 (MW-2)	Water	10/08/19 13:15	10/09/19 09:15
60317489004	DUP-2	Water	10/08/19 08:00	10/09/19 09:15
60317489005	ASH-04	Water	10/08/19 15:30	10/09/19 09:15

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317489

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60317489001	ASH-01 (MW-1)	EPA 6010	LRS	3	PASI-K
		EPA 6020	EMR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2540C	MAP	1	PASI-K
		EPA 9056	CNB	1	PASI-K
60317489002	ASH-06	EPA 6010	LRS	3	PASI-K
		EPA 6020	EMR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2540C	MAP	1	PASI-K
		EPA 9056	CNB	1	PASI-K
60317489003	ASH-02 (MW-2)	EPA 6010	LRS	3	PASI-K
		EPA 6020	EMR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2540C	MAP	1	PASI-K
		EPA 9056	CNB	1	PASI-K
60317489004	DUP-2	EPA 6010	LRS	3	PASI-K
		EPA 6020	EMR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2540C	MAP	1	PASI-K
		EPA 9056	CNB	1	PASI-K
60317489005	ASH-04	EPA 6010	LRS	3	PASI-K
		EPA 6020	EMR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2540C	MAP	1	PASI-K
		EPA 9056	CNB	1	PASI-K

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317489

Sample: ASH-01 (MW-1)		Lab ID: 60317489001	Collected: 10/08/19 09:00		Received: 10/09/19 09:15		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010						
Boron	462	ug/L	100	1	10/14/19 10:00	10/14/19 19:00	7440-42-8	M1
Calcium	346000	ug/L	200	1	10/14/19 10:00	10/14/19 19:00	7440-70-2	
Lithium	387	ug/L	10.0	1	10/14/19 10:00	10/14/19 19:00	7439-93-2	
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010						
Antimony	ND	ug/L	4.0	4	10/16/19 17:10	10/22/19 21:41	7440-36-0	D3
Arsenic	ND	ug/L	4.0	4	10/16/19 17:10	10/22/19 21:41	7440-38-2	D3
Barium	9.7	ug/L	4.0	4	10/16/19 17:10	10/22/19 21:41	7440-39-3	
Beryllium	ND	ug/L	2.0	4	10/16/19 17:10	10/22/19 21:41	7440-41-7	D3
Cadmium	ND	ug/L	2.0	4	10/16/19 17:10	10/22/19 21:41	7440-43-9	D3
Chromium	ND	ug/L	4.0	4	10/16/19 17:10	10/22/19 21:41	7440-47-3	D3
Cobalt	ND	ug/L	4.0	4	10/16/19 17:10	10/22/19 21:41	7440-48-4	D3
Lead	ND	ug/L	4.0	4	10/16/19 17:10	10/22/19 21:41	7439-92-1	D3
Molybdenum	ND	ug/L	4.0	4	10/16/19 17:10	10/22/19 21:41	7439-98-7	D3
Selenium	ND	ug/L	4.0	4	10/16/19 17:10	10/22/19 21:41	7782-49-2	D3
Thallium	ND	ug/L	4.0	4	10/16/19 17:10	10/22/19 21:41	7440-28-0	D3
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470						
Mercury	ND	ug/L	0.20	1	10/09/19 16:22	10/10/19 12:45	7439-97-6	
2540C Total Dissolved Solids		Analytical Method: SM 2540C						
Total Dissolved Solids	3290	mg/L	66.7	1		10/14/19 11:25		
9056 IC Anions		Analytical Method: EPA 9056						
Fluoride	ND	mg/L	0.20	1		10/17/19 21:34	16984-48-8	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317489

Sample: ASH-06		Lab ID: 60317489002		Collected: 10/08/19 11:00		Received: 10/09/19 09:15		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	324	ug/L	100	1	10/14/19 10:00	10/14/19 19:11	7440-42-8		
Calcium	26700	ug/L	200	1	10/14/19 10:00	10/14/19 19:11	7440-70-2		
Lithium	51.9	ug/L	10.0	1	10/14/19 10:00	10/14/19 19:11	7439-93-2		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	10/16/19 17:10	10/22/19 21:53	7440-36-0		
Arsenic	ND	ug/L	1.0	1	10/16/19 17:10	10/22/19 21:53	7440-38-2		
Barium	60.5	ug/L	1.0	1	10/16/19 17:10	10/22/19 21:53	7440-39-3		
Beryllium	ND	ug/L	0.50	1	10/16/19 17:10	10/22/19 21:53	7440-41-7		
Cadmium	ND	ug/L	0.50	1	10/16/19 17:10	10/22/19 21:53	7440-43-9		
Chromium	1.6	ug/L	1.0	1	10/16/19 17:10	10/22/19 21:53	7440-47-3		
Cobalt	ND	ug/L	1.0	1	10/16/19 17:10	10/22/19 21:53	7440-48-4		
Lead	ND	ug/L	1.0	1	10/16/19 17:10	10/22/19 21:53	7439-92-1		
Molybdenum	48.2	ug/L	1.0	1	10/16/19 17:10	10/22/19 21:53	7439-98-7		
Selenium	33.7	ug/L	1.0	1	10/16/19 17:10	10/22/19 21:53	7782-49-2		
Thallium	ND	ug/L	1.0	1	10/16/19 17:10	10/22/19 21:53	7440-28-0		
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	10/09/19 16:22	10/10/19 12:47	7439-97-6		
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	515	mg/L	10.0	1		10/14/19 11:26			
9056 IC Anions		Analytical Method: EPA 9056							
Fluoride	0.81	mg/L	0.20	1		10/17/19 22:25	16984-48-8		

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317489

Sample: ASH-02 (MW-2)		Lab ID: 60317489003	Collected: 10/08/19 13:15	Received: 10/09/19 09:15	Matrix: Water			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010						
Boron	1870	ug/L	100	1	10/14/19 10:00	10/14/19 19:13	7440-42-8	
Calcium	154000	ug/L	200	1	10/14/19 10:00	10/14/19 19:13	7440-70-2	
Lithium	281	ug/L	10.0	1	10/14/19 10:00	10/14/19 19:13	7439-93-2	
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010						
Antimony	ND	ug/L	10.0	10	10/16/19 17:10	10/22/19 21:58	7440-36-0	D3
Arsenic	ND	ug/L	10.0	10	10/16/19 17:10	10/22/19 21:58	7440-38-2	D3
Barium	20.0	ug/L	10.0	10	10/16/19 17:10	10/22/19 21:58	7440-39-3	
Beryllium	ND	ug/L	5.0	10	10/16/19 17:10	10/22/19 21:58	7440-41-7	D3
Cadmium	ND	ug/L	5.0	10	10/16/19 17:10	10/22/19 21:58	7440-43-9	D3
Chromium	ND	ug/L	10.0	10	10/16/19 17:10	10/22/19 21:58	7440-47-3	D3
Cobalt	ND	ug/L	10.0	10	10/16/19 17:10	10/22/19 21:58	7440-48-4	D3
Lead	ND	ug/L	10.0	10	10/16/19 17:10	10/22/19 21:58	7439-92-1	D3
Molybdenum	ND	ug/L	10.0	10	10/16/19 17:10	10/22/19 21:58	7439-98-7	D3
Selenium	ND	ug/L	10.0	10	10/16/19 17:10	10/22/19 21:58	7782-49-2	D3
Thallium	ND	ug/L	10.0	10	10/16/19 17:10	10/22/19 21:58	7440-28-0	D3
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470						
Mercury	ND	ug/L	0.20	1	10/09/19 16:22	10/10/19 12:49	7439-97-6	
2540C Total Dissolved Solids		Analytical Method: SM 2540C						
Total Dissolved Solids	3470	mg/L	66.7	1		10/14/19 11:26		
9056 IC Anions		Analytical Method: EPA 9056						
Fluoride	ND	mg/L	0.20	1		10/17/19 22:42	16984-48-8	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317489

Sample: DUP-2		Lab ID: 60317489004		Collected: 10/08/19 08:00		Received: 10/09/19 09:15		Matrix: Water	
Parameters		Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	1950	ug/L	100	1	10/14/19 10:00	10/14/19 19:15	7440-42-8		
Calcium	155000	ug/L	200	1	10/14/19 10:00	10/14/19 19:15	7440-70-2		
Lithium	280	ug/L	10.0	1	10/14/19 10:00	10/14/19 19:15	7439-93-2		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	10.0	10	10/16/19 17:10	10/22/19 22:03	7440-36-0		D3
Arsenic	ND	ug/L	10.0	10	10/16/19 17:10	10/22/19 22:03	7440-38-2		D3
Barium	20.0	ug/L	10.0	10	10/16/19 17:10	10/22/19 22:03	7440-39-3		
Beryllium	ND	ug/L	5.0	10	10/16/19 17:10	10/22/19 22:03	7440-41-7		D3
Cadmium	ND	ug/L	5.0	10	10/16/19 17:10	10/22/19 22:03	7440-43-9		D3
Chromium	ND	ug/L	10.0	10	10/16/19 17:10	10/22/19 22:03	7440-47-3		D3
Cobalt	ND	ug/L	10.0	10	10/16/19 17:10	10/22/19 22:03	7440-48-4		D3
Lead	ND	ug/L	10.0	10	10/16/19 17:10	10/22/19 22:03	7439-92-1		D3
Molybdenum	ND	ug/L	10.0	10	10/16/19 17:10	10/22/19 22:03	7439-98-7		D3
Selenium	ND	ug/L	10.0	10	10/16/19 17:10	10/22/19 22:03	7782-49-2		D3
Thallium	ND	ug/L	10.0	10	10/16/19 17:10	10/22/19 22:03	7440-28-0		D3
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	10/09/19 16:22	10/10/19 12:52	7439-97-6		
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	3380	mg/L	200	1		10/14/19 11:26			
9056 IC Anions		Analytical Method: EPA 9056							
Fluoride	ND	mg/L	0.20	1		10/17/19 22:58	16984-48-8		

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317489

Sample: ASH-04		Lab ID: 60317489005		Collected: 10/08/19 15:30		Received: 10/09/19 09:15		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	611	ug/L	100	1	10/14/19 10:00	10/14/19 19:18	7440-42-8		
Calcium	420000	ug/L	200	1	10/14/19 10:00	10/14/19 19:18	7440-70-2		
Lithium	337	ug/L	10.0	1	10/14/19 10:00	10/14/19 19:18	7439-93-2		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	5.0	5	10/16/19 17:10	10/22/19 22:08	7440-36-0	D3	
Arsenic	ND	ug/L	5.0	5	10/16/19 17:10	10/22/19 22:08	7440-38-2	D3	
Barium	9.2	ug/L	5.0	5	10/16/19 17:10	10/22/19 22:08	7440-39-3		
Beryllium	ND	ug/L	2.5	5	10/16/19 17:10	10/22/19 22:08	7440-41-7	D3	
Cadmium	ND	ug/L	2.5	5	10/16/19 17:10	10/22/19 22:08	7440-43-9	D3	
Chromium	ND	ug/L	5.0	5	10/16/19 17:10	10/22/19 22:08	7440-47-3	D3	
Cobalt	ND	ug/L	5.0	5	10/16/19 17:10	10/22/19 22:08	7440-48-4	D3	
Lead	ND	ug/L	5.0	5	10/16/19 17:10	10/22/19 22:08	7439-92-1	D3	
Molybdenum	ND	ug/L	5.0	5	10/16/19 17:10	10/22/19 22:08	7439-98-7	D3	
Selenium	70.3	ug/L	5.0	5	10/16/19 17:10	10/22/19 22:08	7782-49-2		
Thallium	ND	ug/L	5.0	5	10/16/19 17:10	10/22/19 22:08	7440-28-0	D3	
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	10/09/19 16:22	10/10/19 12:54	7439-97-6		
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	5350	mg/L	100	1		10/14/19 11:26			
9056 IC Anions		Analytical Method: EPA 9056							
Fluoride	ND	mg/L	0.20	1		10/17/19 23:15	16984-48-8		

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317489

QC Batch: 614609 Analysis Method: EPA 7470
QC Batch Method: EPA 7470 Analysis Description: 7470 Mercury
Associated Lab Samples: 60317489001, 60317489002, 60317489003, 60317489004, 60317489005

METHOD BLANK: 2509427 Matrix: Water
Associated Lab Samples: 60317489001, 60317489002, 60317489003, 60317489004, 60317489005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	10/10/19 12:24	

LABORATORY CONTROL SAMPLE: 2509428

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	5	4.7	95	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2509429 2509430

Parameter	Units	60317441002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	5	5	4.9	4.7	97	92	75-125	5	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317489

QC Batch:	615474	Analysis Method:	EPA 6010
QC Batch Method:	EPA 3010	Analysis Description:	6010 MET
Associated Lab Samples: 60317489001, 60317489002, 60317489003, 60317489004, 60317489005			

METHOD BLANK:	2512793	Matrix:	Water
Associated Lab Samples: 60317489001, 60317489002, 60317489003, 60317489004, 60317489005			

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	ug/L	ND	100	10/14/19 18:55	
Calcium	ug/L	ND	200	10/14/19 18:55	
Lithium	ug/L	ND	10.0	10/14/19 18:55	

LABORATORY CONTROL SAMPLE: 2512794

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	1000	946	95	80-120	
Calcium	ug/L	10000	9630	96	80-120	
Lithium	ug/L	1000	971	97	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2512795 2512796

Parameter	Units	60317489001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	462	1000	1000	1350	1390	88	92	75-125	3	20	
Calcium	ug/L	346000	10000	10000	337000	349000	-91	25	75-125	3	20	M1
Lithium	ug/L	387	1000	1000	1320	1330	93	95	75-125	1	20	

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE CCR
Pace Project No.: 60317489

QC Batch: 616267 Analysis Method: EPA 6020
QC Batch Method: EPA 3010 Analysis Description: 6020 MET
Associated Lab Samples: 60317489001, 60317489002, 60317489003, 60317489004, 60317489005

METHOD BLANK: 2515575 Matrix: Water
Associated Lab Samples: 60317489001, 60317489002, 60317489003, 60317489004, 60317489005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	1.0	10/22/19 20:51	
Arsenic	ug/L	ND	1.0	10/22/19 20:51	
Barium	ug/L	ND	1.0	10/22/19 20:51	
Beryllium	ug/L	ND	0.50	10/22/19 20:51	
Cadmium	ug/L	ND	0.50	10/22/19 20:51	
Chromium	ug/L	ND	1.0	10/22/19 20:51	
Cobalt	ug/L	ND	1.0	10/22/19 20:51	
Lead	ug/L	ND	1.0	10/22/19 20:51	
Molybdenum	ug/L	ND	1.0	10/22/19 20:51	
Selenium	ug/L	ND	1.0	10/22/19 20:51	
Thallium	ug/L	ND	1.0	10/22/19 20:51	

LABORATORY CONTROL SAMPLE: 2515576

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	40	40.2	100	80-120	
Arsenic	ug/L	40	40.1	100	80-120	
Barium	ug/L	40	39.8	100	80-120	
Beryllium	ug/L	40	40.7	102	80-120	
Cadmium	ug/L	40	40.8	102	80-120	
Chromium	ug/L	40	41.7	104	80-120	
Cobalt	ug/L	40	39.6	99	80-120	
Lead	ug/L	40	42.3	106	80-120	
Molybdenum	ug/L	40	41.0	103	80-120	
Selenium	ug/L	40	39.5	99	80-120	
Thallium	ug/L	40	39.2	98	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2515577 2515578

Parameter	Units	60317074001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	ND	40	40	39.5	39.9	98	99	75-125	1	20	
Arsenic	ug/L	ND	40	40	41.2	41.3	102	103	75-125	0	20	
Barium	ug/L	8.8	40	40	47.4	47.8	96	98	75-125	1	20	
Beryllium	ug/L	ND	40	40	35.7	37.7	89	94	75-125	5	20	
Cadmium	ug/L	ND	40	40	39.2	39.6	98	99	75-125	1	20	
Chromium	ug/L	ND	40	40	41.8	42.1	103	104	75-125	1	20	
Cobalt	ug/L	ND	40	40	39.5	39.4	98	98	75-125	0	20	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317489

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2515577 2515578													
Parameter	Units	60317074001	MS	MSD	MS	MSD	MS	MSD	% Rec	Limits	RPD	Max	Qual
		Result	Spike	Spike										Result	Result	% Rec	% Rec
Lead	ug/L	ND	40	40	42.1	42.8	105	106	75-125	1	20		
Molybdenum	ug/L	ND	40	40	43.9	44.5	108	110	75-125	1	20		
Selenium	ug/L	26.5	40	40	64.3	64.8	95	96	75-125	1	20		
Thallium	ug/L	ND	40	40	38.7	39.5	96	98	75-125	2	20		

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317489

QC Batch: 615437 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60317489001, 60317489002, 60317489003, 60317489004, 60317489005

METHOD BLANK: 2512734 Matrix: Water
Associated Lab Samples: 60317489001, 60317489002, 60317489003, 60317489004, 60317489005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	5.0	10/14/19 11:23	

LABORATORY CONTROL SAMPLE: 2512735

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	1090	109	80-120	

SAMPLE DUPLICATE: 2512736

Parameter	Units	60317547003 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	1510	1510	0	10	

SAMPLE DUPLICATE: 2512737

Parameter	Units	60317489005 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	5350	4940	8	10	

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317489

QC Batch: 616590 Analysis Method: EPA 9056
QC Batch Method: EPA 9056 Analysis Description: 9056 IC Anions
Associated Lab Samples: 60317489001, 60317489002, 60317489003, 60317489004, 60317489005

METHOD BLANK: 2516805 Matrix: Water
Associated Lab Samples: 60317489001, 60317489002, 60317489003, 60317489004, 60317489005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Fluoride	mg/L	ND	0.20	10/17/19 15:39	

LABORATORY CONTROL SAMPLE: 2516806

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Fluoride	mg/L	2.5	2.4	95	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2516807 2516808

Parameter	Units	60317630001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Fluoride	mg/L	0.21	2.5	2.5	2.6	2.7	97	99	80-120	2	15	

MATRIX SPIKE SAMPLE: 2516810

Parameter	Units	60317754002 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Fluoride	mg/L	ND	2.5	2.4	94	80-120	

SAMPLE DUPLICATE: 2516809

Parameter	Units	60317630002 Result	Dup Result	RPD	Max RPD	Qualifiers
Fluoride	mg/L	0.19J	.17J		15	

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REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317489

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K Pace Analytical Services - Kansas City

ANALYTE QUALIFIERS

D3 Sample was diluted due to the presence of high levels of non-target analytes or other matrix interference.

M1 Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317489

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60317489001	ASH-01 (MW-1)	EPA 3010	615474	EPA 6010	615590
60317489002	ASH-06	EPA 3010	615474	EPA 6010	615590
60317489003	ASH-02 (MW-2)	EPA 3010	615474	EPA 6010	615590
60317489004	DUP-2	EPA 3010	615474	EPA 6010	615590
60317489005	ASH-04	EPA 3010	615474	EPA 6010	615590
60317489001	ASH-01 (MW-1)	EPA 3010	616267	EPA 6020	616323
60317489002	ASH-06	EPA 3010	616267	EPA 6020	616323
60317489003	ASH-02 (MW-2)	EPA 3010	616267	EPA 6020	616323
60317489004	DUP-2	EPA 3010	616267	EPA 6020	616323
60317489005	ASH-04	EPA 3010	616267	EPA 6020	616323
60317489001	ASH-01 (MW-1)	EPA 7470	614609	EPA 7470	614838
60317489002	ASH-06	EPA 7470	614609	EPA 7470	614838
60317489003	ASH-02 (MW-2)	EPA 7470	614609	EPA 7470	614838
60317489004	DUP-2	EPA 7470	614609	EPA 7470	614838
60317489005	ASH-04	EPA 7470	614609	EPA 7470	614838
60317489001	ASH-01 (MW-1)	SM 2540C	615437		
60317489002	ASH-06	SM 2540C	615437		
60317489003	ASH-02 (MW-2)	SM 2540C	615437		
60317489004	DUP-2	SM 2540C	615437		
60317489005	ASH-04	SM 2540C	615437		
60317489001	ASH-01 (MW-1)	EPA 9056	616590		
60317489002	ASH-06	EPA 9056	616590		
60317489003	ASH-02 (MW-2)	EPA 9056	616590		
60317489004	DUP-2	EPA 9056	616590		
60317489005	ASH-04	EPA 9056	616590		

REPORT OF LABORATORY ANALYSIS

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Sample Condition Upon Receipt

WO#: 60317489



60317489

Client Name: Alcon

Courier: FedEx ☒ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☐ Client ☐ Other ☐

Tracking #: 121929788951 Pace Shipping Label Used? Yes ☐ No ☐

Custody Seal on Cooler/Box Present: Yes ☐ No ☐ Seals intact: Yes ☐ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☐ Other ☐

Thermometer Used: P-301 Type of Ice: Wet ☐ Blue ☐ None ☐

Cooler Temperature (°C): As-read 1.2 Corr. Factor 0.0 Corrected 1.2

Date and initials of person examining contents: 10/9/15

Temperature should be above freezing to 6°C

Chain of Custody present:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Chain of Custody relinquished:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Samples arrived within holding time:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Short Hold Time analyses (<72hr):	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Rush Turn Around Time requested:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Sufficient volume:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Correct containers used:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Pace containers used:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Containers intact:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Filtered volume received for dissolved tests?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Sample labels match COC: Date / time / ID / analyses	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Samples contain multiple phases? Matrix: <u>wt</u>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Containers requiring pH preservation in compliance? (HNO ₃ , H ₂ SO ₄ , HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added.
Cyanide water sample checks:		
Lead acetate strip turns dark? (Record only)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Potassium iodide test strip turns blue/purple? (Preserve)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Trip Blank present:	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Headspace in VOA vials (>6mm):	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Samples from USDA Regulated Area: State:	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	

Client Notification/ Resolution:

Copy COC to Client? Y ☐ N ☒

Field Data Required? Y ☐ N ☒

Person Contacted: _____ Date/Time: _____

Comments/ Resolution: _____

Project Manager Review: _____

Date: _____

Page 19 of 19

Platte River Power Authority – Rawhide DATA REVIEW CHECK

Data Package: 60317489

Sampling Event: October 8, 2019

Data Reviewer: Brian Rothmeyer

Peer Reviewer: Steve Szocik

Date Completed: December 6, 2019

Date Completed: December 19, 2019

This report contains the final results of the data validation conducted for the water samples collected October 8, 2019. The data review was conducted in accordance with the method and laboratory criteria, as applicable. The data review was conducted in accordance with method requirements and laboratory limits using guidance from USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540-R-2017-001 (January 2017).

General Overall Assessment:

- ☒ Data are usable without qualification.
- ☐ Data are usable with qualification (noted below).
- ☐ Some or all data are unusable for any purpose (detailed below).

Data Review Checklist

Review Parameter	Criteria	Criteria Met?		
		Yes	No	NA
<i>Sample-specific Parameters</i>	For each "No" response, list qualified data and bias direction in Table 1 or explain no qualification in comments.			
Chain of Custody, Sample Identification, & Sample Receipt	Samples were received intact and the cooler temperature was <6 degree Celsius upon arrival at the laboratory.	X		
Holding Times	The samples were analyzed within the method required holding times.	X		
Method Blanks (MB)	No target analytes reported in the associated MB.	X		
Quality Control Samples: Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD)	The LCS/LCSD recoveries were within the laboratory determined acceptance limits.	X		
Matrix Spike / Matrix Spike Duplicate (MS/MSD)	The recoveries and relative percent differences for the matrix spike and matrix spike duplicate analyses were within the laboratory-determined acceptance ranges. Results in the native sample greater than four times the concentration of the spike added during digestions/extractions are not considered to be a representative measure of accuracy. Further action with respect to spike recovery evaluation or qualification of data was not considered necessary.	X		
Laboratory Duplicate	The laboratory duplicate samples were within the laboratory determined acceptance limits. The following concentration dependent criteria were used to evaluate laboratory duplicates: <ul style="list-style-type: none"> When both the sample and duplicate values are >5x the reporting limit (RL), acceptable sampling and analytical precision is indicated by an relative percent difference (RPD) between the results of ≤20%. Where the result for one or both analytes of the method duplicate pair is <5xRL, satisfactory precision is indicated if 	X		

Review Parameter	Criteria	Criteria Met?												
<i>Sample-specific Parameters</i>	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA										
	the absolute difference between the method duplicate results is <1xRL.													
Field Duplicate	<div>The field duplicate sample results satisfied the evaluation criteria below:<table><tr><th>Parent Sample</th><th>Field Duplicate</th></tr><tr><td>ASH-02 (MW-2)</td><td>DUP-2</td></tr></table><ul style="list-style-type: none">When both the sample and duplicate values are >5xRL acceptable sampling and analytical precision is indicated by an RPD between the results of ≤30%.Where the result for one or both analytes of the field duplicate pair is <5xRL, satisfactory precision is indicated if the absolute difference between the field duplicate results is <2xRL.</div>	Parent Sample	Field Duplicate	ASH-02 (MW-2)	DUP-2	X								
Parent Sample	Field Duplicate													
ASH-02 (MW-2)	DUP-2													
Equipment Blanks	<div>No target analytes reported in the associated equipment blank.<table><tr><th>Analyte</th><th>Concentration</th></tr><tr><td colspan="2">EB-2 (60318035)</td></tr><tr><td>Lead</td><td>3.3 µg/L</td></tr><tr><td colspan="2">EB-4 (60318083)</td></tr><tr><td>TDS</td><td>6.0 mg/L</td></tr></table><div>µg/L – Microgram per Liter mg/L – Milligrams per Liter TDS – Total Dissolved Solids</div></div>	Analyte	Concentration	EB-2 (60318035)		Lead	3.3 µg/L	EB-4 (60318083)		TDS	6.0 mg/L		X ¹	
Analyte	Concentration													
EB-2 (60318035)														
Lead	3.3 µg/L													
EB-4 (60318083)														
TDS	6.0 mg/L													
Reporting Limits Met (Non –Radiochemistry)	No samples performed at dilutions or reported as non-detect at elevated method detection limits/reporting limits.		X ²											
Detection Limits Mets (Radiochemistry)	For radiochemical results if the associated uncertainty was greater than the reported result, the 2 sigma (σ) uncertainty multiplied by 1.65 was less than or equal to the specified detection limit.			X										
Tracer and/or Carrier Recovery	The sample specific recoveries were within the laboratory limits.			X										
Package Completeness	No results were qualified as unusable and the data are 100% complete.	X												
Comments														
1 – The associated lead and total dissolved solids (TDS) sample results were reported as non-detect or at concentrations >5x the concentration of the blank contamination and qualification was not considered necessary.														
2 – Several analytes were reported as non-detect at elevated reporting limits. These non-detect results will need to be evaluated by the end user of the data with respect to project objectives.														

> – Greater Than
µg/L – Microgram per Liter
% – Percent
LCSD – Laboratory Control Sample Duplicate
RL – Reporting Limit

< – Less Than
mg/L – Milligrams per Liter
± – Plus or Minus σ - Sigma
MS/MSD – Matrix Spike/Matrix Spike Duplicate
RPD – Relative Percent Difference

≤ – Less Than or Equal To
σ – Sigma
LCS – Laboratory Control Sample
NA – Not Applicable
TDS – Total Dissolved Solids

October 30, 2019

Vasanta Kalluri
AECOM
6200 South Quebec Street
Greenwood Village, CO 80111

RE: Project: PRPA Rawhide CCR
Pace Project No.: 60317751

Dear Vasanta Kalluri:

Enclosed are the analytical results for sample(s) received by the laboratory on October 09, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Heather Wilson
heather.wilson@pacelabs.com
1(913)563-1407
Project Manager

Enclosures

cc: Jeremy Hurshman, AECOM
Jeff Mott, AECOM
Brian Rothmeyer, AECOM



REPORT OF LABORATORY ANALYSIS

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CERTIFICATIONS

Project: PRPA Rawhide CCR

Pace Project No.: 60317751

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601

ANAB DOD-ELAP Rad Accreditation #: L2417

Alabama Certification #: 41590

Arizona Certification #: AZ0734

Arkansas Certification

California Certification #: 04222CA

Colorado Certification #: PA01547

Connecticut Certification #: PH-0694

Delaware Certification

EPA Region 4 DW Rad

Florida/TNI Certification #: E87683

Georgia Certification #: C040

Florida: Cert E871149 SEKS WET

Guam Certification

Hawaii Certification

Idaho Certification

Illinois Certification

Indiana Certification

Iowa Certification #: 391

Kansas/TNI Certification #: E-10358

Kentucky Certification #: KY90133

KY WW Permit #: KY0098221

KY WW Permit #: KY0000221

Louisiana DHH/TNI Certification #: LA180012

Louisiana DEQ/TNI Certification #: 4086

Maine Certification #: 2017020

Maryland Certification #: 308

Massachusetts Certification #: M-PA1457

Michigan/PADEP Certification #: 9991

Missouri Certification #: 235

Montana Certification #: Cert0082

Nebraska Certification #: NE-OS-29-14

Nevada Certification #: PA014572018-1

New Hampshire/TNI Certification #: 297617

New Jersey/TNI Certification #: PA051

New Mexico Certification #: PA01457

New York/TNI Certification #: 10888

North Carolina Certification #: 42706

North Dakota Certification #: R-190

Ohio EPA Rad Approval: #41249

Oregon/TNI Certification #: PA200002-010

Pennsylvania/TNI Certification #: 65-00282

Puerto Rico Certification #: PA01457

Rhode Island Certification #: 65-00282

South Dakota Certification

Tennessee Certification #: 02867

Texas/TNI Certification #: T104704188-17-3

Utah/TNI Certification #: PA014572017-9

USDA Soil Permit #: P330-17-00091

Vermont Dept. of Health: ID# VT-0282

Virgin Island/PADEP Certification

Virginia/VELAP Certification #: 9526

Washington Certification #: C868

West Virginia DEP Certification #: 143

West Virginia DHHR Certification #: 9964C

Wisconsin Approve List for Rad

Wyoming Certification #: 8TMS-L

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SAMPLE SUMMARY

Project: PRPA Rawhide CCR

Pace Project No.: 60317751

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60317751001	ASH-01 (MW-1)	Water	10/08/19 09:00	10/09/19 09:20
60317751002	ASH-06	Water	10/08/19 11:00	10/09/19 09:20
60317751003	ASH-02 (MW-2)	Water	10/08/19 13:15	10/09/19 09:20
60317751004	DUP-2	Water	10/08/19 00:00	10/09/19 09:20
60317751005	ASH-04	Water	10/08/19 15:30	10/09/19 09:20

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SAMPLE ANALYTE COUNT

Project: PRPA Rawhide CCR

Pace Project No.: 60317751

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60317751001	ASH-01 (MW-1)	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60317751002	ASH-06	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60317751003	ASH-02 (MW-2)	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60317751004	DUP-2	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60317751005	ASH-04	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide CCR

Pace Project No.: 60317751

Sample: ASH-01 (MW-1)		Lab ID: 60317751001	Collected: 10/08/19 09:00	Received: 10/09/19 09:20	Matrix: Water		
PWS:		Site ID:	Sample Type:				
Parameters	Method	Act ± Unc (MDC) Carr Trac		Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.187 ± 0.441 (0.818) C:NA T:93%		pCi/L	10/23/19 14:56	13982-63-3	
Radium-228	EPA 904.0	1.08 ± 0.468 (0.770) C:73% T:84%		pCi/L	10/29/19 12:20	15262-20-1	
Total Radium	Total Radium Calculation	0.282 ± 0.476 (1.00)		pCi/L	10/29/19 11:13	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide CCR

Pace Project No.: 60317751

Sample: ASH-06		Lab ID: 60317751002	Collected: 10/08/19 11:00	Received: 10/09/19 09:20	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	-0.0627 ± 0.286 (0.675) C:NA T:86%	pCi/L	10/23/19 15:10	13982-63-3	
Radium-228	EPA 904.0	0.969 ± 0.930 (1.91) C:76% T:82%	pCi/L	10/29/19 12:21	15262-20-1	
Total Radium	Total Radium Calculation	0.901 ± 0.869 (1.66)	pCi/L	10/29/19 11:13	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide CCR

Pace Project No.: 60317751

Sample: ASH-02 (MW-2)		Lab ID: 60317751003	Collected: 10/08/19 13:15	Received: 10/09/19 09:20	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.000 ± 0.340 (0.763) C:NA T:80%	pCi/L	10/23/19 15:10	13982-63-3	
Radium-228	EPA 904.0	0.607 ± 0.476 (0.935) C:71% T:83%	pCi/L	10/29/19 12:24	15262-20-1	
Total Radium	Total Radium Calculation	1.22 ± 0.866 (1.50)	pCi/L	10/29/19 11:13	7440-14-4	

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide CCR

Pace Project No.: 60317751

Sample: DUP-2		Lab ID: 60317751004	Collected: 10/08/19 00:00	Received: 10/09/19 09:20	Matrix: Water		
PWS:		Site ID:	Sample Type:				
Parameters	Method	Act ± Unc (MDC) Carr Trac		Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.179 ± 0.352 (0.643) C:NA T:92%		pCi/L	10/23/19 15:10	13982-63-3	
Radium-228	EPA 904.0	1.06 ± 0.497 (0.857) C:72% T:93%		pCi/L	10/29/19 12:21	15262-20-1	
Total Radium	Total Radium Calculation	1.25 ± 0.885 (1.50)		pCi/L	10/29/19 11:13	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide CCR

Pace Project No.: 60317751

Sample: ASH-04		Lab ID: 60317751005	Collected: 10/08/19 15:30	Received: 10/09/19 09:20	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.000 ± 0.542 (1.10) C:NA T:87%	pCi/L	10/23/19 15:10	13982-63-3	
Radium-228	EPA 904.0	1.09 ± 0.545 (0.993) C:71% T:87%	pCi/L	10/29/19 12:15	15262-20-1	
Total Radium	Total Radium Calculation	1.65 ± 1.22 (2.02)	pCi/L	10/29/19 11:13	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL - RADIOCHEMISTRY

Project: PRPA Rawhide CCR

Pace Project No.: 60317751

QC Batch:	365780	Analysis Method:	EPA 903.1
QC Batch Method:	EPA 903.1	Analysis Description:	903.1 Radium-226
Associated Lab Samples:	60317751001, 60317751002, 60317751003, 60317751004, 60317751005		

METHOD BLANK:	1774276	Matrix:	Water
---------------	---------	---------	-------

Associated Lab Samples: 60317751001, 60317751002, 60317751003, 60317751004, 60317751005

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.412 ± 0.353 (0.478) C:NA T:91%	pCi/L	10/23/19 14:56	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL - RADIOCHEMISTRY

Project: PRPA Rawhide CCR

Pace Project No.: 60317751

QC Batch:	365778	Analysis Method:	EPA 904.0
QC Batch Method:	EPA 904.0	Analysis Description:	904.0 Radium 228
Associated Lab Samples:	60317751001, 60317751002, 60317751003, 60317751004, 60317751005		

METHOD BLANK:	1774275	Matrix:	Water
Associated Lab Samples:	60317751001, 60317751002, 60317751003, 60317751004, 60317751005		

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.377 ± 0.383 (0.793) C:79% T:87%	pCi/L	10/28/19 14:58	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: PRPA Rawhide CCR

Pace Project No.: 60317751

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval).

Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-PA Pace Analytical Services - Greensburg

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: PRPA Rawhide CCR

Pace Project No.: 60317751

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60317751001	ASH-01 (MW-1)	EPA 903.1	365780		
60317751002	ASH-06	EPA 903.1	365780		
60317751003	ASH-02 (MW-2)	EPA 903.1	365780		
60317751004	DUP-2	EPA 903.1	365780		
60317751005	ASH-04	EPA 903.1	365780		
60317751001	ASH-01 (MW-1)	EPA 904.0	365778		
60317751002	ASH-06	EPA 904.0	365778		
60317751003	ASH-02 (MW-2)	EPA 904.0	365778		
60317751004	DUP-2	EPA 904.0	365778		
60317751005	ASH-04	EPA 904.0	365778		
60317751001	ASH-01 (MW-1)	Total Radium Calculation	368275		
60317751002	ASH-06	Total Radium Calculation	368275		
60317751003	ASH-02 (MW-2)	Total Radium Calculation	368275		
60317751004	DUP-2	Total Radium Calculation	368275		
60317751005	ASH-04	Total Radium Calculation	368275		

REPORT OF LABORATORY ANALYSIS

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Pittsburgh Lab Sample Condition Upon Receipt



Client Name:

AECOM

Project #

Courier: ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace Other

Tracking #:

1219 2978 777

Label

LIMS Login

Custody Seal on Cooler/Box Present: ☒ yes ☐ no

Seals intact: ☒ yes ☐ no

Thermometer Used

10

Type of Ice: Wet Blue None

Cooler Temperature

Observed Temp

1.2 °C

Correction Factor: 0 °C

Final Temp:

1.2 °C

Temp should be above freezing to 6°C

Comments:

Yes No N/A

pH paper Lot#

1013581

Date and Initials of person examining contents:

10/9/15

Chain of Custody Present:

☒ ☐ ☐

1.

Chain of Custody Filled Out:

☒ ☐ ☐

2.

Chain of Custody Relinquished:

☒ ☐ ☐

3.

Sampler Name & Signature on COC:

☒ ☐ ☐

4.

Sample Labels match COC:

☒ ☐ ☐

5.

-Includes date/time/ID

Matrix:

10

Samples Arrived within Hold Time:

☒ ☐ ☐

6.

Short Hold Time Analysis (<72hr remaining):

☐ ☒ ☐

7.

Rush Turn Around Time Requested:

☐ ☒ ☐

8.

Sufficient Volume:

☒ ☐ ☐

9.

Correct Containers Used:

☒ ☐ ☐

10.

-Pace Containers Used:

☒ ☐ ☐

Containers Intact:

☒ ☐ ☐

11.

Orthophosphate field filtered

☐ ☐ ☒

12.

Hex Cr Aqueous sample field filtered

☐ ☐ ☒

13.

Organic Samples checked for dechlorination:

☐ ☐ ☒

14.

Filtered volume received for Dissolved tests

☐ ☐ ☒

15.

All containers have been checked for preservation.

☒ ☐ ☐

16.

exceptions: VOA, coliform, TOC, O&G, Phenolics, Radon, Non-aqueous matrix

All containers meet method preservation requirements.

☒ ☐ ☐

Initial when completed

10/9/15

Date/time of preservation

Lot # of added preservative

Headspace in VOA Vials (>6mm):

☐ ☐ ☒

17.

Trip Blank Present:

☐ ☐ ☒

18.

Trip Blank Custody Seals Present

☐ ☐ ☒

Rad Samples Screened < 0.5 mrem/hr

☒ ☐ ☐

Initial when completed

10/9/15

Date:

10.9.15

Client Notification/ Resolution:

Person-Contacted:

Date/Time:

Contacted By:

Comments/ Resolution:

☐ A check in this box indicates that additional information has been stored in ereports.

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

*PM review is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

Chain of Custody

☒ Samples were sent directly to the Subcontracting Laboratory.

State Of Origin: CO
Cert. Needed: ☐ Yes ☒ No

Workorder: 60317751

Workorder Name: PRPA Rawhide CCR

Owner Received Date: 10/9/2019 Results Requested By: 10/23/2019

Report To		Subcontract To		Requested Analysis																					
Heather Wilson Pace Analytical Kansas 9608 Loiret Blvd. Lenexa, KS 66219 Phone 1(913)563-1407		Pace Analytical Pittsburgh 1638 Roseytown Road Suites 2,3, & 4 Greensburg, PA 15601 Phone (724)850-5600		<div style="display: flex; justify-content: space-between;"> <div> <p>Radium-226 & Total Radium</p> <p>Radium-228</p> </div> <div> <p>Preserved Containers</p> <table border="1"> <thead> <tr> <th>Other</th> <th>Matrix</th> </tr> </thead> <tbody> <tr><td>2</td><td>Water</td></tr> <tr><td>2</td><td>Water</td></tr> <tr><td>2</td><td>Water</td></tr> <tr><td>2</td><td>Water</td></tr> <tr><td>2</td><td>Water</td></tr> </tbody> </table> </div> </div>										Other	Matrix	2	Water	2	Water	2	Water	2	Water	2	Water
Other	Matrix																								
2	Water																								
2	Water																								
2	Water																								
2	Water																								
2	Water																								
Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix						LAB USE ONLY														
1	ASH-01 (MW-1)	PS	10/8/2019 09:00	60317751001	Water	X	X								001										
2	ASH-06	PS	10/8/2019 11:00	60317751002	Water	X	X								002										
3	ASH-02 (MW-2)	PS	10/8/2019 13:15	60317751003	Water	X	X								003										
4	DUP-2	PS	10/8/2019 00:00	60317751004	Water	X	X								004										
5	ASH-04	PS	10/8/2019 15:30	60317751005	Water	X	X								005										

Transfers		Released By	Date/Time	Received By	Date/Time	DIRECT SHIP *Please Provide QC sheets with report	
1				<i>Ben Williams</i>	10-9-19 1020		
2							
3							

Cooler Temperature on Receipt		12 °C	Custody Seal	Y or N	Received on Ice	Y or N	Samples Intact	Y or N

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC document.

This chain of custody is considered complete as is since this information is available in the owner laboratory.

WO#: 30329187



CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

30329187

Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:	
Company:	AECOM	Report To:	Geoff Webb	Attention:	Accounts Payable
Address:	6200 South Quebec St Greenwood Village, CO 80111	Copy To:	Brian Rothmeyer	Company Name:	AECOM
Email To:	brian.rothmeyer@aecom.com	Purchase Order No.:		Address:	Same as Section A
Phone:	(303) 740-2614	Project Name:	PRPA Rawhide CCR	Pace Quote Reference:	42700
Requested Due Date/TAT:	Standard	Project Number:		Pace Project Manager:	Heather Wilson
				Site Location:	CO
				STATE:	

Page: 1 of 1

REGULATORY AGENCY	
<input type="checkbox"/> NPDES	<input checked="" type="checkbox"/> GROUND WATER
<input type="checkbox"/> UST	<input type="checkbox"/> RCRA
<input type="checkbox"/> OTHER	CCR

ITEM #	Section D Required Client Information	Valid Matrix Codes										MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED		SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives							Y/N	Requested Analysis Filtered (Y/N)												Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
		MATRIX	CODE	DRINKING WATER	DW	WATER	WT	WASTE WATER	WW	PRODUCT	P			SOIL/SOLID	SL			OIL	OL	WIPE	WP	AIR	AR	OTHER		OT	TISSUE	TS	Unpreserved	H ₂ SO ₄	HNO ₃	HCl	NaOH	Na ₂ S ₂ O ₃	Methanol	Other	Analysis Test			Radium-226	Radium-228	Total Radium																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
ASH-06 pumped dry - Collect as much sample as possible	Wm Wint / AECOM	10.8.19	17:30	Wm Wint / AECOM	10/08/19		Y Y Y

SAMPLER NAME AND SIGNATURE		Temp in °C	Received on	Custody Sealed	Cooler (Y/N)	Samples Intact
PRINT Name of SAMPLER: Wes Weichert						
SIGNATURE of SAMPLER: Wm Wint						
DATE Signed (MM/DD/YY): 10/08/19						

Pittsburgh Lab Sample Condition Upon Receipt

Client Name: AECOMProject # # 30329187Courier: ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace OtherTracking #: 1319 2978 771Custody Seal on Cooler/Box Present: ☒ yes ☐ no Seals Intact: ☒ yes ☐ noThermometer Used 10 Type of Ice: Wet Blue NoneCooler Temperature Observed Temp 1.2 °C Correction Factor: 0 °C Final Temp: 1.2 °C

Temp should be above freezing to 6°C

Label BLM
LIMS Login BLM
BLM
10-10-19

Comments:	Yes	No	N/A	pH paper Lot# <u>1013587</u>	Date and Initials of person examining contents: <u>10/10/19</u>
Chain of Custody Present:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.	
Chain of Custody Filled Out:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2.	
Chain of Custody Relinquished:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3.	
Sampler Name & Signature on COC:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4.	
Sample Labels match COC:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5.	
-Includes date/time/ID Matrix: <u>10/10/19</u>					
Samples Arrived within Hold Time:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.	
Short Hold Time Analysis (<72hr remaining):	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	7.	
Rush Turn Around Time Requested:	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	8.	
Sufficient Volume:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	9.	
Correct Containers Used:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10.	
-Pace Containers Used:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Containers Intact:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	11.	
Orthophosphate field filtered	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	12.	
Hex Cr Aqueous sample field filtered	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	13.	
Organic Samples checked for dechlorination:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	14.	
Filtered volume received for Dissolved tests	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	15.	
All containers have been checked for preservation.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	16.	
exceptions: VOA, coliform, TOC, O&G, Phenolics, Radon, Non-aqueous matrix					
All containers meet method preservation requirements.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Initial when completed <u>10/10/19</u>	Date/time of preservation
				Lot # of added preservative	
Headspace in VOA Vials (>6mm):	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	17.	
Trip Blank Present:	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	18.	
Trip Blank Custody Seals Present	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Rad Samples Screened < 0.5 mrem/hr	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Initial when completed <u>10/10/19</u>	Date: <u>10.9.19</u>

Client Notification/ Resolution:

Person Contacted: _____ Date/Time: _____ Contacted By: _____

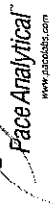
Comments/ Resolution: _____

☐ A check in this box indicates that additional information has been stored in ereports.

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

*PM review is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

Quality Control Sample Performance Assessment



Analyst Must Manually Enter All Fields Highlighted in Yellow.

Test: Ra-226
Analyst: MK1
Date: 10/17/2019
Batch ID: 50319
Matrix: DW

Method Blank Assessment	
MB Sample ID	1774276
MB Concentration:	0.412
MB Counting Uncertainty:	0.350
MB MDC:	0.478
MB Numerical Performance Indicator:	2.31
MB Status vs Numerical Indicator:	N/A
MB Status vs. MDC:	Pass

Laboratory Control Sample Assessment	
LCSID (Y or N)?	Y
LCS50319	10/23/2019
Count Date:	10/23/2019
Spike I.D.:	19-022
Spike Concentration (pCi/mL):	32.117
Volume Used (mL):	0.10
Aliquot Volume (L, g, F):	0.666
Target Conc. (pCi/L, g, F):	4.821
Uncertainty (Calculated):	0.227
Result (pCi/L, g, F):	4.608
LCS/LCSD Counting Uncertainty (pCi/L, g, F):	1.020
Numerical Performance Indicator:	-0.40
Percent Recovery:	95.57%
Status vs Numerical Indicator:	N/A
Status vs Recovery:	Pass
Upper % Recovery Limits:	135%
Lower % Recovery Limits:	73%

Duplicate Sample Assessment	
Sample I.D.:	LCS50319
Duplicate Sample I.D.:	LCS50319
Sample Result Counting Uncertainty (pCi/L, g, F):	4.608
Sample Duplicate Result (pCi/L, g, F):	1.020
Sample Duplicate Result Counting Uncertainty (pCi/L, g, F):	5.061
Are sample and/or duplicate results below RL?	NO
Duplicate Numerical Performance Indicator:	-0.627
(Based on the LCS/LCSD Percent Recoveries) Duplicate RPD:	8.85%
Duplicate Status vs Numerical Indicator:	N/A
Duplicate Status vs RPD:	Pass
% RPD Limit:	32%

Evaluation of duplicate precision is not applicable if either the sample or duplicate results are below the RL.

Comments:

Capit
10/23/19

Sample Matrix Spike Control Assessment	
Sample Collection Date:	10/12/2019
Sample I.D.:	30329020001
Sample MS I.D.:	30329020001MS
Sample MSD I.D.:	19-022
MS/MSD Decay Corrected Spike Concentration (pCi/mL):	32.118
Spike Volume Used in MS (mL):	0.20
Spike Volume Used in MSD (mL):	0.640
MS Aliquot (L, g, F):	10.032
MSD Aliquot (L, g, F):	0.472
MSD Target Conc. (pCi/L, g, F):	1.253
MS Spike Uncertainty (calculated):	0.507
MSD Spike Uncertainty (calculated):	11.760
Sample Result Counting Uncertainty (pCi/L, g, F):	1.588
Sample Matrix Spike Duplicate Result:	0.537
Matrix Spike Result Counting Uncertainty (pCi/L, g, F):	104.73%
Matrix Spike Duplicate Result Counting Uncertainty (pCi/L, g, F):	N/A
MS Numerical Performance Indicator:	Pass
MSD Numerical Performance Indicator:	136%
MS Percent Recovery:	71%
MSD Percent Recovery:	
MS Status vs Numerical Indicator:	
MSD Status vs Numerical Indicator:	
MS Status vs Recovery:	
MSD Status vs Recovery:	
MS/MSD Upper % Recovery Limits:	
MS/MSD Lower % Recovery Limits:	

Matrix Spike/Matrix Spike Duplicate Sample Assessment	
Sample I.D.:	Sample MS I.D.:
Sample MS I.D.:	Sample MSD I.D.:
Sample Result Counting Uncertainty (pCi/L, g, F):	Sample Matrix Spike Result:
Sample Duplicate Result Counting Uncertainty (pCi/L, g, F):	Sample Matrix Spike Duplicate Result:
Matrix Spike Duplicate Result Counting Uncertainty (pCi/L, g, F):	Duplicate Numerical Performance Indicator:
(Based on the Percent Recoveries) MSI/MSD Duplicate RPD:	MSI/MSD Duplicate Status vs Numerical Indicator:
MSI/MSD Duplicate Status vs RPD:	% RPD Limit:

10-23-19 ue

Quality Control Sample Performance Assessment



Test: Ra-228
Analyst: VAL
Date: 10/25/2019
Worklist: 50318
Matrix: WT

Analyst Must Manually Enter All Fields Highlighted in Yellow.

Method Blank Assessment	
MB Sample ID	1774275
MB concentration:	0.377
M/B 2 Sigma CSU:	0.383
MB MDC:	0.793
MB Numerical Performance Indicator:	1.93
MB Status vs. Numerical Indicator:	Pass
MB Status vs. MDC:	Pass

Laboratory Control Sample Assessment	
LCSID (Y or N)?	N
LCSID50318	LCSID50318
Count Date:	10/28/2019
Spike ID:	19-026
Decay Corrected Spike Concentration (pCi/mL):	34.911
Volume Used (mL):	0.10
Aliquot Volume (L, g, F):	0.805
Target Conc. (pCi/L, g, F):	4.336
Uncertainty (Calculated):	0.212
Result (pCi/L, g, F):	4.987
LCS/LCSD 2 Sigma CSU (pCi/L, g, F):	1.141
Numerical Performance Indicator:	1.10
Percent Recovery:	115.02%
Status vs Numerical Indicator:	N/A
Status vs Recovery:	Pass
Upper % Recovery Limits:	135%
Lower % Recovery Limits:	60%

Duplicate Sample Assessment	
Sample ID:	30329170001
Duplicate Sample ID:	30329170001DUP
Sample Result (pCi/L, g, F):	0.897
Sample Result 2 Sigma CSU (pCi/L, g, F):	0.432
Sample Duplicate Result (pCi/L, g, F):	0.439
Sample Duplicate Result 2 Sigma CSU (pCi/L, g, F):	0.403
Are sample and/or duplicate results below RL?	See Below ##
Duplicate Numerical Performance Indicator:	1.518
Duplicate RPD:	68.52%
Duplicate Status vs Numerical Indicator:	Pass
Duplicate Status vs RPD:	Fail***
% RPD Limit:	36%

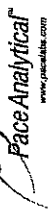
Evaluation of duplicate precision is not applicable if either the sample or duplicate results are below the MDC.

Comments:

Sample Matrix Spike Control Assessment		MS/MSD 1	MS/MSD 2
Sample Collection Date:	Sample I.D.:	10/10/2019	
Sample MS I.D.:	Sample MS I.D.:	30329232001	
Sample MSD I.D.:	Sample MSD I.D.:	30329232001MS	
MS/MSD Decay Corrected Spike Concentration (pCi/mL):	Spike I.D.:	19-026	
Spike Volume Used in MS (mL):		35.122	
MS Aliquot (L, g, F):		0.20	
MS Target Conc. (pCi/L, g, F):		0.815	
MSD Aliquot (L, g, F):		8.619	
MSD Target Conc. (pCi/L, g, F):		0.422	
MS Spike Uncertainty (calculated):		-0.029	
MSD Spike Uncertainty (calculated):		0.295	
Sample Result 2 Sigma CSU (pCi/L, g, F):		6.867	
Sample Matrix Spike Result:		1.431	
Matrix Spike Result 2 Sigma CSU (pCi/L, g, F):		-2.220	
Sample Matrix Spike Duplicate Result:		80.01%	
Matrix Spike Duplicate Result 2 Sigma CSU (pCi/L, g, F):		Warning	
MS Numerical Performance Indicator:		Pass	
MSD Numerical Performance Indicator:		135%	
MS Percent Recovery:		60%	
MSD Percent Recovery:			
MS Status vs Numerical Indicator:			
MSD Status vs Numerical Indicator:			
MS Status vs Recovery:			
MSD Status vs Recovery:			
MS/MSD Upper % Recovery Limits:			
MS/MSD Lower % Recovery Limits:			

Matrix Spike/Matrix Spike Duplicate Sample Assessment	
Sample I.D.:	Sample MS I.D.:
Sample MS I.D.:	Sample MSD I.D.:
Matrix Spike Result 2 Sigma CSU (pCi/L, g, F):	Sample Matrix Spike Result:
Sample Matrix Spike Duplicate Result:	Sample Matrix Spike Duplicate Result:
Matrix Spike Duplicate Result 2 Sigma CSU (pCi/L, g, F):	Duplicate Numerical Performance Indicator:
Duplicate Numerical Performance Indicator:	Duplicate Numerical Performance Indicator:
(Based on the Percent Recoveries) MS/MSD Duplicate RPD:	MS/MSD Duplicate Status vs Numerical Indicator:
MS/MSD Duplicate Status vs RPD:	% RPD Limit:

Quality Control Sample Performance Assessment



Analyst Must Manually Enter All Fields Highlighted in Yellow.

Test: Ra-228
Analyst: VAL
Date: 10/25/2019
Worklist: 50318
Matrix: WT

Method Blank Assessment	
MB Sample ID	1774275
MB concentration:	0.377
MB 2 Sigma CSU:	0.383
MB MDC:	0.793
MB Numerical Performance Indicator:	1.93
MB Status vs Numerical Indicator:	Pass
MB Status vs. MDC:	Pass

Laboratory Control Sample Assessment	
LCSD (Y or N)?	N
LCSD50318	LCSD50318
Count Date:	10/28/2019
Spike I.D.:	19-026
Decay Corrected Spike Concentration (pCi/mL):	34.911
Volume Used (mL):	0.10
Aliquot Volume (L, g, F):	0.805
Target Conc. (pCi/L, g, F):	4.336
Uncertainty (Calculated):	0.212
Result (pCi/L, g, F):	4.987
LCSD/LCSD 2 Sigma CSU (pCi/L, g, F):	1.141
Numerical Performance Indicator:	1.10
Percent Recovery:	115.02%
Status vs Numerical Indicator:	N/A
Status vs Recovery:	Pass
Upper % Recovery Limits:	135%
Lower % Recovery Limits:	60%

Duplicate Sample Assessment	
Sample I.D.:	30329170001
Duplicate Sample I.D.:	30329170001DUP
Sample Result (pCi/L, g, F):	0.897
Sample Result 2 Sigma CSU (pCi/L, g, F):	0.432
Sample Duplicate Result (pCi/L, g, F):	0.439
Sample Duplicate Result 2 Sigma CSU (pCi/L, g, F):	0.403
Are sample and/or duplicate results below RL?	See Below ##
Duplicate Numerical Performance Indicator:	1.518
Duplicate RPD:	68.52%
Duplicate Status vs Numerical Indicator:	Pass
Duplicate Status vs RPD:	Fail
% RPD Limit:	36%

Evaluation of duplicate precision is not applicable if either the sample or duplicate results are below the MDC.

Comments:

Sample Matrix Spike Control Assessment	
Sample Collection Date:	10/10/2019
Sample I.D.:	30329232001
Sample MS I.D.:	30329232001MS
Sample MSD I.D.:	
MS/MSD Decay Corrected Spike Concentration (pCi/mL):	19-026
Spike Volume Used in MS (mL):	35.122
MS Aliquot (L, g, F):	0.20
MS Target Conc. (pCi/L, g, F):	0.815
MSD Aliquot (L, g, F):	8.619
MSD Target Conc. (pCi/L, g, F):	
MSD Spike Uncertainty (calculated):	0.422
Sample Result:	-0.029
Sample Matrix Spike Result:	0.295
Matrix Spike Result 2 Sigma CSU (pCi/L, g, F):	6.867
Sample Matrix Spike Duplicate Result:	1.431
Sample Matrix Spike Duplicate Result:	
MS Numerical Performance Indicator:	-2.220
MS Percent Recovery:	80.01%
MS Status vs Numerical Indicator:	Warning
MS Status vs Recovery:	Pass
MS/MSD Upper % Recovery Limits:	135%
MS/MSD Lower % Recovery Limits:	60%

Matrix Spike/Matrix Spike Duplicate Sample Assessment	
Sample I.D.:	Sample MS I.D.
Sample MS I.D.:	Sample MSD I.D.
Sample Matrix Spike Result:	Sample Matrix Spike Duplicate Result:
Matrix Spike Result 2 Sigma CSU (pCi/L, g, F):	Sample Matrix Spike Duplicate Result:
Sample Matrix Spike Duplicate Result:	Duplicate Numerical Performance Indicator:
Matrix Spike Duplicate Result 2 Sigma CSU (pCi/L, g, F):	(Based on the Percent Recoveries) MS/MSD Duplicate RPD:
Duplicate Numerical Performance Indicator:	MS/MSD Duplicate Status vs Numerical Indicator:
MS/MSD Duplicate Status vs RPD:	% RPD Limit:

Handwritten signature/initials

Platte River Power Authority – Rawhide DATA REVIEW CHECK

Data Package: 60317751

Sampling Event: October 8, 2019

Data Reviewer: Brian Rothmeyer

Peer Reviewer: Steve Szocik

Date Completed: December 6, 2019

Date Completed: December 19, 2019

This report contains the final results of the data validation conducted for the water samples collected October 8, 2019. The data review was conducted in accordance with the method and laboratory criteria, as applicable. The data review was conducted in accordance with method requirements and laboratory limits using guidance from USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540-R-2017-001 (January 2017).

General Overall Assessment:

- _____ Data are usable without qualification.
☒ Data are usable with qualification (noted below).
 _____ Some or all data are unusable for any purpose (detailed below).

Data Review Checklist

Review Parameter	Criteria	Criteria Met?												
Sample-specific Parameters	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA										
Chain of Custody, Sample Identification, & Sample Receipt	Samples were received intact and the cooler temperature was <6 degree Celsius upon arrival at the laboratory.	X												
Holding Times	The samples were analyzed within the method required holding times.	X												
Method Blanks (MB)	<div>No target analytes reported in the associated MB.</div> <table><tr><th>Analyte</th><th>Concentration</th></tr><tr><td>MB 1774276</td><td></td></tr><tr><td>Radium-226</td><td>0.412 ± 0.353 pCi/L</td></tr><tr><td>MB 1774275</td><td></td></tr><tr><td>Radium-228</td><td>0.377 ± 0.383 pCi/L</td></tr></table> <div>± – Plus or Minus pCi/L – Picocuries Per Liter MB – Method Blank</div>	Analyte	Concentration	MB 1774276		Radium-226	0.412 ± 0.353 pCi/L	MB 1774275		Radium-228	0.377 ± 0.383 pCi/L		X ¹	
Analyte	Concentration													
MB 1774276														
Radium-226	0.412 ± 0.353 pCi/L													
MB 1774275														
Radium-228	0.377 ± 0.383 pCi/L													
Quality Control Samples: Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD)	The LCS/LCSD recoveries were within the laboratory determined acceptance limits.	X												
Matrix Spike / Matrix Spike Duplicate (MS/MSD)	The recoveries and relative percent differences for the matrix spike and matrix spike duplicate analyses were within the laboratory-determined acceptance ranges.			X										
Laboratory Duplicate	<div>The laboratory duplicate samples were within the laboratory determined acceptance limits. The following concentration dependent criteria were used to evaluate laboratory duplicates:</div> <ul style="list-style-type: none">The agreement between parent sample results and the lab duplicate sample results were evaluated. The duplicate error ratios (DER) met the criterion of a DER ≤1.			X										

Review Parameter	Criteria	Criteria Met?																				
Sample-specific Parameters	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA																		
Field Duplicate	<p>The field duplicate sample results satisfied the evaluation criteria below:</p> <table><tr><th>Parent Sample</th><th>Field Duplicate</th></tr><tr><td>ASH-02 (MW-2)</td><td>DUP-2</td></tr></table> <ul style="list-style-type: none">The agreement between parent sample results and the lab duplicate sample results were evaluated. The DER met the criterion of a DER ≤1.	Parent Sample	Field Duplicate	ASH-02 (MW-2)	DUP-2	X																
Parent Sample	Field Duplicate																					
ASH-02 (MW-2)	DUP-2																					
Equipment Blanks	<p>No target analytes reported in the associated equipment blank.</p> <table><tr><th>Analyte</th><th>Concentration</th></tr><tr><td colspan="2">EB-2 (60318035)</td></tr><tr><td>Radium-226</td><td>0.150 ± 0.361 pCi/L</td></tr><tr><td>Radium-228</td><td>0.169 ± 0.653 pCi/L</td></tr><tr><td>Radium, Total</td><td>0.319 ± 1.01 pCi/L</td></tr><tr><td colspan="2">EB-4 (60318083)</td></tr><tr><td>Radium-226</td><td>0.276 ± 0.447 pCi/L</td></tr><tr><td>Radium-228</td><td>1.82 ± 0.614 pCi/L</td></tr><tr><td>Radium, Total</td><td>2.10 ± 1.06 pCi/L</td></tr></table> <p>± – Plus or Minus pCi/L – Picocuries Per Liter</p>	Analyte	Concentration	EB-2 (60318035)		Radium-226	0.150 ± 0.361 pCi/L	Radium-228	0.169 ± 0.653 pCi/L	Radium, Total	0.319 ± 1.01 pCi/L	EB-4 (60318083)		Radium-226	0.276 ± 0.447 pCi/L	Radium-228	1.82 ± 0.614 pCi/L	Radium, Total	2.10 ± 1.06 pCi/L		X ²	
Analyte	Concentration																					
EB-2 (60318035)																						
Radium-226	0.150 ± 0.361 pCi/L																					
Radium-228	0.169 ± 0.653 pCi/L																					
Radium, Total	0.319 ± 1.01 pCi/L																					
EB-4 (60318083)																						
Radium-226	0.276 ± 0.447 pCi/L																					
Radium-228	1.82 ± 0.614 pCi/L																					
Radium, Total	2.10 ± 1.06 pCi/L																					
Reporting Limits Met (Non –Radiochemistry)	No samples performed at dilutions or reported as non-detect at elevated method detection limits/reporting limits.			X																		
Detection Limits Mets (Radiochemistry)	For radiochemical results if the associated uncertainty was greater than the reported result, the 2 sigma (σ) uncertainty multiplied by 1.65 was less than or equal to the specified detection limit.	X																				
Tracer and/or Carrier Recovery	The sample specific recoveries were within the laboratory limits.	X																				
Package Completeness	No results were qualified as unusable and the data are 100% complete.	X																				
Comments																						
<p>1 – The associated radium-226 results for samples ASH-01 (MW-1) and DUP-2 were reported at concentrations <5x the concentration of the blank contamination and were qualified as estimated (J+ bl) to reflect the potential high bias indicated by the blank contamination.</p> <p>The associated radium-228 sample results reported at concentrations <5x the concentration of the blank contamination were qualified as estimated (J+ bl) to reflect the potential high bias indicated by the blank contamination.</p> <p>2 – The associated radium-226, radium-228, and total radium results reported at concentrations <5x the concentration of the blank contamination were qualified as estimated (J+ be) to reflect the potential high bias indicated by the blank contamination.</p>																						

< – Less Than

pCi/L – Picocuries Per Liter

be – Equipment Blank Contamination

J – Estimated

MDC – Minimum Detectable Concentration

 \leq – Less Than or Equal To

% – Percent

bl – Laboratory Blank Contamination

LCS – Laboratory Control Sample

MS/MSD – Matrix Spike/Matrix Spike Duplicate

 σ – Sigma \pm – Plus or Minus/High or Low Bias

DER – Duplicate Error Ration

LCSD – Laboratory Control Sample Duplicate

NA – Not Applicable

October 24, 2019

Vasanta Kalluri
AECOM
6200 South Quebec Street
Greenwood Village, CO 80111

RE: Project: PRPA RAWHIDE CCR
Pace Project No.: 60317754

Dear Vasanta Kalluri:

Enclosed are the analytical results for sample(s) received by the laboratory on October 10, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Heather Wilson
heather.wilson@pacelabs.com
1(913)563-1407
Project Manager

Enclosures

cc: Jeremy Hurshman, AECOM
Jeff Mott, AECOM
Brian Rothmeyer, AECOM



REPORT OF LABORATORY ANALYSIS

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CERTIFICATIONS

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317754

Kansas Certification IDs

9608 Loiret Boulevard, Lenexa, KS 66219

Missouri Inorganic Drinking Water Certification #: 10090

Arkansas Drinking Water

Arkansas Certification #: 19-016-0

Arkansas Drinking Water

Illinois Certification #: 004455

Iowa Certification #: 118

Kansas/NELAP Certification #: E-10116

Louisiana Certification #: 03055

Nevada Certification #: KS000212020-2

Oklahoma Certification #: 9205/9935

Florida: Cert E871149 SEKS WET

Texas Certification #: T104704407-19-12

Utah Certification #: KS000212018-8

Illinois Certification #: 004592

Kansas Field Laboratory Accreditation: # E-92587

Missouri SEKS Micro Certification: 10070

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SAMPLE SUMMARY

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317754

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60317754001	ASH-03	Water	10/09/19 09:15	10/10/19 08:25
60317754002	ASH-08	Water	10/09/19 10:45	10/10/19 08:25
60317754003	ASH-07	Water	10/09/19 12:30	10/10/19 08:25
60317754004	ASH-05	Water	10/09/19 14:15	10/10/19 08:25

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SAMPLE ANALYTE COUNT

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317754

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60317754001	ASH-03	EPA 6010	EMR	3	PASI-K
		EPA 6020	EMR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2540C	LDB	1	PASI-K
		EPA 9056	CNB	3	PASI-K
60317754002	ASH-08	EPA 6010	EMR	3	PASI-K
		EPA 6020	EMR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2540C	LDB	1	PASI-K
		EPA 9056	CNB	3	PASI-K
60317754003	ASH-07	EPA 6010	EMR	3	PASI-K
		EPA 6020	EMR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2540C	LDB	1	PASI-K
		EPA 9056	CNB	3	PASI-K
60317754004	ASH-05	EPA 6010	EMR	3	PASI-K
		EPA 6020	EMR	11	PASI-K
		EPA 7470	HKC	1	PASI-K
		SM 2540C	LDB	1	PASI-K
		EPA 9056	CNB	3	PASI-K

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317754

Sample: ASH-03		Lab ID: 60317754001		Collected: 10/09/19 09:15		Received: 10/10/19 08:25		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	738	ug/L	100	1	10/17/19 15:05	10/21/19 19:47	7440-42-8		
Calcium	415000	ug/L	200	1	10/17/19 15:05	10/21/19 19:47	7440-70-2		
Lithium	373	ug/L	10.0	1	10/17/19 15:05	10/21/19 19:47	7439-93-2		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	2.0	2	10/18/19 13:10	10/24/19 11:30	7440-36-0	D3	
Arsenic	ND	ug/L	2.0	2	10/18/19 13:10	10/24/19 11:30	7440-38-2	D3	
Barium	8.5	ug/L	2.0	2	10/18/19 13:10	10/24/19 11:30	7440-39-3		
Beryllium	ND	ug/L	1.0	2	10/18/19 13:10	10/24/19 11:30	7440-41-7	D3	
Cadmium	ND	ug/L	1.0	2	10/18/19 13:10	10/24/19 11:30	7440-43-9	D3	
Chromium	ND	ug/L	2.0	2	10/18/19 13:10	10/24/19 11:30	7440-47-3	D3	
Cobalt	ND	ug/L	2.0	2	10/18/19 13:10	10/24/19 11:30	7440-48-4	D3	
Lead	ND	ug/L	2.0	2	10/18/19 13:10	10/24/19 11:30	7439-92-1	D3	
Molybdenum	ND	ug/L	2.0	2	10/18/19 13:10	10/24/19 11:30	7439-98-7	D3	
Selenium	102	ug/L	2.0	2	10/18/19 13:10	10/24/19 11:30	7782-49-2		
Thallium	ND	ug/L	2.0	2	10/18/19 13:10	10/24/19 11:30	7440-28-0	D3	
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	10/11/19 13:56	10/14/19 13:20	7439-97-6		
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	5190	mg/L	100	1		10/16/19 19:00			
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	71.5	mg/L	10.0	10		10/18/19 00:56	16887-00-6		
Fluoride	ND	mg/L	0.20	1		10/18/19 00:40	16984-48-8		
Sulfate	3180	mg/L	500	500		10/18/19 01:47	14808-79-8		

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317754

Sample: ASH-08		Lab ID: 60317754002	Collected: 10/09/19 10:45		Received: 10/10/19 08:25		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010						
Boron	891	ug/L	100	1	10/17/19 15:05	10/21/19 19:50	7440-42-8	M1
Calcium	401000	ug/L	200	1	10/17/19 15:05	10/21/19 19:50	7440-70-2	
Lithium	288	ug/L	10.0	1	10/17/19 15:05	10/21/19 19:50	7439-93-2	
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010						
Antimony	ND	ug/L	1.0	1	10/18/19 13:10	10/24/19 11:34	7440-36-0	D3
Arsenic	1.4	ug/L	1.0	1	10/18/19 13:10	10/24/19 11:34	7440-38-2	
Barium	18.6	ug/L	1.0	1	10/18/19 13:10	10/24/19 11:34	7440-39-3	
Beryllium	ND	ug/L	0.50	1	10/18/19 13:10	10/24/19 11:34	7440-41-7	
Cadmium	ND	ug/L	0.50	1	10/18/19 13:10	10/24/19 11:34	7440-43-9	
Chromium	ND	ug/L	1.0	1	10/18/19 13:10	10/24/19 11:34	7440-47-3	
Cobalt	2.4	ug/L	1.0	1	10/18/19 13:10	10/24/19 11:34	7440-48-4	
Lead	ND	ug/L	2.0	2	10/18/19 13:10	10/24/19 11:39	7439-92-1	
Molybdenum	2.5	ug/L	1.0	1	10/18/19 13:10	10/24/19 11:34	7439-98-7	
Selenium	ND	ug/L	1.0	1	10/18/19 13:10	10/24/19 11:34	7782-49-2	
Thallium	ND	ug/L	2.0	2	10/18/19 13:10	10/24/19 11:39	7440-28-0	D3
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470						
Mercury	ND	ug/L	0.20	1	10/11/19 13:56	10/14/19 13:22	7439-97-6	
2540C Total Dissolved Solids		Analytical Method: SM 2540C						
Total Dissolved Solids	4710	mg/L	66.7	1		10/16/19 19:00		D6
9056 IC Anions		Analytical Method: EPA 9056						
Chloride	17.8	mg/L	1.0	1		10/18/19 02:04	16887-00-6	
Fluoride	ND	mg/L	0.20	1		10/18/19 02:04	16984-48-8	
Sulfate	2710	mg/L	200	200		10/18/19 03:11	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317754

Sample: ASH-07		Lab ID: 60317754003	Collected: 10/09/19 12:30	Received: 10/10/19 08:25	Matrix: Water			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010						
Boron	732	ug/L	100	1	10/17/19 15:05	10/21/19 19:58	7440-42-8	
Calcium	426000	ug/L	200	1	10/17/19 15:05	10/21/19 19:58	7440-70-2	
Lithium	542	ug/L	10.0	1	10/17/19 15:05	10/21/19 19:58	7439-93-2	
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010						
Antimony	ND	ug/L	2.0	2	10/18/19 13:10	10/24/19 12:03	7440-36-0	D3
Arsenic	ND	ug/L	2.0	2	10/18/19 13:10	10/24/19 12:03	7440-38-2	D3
Barium	13.0	ug/L	2.0	2	10/18/19 13:10	10/24/19 12:03	7440-39-3	
Beryllium	ND	ug/L	1.0	2	10/18/19 13:10	10/24/19 12:03	7440-41-7	D3
Cadmium	ND	ug/L	1.0	2	10/18/19 13:10	10/24/19 12:03	7440-43-9	D3
Chromium	ND	ug/L	2.0	2	10/18/19 13:10	10/24/19 12:03	7440-47-3	D3
Cobalt	ND	ug/L	2.0	2	10/18/19 13:10	10/24/19 12:03	7440-48-4	D3
Lead	ND	ug/L	2.0	2	10/18/19 13:10	10/24/19 12:03	7439-92-1	D3
Molybdenum	ND	ug/L	2.0	2	10/18/19 13:10	10/24/19 12:03	7439-98-7	D3
Selenium	122	ug/L	2.0	2	10/18/19 13:10	10/24/19 12:03	7782-49-2	
Thallium	ND	ug/L	2.0	2	10/18/19 13:10	10/24/19 12:03	7440-28-0	D3
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470						
Mercury	ND	ug/L	0.20	1	10/11/19 13:56	10/14/19 13:24	7439-97-6	
2540C Total Dissolved Solids		Analytical Method: SM 2540C						
Total Dissolved Solids	4410	mg/L	66.7	1		10/16/19 19:00		
9056 IC Anions		Analytical Method: EPA 9056						
Chloride	113	mg/L	10.0	10		10/18/19 04:02	16887-00-6	
Fluoride	ND	mg/L	0.20	1		10/18/19 03:45	16984-48-8	
Sulfate	3970	mg/L	500	500		10/18/19 04:19	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317754

Sample: ASH-05		Lab ID: 60317754004		Collected: 10/09/19 14:15		Received: 10/10/19 08:25		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
6010 MET ICP		Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Boron	718	ug/L	100	1	10/17/19 15:05	10/21/19 20:05	7440-42-8		
Calcium	466000	ug/L	200	1	10/17/19 15:05	10/21/19 20:05	7440-70-2		
Lithium	279	ug/L	10.0	1	10/17/19 15:05	10/21/19 20:05	7439-93-2		
6020 MET ICPMS		Analytical Method: EPA 6020 Preparation Method: EPA 3010							
Antimony	ND	ug/L	1.0	1	10/18/19 13:10	10/24/19 12:19	7440-36-0		
Arsenic	ND	ug/L	1.0	1	10/18/19 13:10	10/24/19 12:19	7440-38-2		
Barium	15.1	ug/L	1.0	1	10/18/19 13:10	10/24/19 12:19	7440-39-3		
Beryllium	ND	ug/L	0.50	1	10/18/19 13:10	10/24/19 12:19	7440-41-7		
Cadmium	ND	ug/L	0.50	1	10/18/19 13:10	10/24/19 12:19	7440-43-9		
Chromium	ND	ug/L	1.0	1	10/18/19 13:10	10/24/19 12:19	7440-47-3		
Cobalt	ND	ug/L	1.0	1	10/18/19 13:10	10/24/19 12:19	7440-48-4		
Lead	ND	ug/L	2.0	2	10/18/19 13:10	10/24/19 12:24	7439-92-1	D3	
Molybdenum	ND	ug/L	1.0	1	10/18/19 13:10	10/24/19 12:19	7439-98-7		
Selenium	78.4	ug/L	1.0	1	10/18/19 13:10	10/24/19 12:19	7782-49-2		
Thallium	ND	ug/L	2.0	2	10/18/19 13:10	10/24/19 12:24	7440-28-0	D3	
7470 Mercury		Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	0.20	1	10/11/19 13:56	10/14/19 13:26	7439-97-6		
2540C Total Dissolved Solids		Analytical Method: SM 2540C							
Total Dissolved Solids	6390	mg/L	100	1		10/16/19 19:01			
9056 IC Anions		Analytical Method: EPA 9056							
Chloride	199	mg/L	20.0	20		10/18/19 05:26	16887-00-6		
Fluoride	ND	mg/L	0.20	1		10/18/19 05:09	16984-48-8		
Sulfate	2710	mg/L	200	200		10/18/19 05:43	14808-79-8		

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317754

QC Batch: 615191

Analysis Method: EPA 7470

QC Batch Method: EPA 7470

Analysis Description: 7470 Mercury

Associated Lab Samples: 60317754001, 60317754002, 60317754003, 60317754004

METHOD BLANK: 2511586

Matrix: Water

Associated Lab Samples: 60317754001, 60317754002, 60317754003, 60317754004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	10/14/19 12:31	

LABORATORY CONTROL SAMPLE: 2511587

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	5	5.0	99	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2511588 2511589

Parameter	Units	60317754002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	5	5	5.0	5.0	100	99	75-125	1	20	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE CCR
Pace Project No.: 60317754

QC Batch: 616515 Analysis Method: EPA 6010
QC Batch Method: EPA 3010 Analysis Description: 6010 MET
Associated Lab Samples: 60317754001, 60317754002, 60317754003, 60317754004

METHOD BLANK: 2516618 Matrix: Water
Associated Lab Samples: 60317754001, 60317754002, 60317754003, 60317754004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	ug/L	ND	100	10/21/19 19:44	
Calcium	ug/L	ND	200	10/21/19 19:44	
Lithium	ug/L	ND	10.0	10/21/19 19:44	

LABORATORY CONTROL SAMPLE: 2516619

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	1000	953	95	80-120	
Calcium	ug/L	10000	10000	100	80-120	
Lithium	ug/L	1000	1040	104	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2516620 2516621

Parameter	Units	60317754002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	891	1000	1000	1870	1800	98	91	75-125	4	20	
Calcium	ug/L	401000	10000	10000	429000	409000	279	84	75-125	5	20	M1
Lithium	ug/L	288	1000	1000	1270	1240	98	95	75-125	2	20	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2516622 2516623

Parameter	Units	60317960001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	314	1000	1000	1270	1280	95	96	75-125	1	20	
Calcium	ug/L	134000	10000	10000	143000	148000	95	140	75-125	3	20	M1
Lithium	ug/L	87.9	1000	1000	1070	1070	98	98	75-125	0	20	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE CCR
Pace Project No.: 60317754

QC Batch: 616751 Analysis Method: EPA 6020
QC Batch Method: EPA 3010 Analysis Description: 6020 MET
Associated Lab Samples: 60317754001, 60317754002, 60317754003, 60317754004

METHOD BLANK: 2517512 Matrix: Water
Associated Lab Samples: 60317754001, 60317754002, 60317754003, 60317754004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	1.0	10/24/19 11:23	
Arsenic	ug/L	ND	1.0	10/24/19 11:23	
Barium	ug/L	ND	1.0	10/24/19 11:23	
Beryllium	ug/L	ND	0.50	10/24/19 11:23	
Cadmium	ug/L	ND	0.50	10/24/19 11:23	
Chromium	ug/L	ND	1.0	10/24/19 11:23	
Cobalt	ug/L	ND	1.0	10/24/19 11:23	
Lead	ug/L	ND	1.0	10/24/19 11:23	
Molybdenum	ug/L	ND	1.0	10/24/19 11:23	
Selenium	ug/L	ND	1.0	10/24/19 11:23	
Thallium	ug/L	ND	1.0	10/24/19 11:23	

LABORATORY CONTROL SAMPLE: 2517513

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	40	39.2	98	80-120	
Arsenic	ug/L	40	38.9	97	80-120	
Barium	ug/L	40	39.2	98	80-120	
Beryllium	ug/L	40	40.8	102	80-120	
Cadmium	ug/L	40	40.4	101	80-120	
Chromium	ug/L	40	38.2	95	80-120	
Cobalt	ug/L	40	36.5	91	80-120	
Lead	ug/L	40	41.3	103	80-120	
Molybdenum	ug/L	40	39.4	99	80-120	
Selenium	ug/L	40	39.9	100	80-120	
Thallium	ug/L	40	38.4	96	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2517514 2517515

Parameter	Units	60317754002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	ND	40	40	34.5	34.4	86	86	75-125	0	20	
Arsenic	ug/L	1.4	40	40	42.3	42.5	102	103	75-125	0	20	
Barium	ug/L	18.6	40	40	56.5	56.4	95	95	75-125	0	20	
Beryllium	ug/L	ND	40	40	35.0	34.9	87	87	75-125	0	20	
Cadmium	ug/L	ND	40	40	33.0	33.1	82	83	75-125	0	20	
Chromium	ug/L	ND	40	40	43.0	43.1	106	107	75-125	0	20	
Cobalt	ug/L	2.4	40	40	43.4	43.6	103	103	75-125	0	20	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317754

QC Batch:	616099	Analysis Method:	SM 2540C
QC Batch Method:	SM 2540C	Analysis Description:	2540C Total Dissolved Solids
Associated Lab Samples: 60317754001, 60317754002, 60317754003, 60317754004			

METHOD BLANK:	2514929	Matrix:	Water
Associated Lab Samples: 60317754001, 60317754002, 60317754003, 60317754004			

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	5.0	10/16/19 18:57	

LABORATORY CONTROL SAMPLE: 2514930

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	1030	103	80-120	

SAMPLE DUPLICATE: 2514931

Parameter	Units	60317754002 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	4710	3810	21	10	D6

SAMPLE DUPLICATE: 2514932

Parameter	Units	60317766001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	1170	1160	1	10	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: PRPA RAWHIDE CCR
Pace Project No.: 60317754

QC Batch: 616590 Analysis Method: EPA 9056
QC Batch Method: EPA 9056 Analysis Description: 9056 IC Anions
Associated Lab Samples: 60317754001, 60317754002, 60317754003, 60317754004

METHOD BLANK: 2516805 Matrix: Water
Associated Lab Samples: 60317754001, 60317754002, 60317754003, 60317754004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	10/17/19 15:39	
Fluoride	mg/L	ND	0.20	10/17/19 15:39	
Sulfate	mg/L	ND	1.0	10/17/19 15:39	

LABORATORY CONTROL SAMPLE: 2516806

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.6	91	80-120	
Fluoride	mg/L	2.5	2.4	95	80-120	
Sulfate	mg/L	5	4.7	95	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2516807 2516808

Parameter	Units	60317630001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	21.5	50	50	68.1	67.6	93	92	80-120	1	15	
Fluoride	mg/L	0.21	2.5	2.5	2.6	2.7	97	99	80-120	2	15	
Sulfate	mg/L	35.7	50	50	85.5	84.7	100	98	80-120	1	15	

MATRIX SPIKE SAMPLE: 2516810

Parameter	Units	60317754002 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	17.8	10	27.5	97	80-120	
Fluoride	mg/L	ND	2.5	2.4	94	80-120	
Sulfate	mg/L	2710	1000	3680	96	80-120	

SAMPLE DUPLICATE: 2516809

Parameter	Units	60317630002 Result	Dup Result	RPD	Max RPD	Qualifiers
Chloride	mg/L	22.8	22.0	4	15	
Fluoride	mg/L	0.19J	.17J		15	
Sulfate	mg/L	47.7	47.4	1	15	

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REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317754

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K Pace Analytical Services - Kansas City

ANALYTE QUALIFIERS

D3 Sample was diluted due to the presence of high levels of non-target analytes or other matrix interference.

D6 The precision between the sample and sample duplicate exceeded laboratory control limits.

M1 Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: PRPA RAWHIDE CCR

Pace Project No.: 60317754

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60317754001	ASH-03	EPA 3010	616515	EPA 6010	616579
60317754002	ASH-08	EPA 3010	616515	EPA 6010	616579
60317754003	ASH-07	EPA 3010	616515	EPA 6010	616579
60317754004	ASH-05	EPA 3010	616515	EPA 6010	616579
60317754001	ASH-03	EPA 3010	616751	EPA 6020	616926
60317754002	ASH-08	EPA 3010	616751	EPA 6020	616926
60317754003	ASH-07	EPA 3010	616751	EPA 6020	616926
60317754004	ASH-05	EPA 3010	616751	EPA 6020	616926
60317754001	ASH-03	EPA 7470	615191	EPA 7470	615493
60317754002	ASH-08	EPA 7470	615191	EPA 7470	615493
60317754003	ASH-07	EPA 7470	615191	EPA 7470	615493
60317754004	ASH-05	EPA 7470	615191	EPA 7470	615493
60317754001	ASH-03	SM 2540C	616099		
60317754002	ASH-08	SM 2540C	616099		
60317754003	ASH-07	SM 2540C	616099		
60317754004	ASH-05	SM 2540C	616099		
60317754001	ASH-03	EPA 9056	616590		
60317754002	ASH-08	EPA 9056	616590		
60317754003	ASH-07	EPA 9056	616590		
60317754004	ASH-05	EPA 9056	616590		

REPORT OF LABORATORY ANALYSIS

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Sample Condition Upon Receipt

WO#: 60317754Client Name: AECOMCourier: FedEx ☒ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☐ Client ☐ Other ☐Tracking #: 121929788697 Pace Shipping Label Used? Yes ☐ No ☒Custody Seal on Cooler/Box Present: Yes ☒ No ☐ Seals intact: Yes ☒ No ☐Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☐ Other ☒ ZiplocThermometer Used: 7301 Type of Ice: Wet Blue ☐ None ☐Cooler Temperature (°C): As-read 3.0 Corr. Factor 40.0 Corrected 3.0Date and initials of person examining contents: 10-10-19

Temperature should be above freezing to 6°C

Chain of Custody present:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Chain of Custody relinquished:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Samples arrived within holding time:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Short Hold Time analyses (<72hr):	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	
Rush Turn Around Time requested:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	
Sufficient volume:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Correct containers used:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Pace containers used:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Containers intact:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Filtered volume received for dissolved tests?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Sample labels match COC: Date / time / ID / analyses	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Samples contain multiple phases? Matrix: <u>WT</u>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	
Containers requiring pH preservation in compliance? (HNO ₃ , H ₂ SO ₄ , HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added.
Cyanide water sample checks:		
Lead acetate strip turns dark? (Record only)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Potassium iodide test strip turns blue/purple? (Preserve)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Trip Blank present:	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Headspace in VOA vials (>6mm):	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Samples from USDA Regulated Area: State:	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	

Client Notification/ Resolution:

Copy COC to Client? Y / N

Field Data Required? Y / N

Person Contacted: _____ Date/Time: _____

Comments/ Resolution: _____

Project Manager Review: _____ Date: _____

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately

Page: 1 of 1 Pa

SAMPLER NAME AND SIGNATURE			
PRINT Name of SAMPLER:	Mrs Weichert		
SIGNATURE of SAMPLER:	Mrs Weichert	DATE Signed (MM/DD/YY):	10/09/19
Temp in °C		Received on Ice (Y/N)	
Custody Sealed Cooler (Y/N)			
Samples Intact (Y/N)			

Platte River Power Authority – Rawhide DATA REVIEW CHECK

Data Package: 60317754

Sampling Event: October 9, 2019

Data Reviewer: Brian Rothmeyer

Peer Reviewer: Steve Szocik

Date Completed: December 6, 2019

Date Completed: December 19, 2019

This report contains the final results of the data validation conducted for the water samples collected October 9, 2019. The data review was conducted in accordance with the method and laboratory criteria, as applicable. The data review was conducted in accordance with method requirements and laboratory limits using guidance from USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540-R-2017-001 (January 2017).

General Overall Assessment:

- _____ Data are usable without qualification.
- X Data are usable with qualification (noted below).
- _____ Some or all data are unusable for any purpose (detailed below).

Data Review Checklist

Review Parameter	Criteria	Criteria Met?		
		Yes	No	NA
<i>Sample-specific Parameters</i>	For each "No" response, list qualified data and bias direction in Table 1 or explain no qualification in comments.			
Chain of Custody, Sample Identification, & Sample Receipt	Samples were received intact and the cooler temperature was <6 degree Celsius upon arrival at the laboratory.	X		
Holding Times	The samples were analyzed within the method required holding times.	X		
Method Blanks (MB)	No target analytes reported in the associated MB.	X		
Quality Control Samples: Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD)	The LCS/LCSD recoveries were within the laboratory determined acceptance limits.	X		
Matrix Spike / Matrix Spike Duplicate (MS/MSD)	The recoveries and relative percent differences for the matrix spike and matrix spike duplicate analyses were within the laboratory-determined acceptance ranges. Results in the native sample greater than four times the concentration of the spike added during digestions/extractions are not considered to be a representative measure of accuracy. Further action with respect to spike recovery evaluation or qualification of data was not considered necessary.	X		
Laboratory Duplicate	The laboratory duplicate samples were within the laboratory determined acceptance limits. The following concentration dependent criteria were used to evaluate laboratory duplicates: <ul style="list-style-type: none"> When both the sample and duplicate values are >5x the reporting limit (RL), acceptable sampling and analytical precision is indicated by an relative percent difference (RPD) between the results of ≤20%. Where the result for one or both analytes of the method duplicate pair is <5xRL, satisfactory precision is indicated if 		X ¹	

Review Parameter	Criteria	Criteria Met?												
Sample-specific Parameters	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA										
	the absolute difference between the method duplicate results is <1xRL.													
Field Duplicate	The field duplicate sample results satisfied the evaluation criteria below: <ul style="list-style-type: none">When both the sample and duplicate values are >5xRL acceptable sampling and analytical precision is indicated by a relative percent difference (RPD) between the results of ≤30%.Where the result for one or both analytes of the field duplicate pair is <5xRL, satisfactory precision is indicated if the absolute difference between the field duplicate results is <2xRL.			X										
Equipment Blanks	No target analytes reported in the associated equipment blank. <table><tr><th>Analyte</th><th>Concentration</th></tr><tr><td>EB-2 (60318035)</td><td></td></tr><tr><td>Lead</td><td>3.3 µg/L</td></tr><tr><td>EB-4 (60318083)</td><td></td></tr><tr><td>TDS</td><td>6.0 mg/L</td></tr></table> <p>µg/L – Microgram per Liter mg/L – Milligrams per Liter TDS – Total Dissolved Solids</p>	Analyte	Concentration	EB-2 (60318035)		Lead	3.3 µg/L	EB-4 (60318083)		TDS	6.0 mg/L		X ²	
Analyte	Concentration													
EB-2 (60318035)														
Lead	3.3 µg/L													
EB-4 (60318083)														
TDS	6.0 mg/L													
Reporting Limits Met (Non –Radiochemistry)	No samples performed at dilutions or reported as non-detect at elevated method detection limits/reporting limits.		X ³											
Detection Limits Mets (Radiochemistry)	For radiochemical results if the associated uncertainty was greater than the reported result, the 2 sigma (σ) uncertainty multiplied by 1.65 was less than or equal to the specified detection limit.			X										
Tracer and/or Carrier Recovery	The sample specific recoveries were within the laboratory limits.			X										
Package Completeness	No results were qualified as unusable and the data are 100% complete.	X												
Comments														
1 – As the laboratory duplicate was outside the criterion listed above, the associated TDS result for sample ASH-08 was qualified as estimated (J ld).														
2 – The associated lead and total dissolved solids (TDS) sample results were reported as non-detect or at concentrations >5x the concentration of the blank contamination and qualification was not considered necessary.														
3 – Several analytes were reported as non-detect at elevated reporting limits. These non-detect results will need to be evaluated by the end user of the data with respect to project objectives.														

> – Greater Than
µg/L – Microgram per Liter
% – Percent

LCS – Laboratory Control Sample
MS/MSD – Matrix Spike/Matrix Spike Duplicate
RPD – Relative Percent Difference

< – Less Than
mg/L – Milligrams per Liter
± – Plus or Minus/ High or Low Bias

LCSd – Laboratory Control Sample Duplicate
NA – Not Applicable
TDS – Total Dissolved Solids

≤ – Less Than or Equal To
σ – Sigma
J – Estimated
ld – Laboratory Duplicate RPD
RL – Reporting Limit

December 18, 2019

Vasanta Kalluri
AECOM
6200 South Quebec Street
Greenwood Village, CO 80111

RE: Project: PRPA Rawhide CCR-Revised Report
Pace Project No.: 60317817

Dear Vasanta Kalluri:

Enclosed are the analytical results for sample(s) received by the laboratory on October 10, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

Revised Report_rev.1 Added QC sheets to report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Heather Wilson
heather.wilson@pacelabs.com
1(913)563-1407
Project Manager

Enclosures

cc: Jeremy Hurshman, AECOM
Jeff Mott, AECOM
Brian Rothmeyer, AECOM



REPORT OF LABORATORY ANALYSIS

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CERTIFICATIONS

Project: PRPA Rawhide CCR-Revised Report

Pace Project No.: 60317817

Pace Analytical Services Pennsylvania

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601

ANAB DOD-ELAP Rad Accreditation #: L2417

Alabama Certification #: 41590

Arizona Certification #: AZ0734

Arkansas Certification

California Certification #: 04222CA

Colorado Certification #: PA01547

Connecticut Certification #: PH-0694

Delaware Certification

EPA Region 4 DW Rad

Florida/TNI Certification #: E87683

Georgia Certification #: C040

Florida: Cert E871149 SEKS WET

Guam Certification

Hawaii Certification

Idaho Certification

Illinois Certification

Indiana Certification

Iowa Certification #: 391

Kansas/TNI Certification #: E-10358

Kentucky Certification #: KY90133

KY WW Permit #: KY0098221

KY WW Permit #: KY0000221

Louisiana DHH/TNI Certification #: LA180012

Louisiana DEQ/TNI Certification #: 4086

Maine Certification #: 2017020

Maryland Certification #: 308

Massachusetts Certification #: M-PA1457

Michigan/PADEP Certification #: 9991

Missouri Certification #: 235

Montana Certification #: Cert0082

Nebraska Certification #: NE-OS-29-14

Nevada Certification #: PA014572018-1

New Hampshire/TNI Certification #: 297617

New Jersey/TNI Certification #: PA051

New Mexico Certification #: PA01457

New York/TNI Certification #: 10888

North Carolina Certification #: 42706

North Dakota Certification #: R-190

Ohio EPA Rad Approval: #41249

Oregon/TNI Certification #: PA200002-010

Pennsylvania/TNI Certification #: 65-00282

Puerto Rico Certification #: PA01457

Rhode Island Certification #: 65-00282

South Dakota Certification

Tennessee Certification #: 02867

Texas/TNI Certification #: T104704188-17-3

Utah/TNI Certification #: PA014572017-9

USDA Soil Permit #: P330-17-00091

Vermont Dept. of Health: ID# VT-0282

Virgin Island/PADEP Certification

Virginia/VELAP Certification #: 9526

Washington Certification #: C868

West Virginia DEP Certification #: 143

West Virginia DHHR Certification #: 9964C

Wisconsin Approve List for Rad

Wyoming Certification #: 8TMS-L

REPORT OF LABORATORY ANALYSIS

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SAMPLE SUMMARY

Project: PRPA Rawhide CCR-Revised Report

Pace Project No.: 60317817

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60317817001	ASH-03	Water	10/09/19 09:15	10/10/19 09:20
60317817002	ASH-08	Water	10/09/19 10:45	10/10/19 09:20
60317817003	ASH-07	Water	10/09/19 12:30	10/10/19 09:20
60317817004	ASH-05	Water	10/09/19 14:15	10/10/19 09:20
60317817005	ASH-08 MS	Water	10/09/19 10:45	10/10/19 09:20

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: PRPA Rawhide CCR-Revised Report

Pace Project No.: 60317817

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60317817001	ASH-03	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60317817002	ASH-08	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60317817003	ASH-07	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60317817004	ASH-05	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
60317817005	ASH-08 MS	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide CCR-Revised Report

Pace Project No.: 60317817

Sample: ASH-03		Lab ID: 60317817001	Collected: 10/09/19 09:15	Received: 10/10/19 09:20	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.460 ± 0.394 (0.534) C:NA T:91%	pCi/L	10/30/19 12:23	13982-63-3	
Radium-228	EPA 904.0	0.519 ± 0.529 (1.11) C:77% T:85%	pCi/L	10/29/19 14:28	15262-20-1	
Total Radium	Total Radium Calculation	0.979 ± 0.923 (1.64)	pCi/L	11/01/19 10:40	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide CCR-Revised Report

Pace Project No.: 60317817

Sample: ASH-08		Lab ID: 60317817002	Collected: 10/09/19 10:45	Received: 10/10/19 09:20	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.150 ± 0.379 (0.703) C:NA T:102%	pCi/L	10/30/19 12:23	13982-63-3	
Radium-228	EPA 904.0	0.976 ± 0.530 (0.963) C:76% T:86%	pCi/L	10/29/19 14:28	15262-20-1	
Total Radium	Total Radium Calculation	1.13 ± 0.909 (1.67)	pCi/L	11/01/19 10:40	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide CCR-Revised Report

Pace Project No.: 60317817

Sample: ASH-07		Lab ID: 60317817003	Collected: 10/09/19 12:30	Received: 10/10/19 09:20	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.292 ± 0.304 (0.452) C:NA T:102%	pCi/L	10/30/19 12:23	13982-63-3	
Radium-228	EPA 904.0	-0.0622 ± 0.369 (0.869) C:80% T:86%	pCi/L	10/29/19 14:28	15262-20-1	
Total Radium	Total Radium Calculation	0.292 ± 0.673 (1.32)	pCi/L	11/01/19 10:40	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide CCR-Revised Report

Pace Project No.: 60317817

Sample: ASH-05 **Lab ID: 60317817004** Collected: 10/09/19 14:15 Received: 10/10/19 09:20 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	0.100 ± 0.368 (0.707) C:NA T:98%	pCi/L	10/30/19 12:23	13982-63-3	
Radium-228	EPA 904.0	0.155 ± 0.361 (0.802) C:77% T:93%	pCi/L	10/29/19 14:28	15262-20-1	
Total Radium	Total Radium Calculation	0.255 ± 0.729 (1.51)	pCi/L	11/01/19 10:40	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: PRPA Rawhide CCR-Revised Report

Pace Project No.: 60317817

Sample: ASH-08 MS		Lab ID: 60317817005	Collected: 10/09/19 10:45	Received: 10/10/19 09:20	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	-0.114 ± 0.418 (0.905) C:NA T:86%	pCi/L	10/30/19 12:23	13982-63-3	
Radium-228	EPA 904.0	0.424 ± 0.416 (0.857) C:73% T:88%	pCi/L	10/29/19 14:28	15262-20-1	

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL - RADIOCHEMISTRY

Project: PRPA Rawhide CCR-Revised Report

Pace Project No.: 60317817

QC Batch:	366483	Analysis Method:	EPA 904.0
QC Batch Method:	EPA 904.0	Analysis Description:	904.0 Radium 228
Associated Lab Samples:	60317817001, 60317817002, 60317817003, 60317817004, 60317817005		

METHOD BLANK:	1777689	Matrix:	Water
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Associated Lab Samples: 60317817001, 60317817002, 60317817003, 60317817004, 60317817005

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.114 ± 0.363 (0.818) C:76% T:83%	pCi/L	10/29/19 14:29	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALITY CONTROL - RADIOCHEMISTRY

Project: PRPA Rawhide CCR-Revised Report

Pace Project No.: 60317817

QC Batch:	366481	Analysis Method:	EPA 903.1
QC Batch Method:	EPA 903.1	Analysis Description:	903.1 Radium-226
Associated Lab Samples:	60317817001, 60317817002, 60317817003, 60317817004, 60317817005		

METHOD BLANK:	1777686	Matrix:	Water
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Associated Lab Samples: 60317817001, 60317817002, 60317817003, 60317817004, 60317817005

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.0383 ± 0.225 (0.460) C:NA T:97%	pCi/L	10/30/19 12:23	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: PRPA Rawhide CCR-Revised Report

Pace Project No.: 60317817

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval).

Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-PA Pace Analytical Services - Greensburg

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: PRPA Rawhide CCR-Revised Report

Pace Project No.: 60317817

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60317817001	ASH-03	EPA 903.1	366481		
60317817002	ASH-08	EPA 903.1	366481		
60317817003	ASH-07	EPA 903.1	366481		
60317817004	ASH-05	EPA 903.1	366481		
60317817005	ASH-08 MS	EPA 903.1	366481		
60317817001	ASH-03	EPA 904.0	366483		
60317817002	ASH-08	EPA 904.0	366483		
60317817003	ASH-07	EPA 904.0	366483		
60317817004	ASH-05	EPA 904.0	366483		
60317817005	ASH-08 MS	EPA 904.0	366483		
60317817001	ASH-03	Total Radium Calculation	368952		
60317817002	ASH-08	Total Radium Calculation	368952		
60317817003	ASH-07	Total Radium Calculation	368952		
60317817004	ASH-05	Total Radium Calculation	368952		

REPORT OF LABORATORY ANALYSIS

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Page: 1 of 1Requested Analysis Filtered (Y/N)

SAMPLE CONDITIONS

SAMPLER NAME AND SIGNATURE

Pittsburgh Lab Sample Condition Upon Receipt



Client Name: Pace KS Project # _____

Courier: ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace Other _____

Tracking #: 1219 2978 7819

Label _____
LIMS Login _____

Custody Seal on Cooler/Box Present: ☐ yes ☒ no Seals intact: ☐ yes ☐ no

Thermometer Used 9 Type of Ice: Wet Blue None

Cooler Temperature Observed Temp 1.7 °C Correction Factor: 0 °C Final Temp: 1.7 °C

Temp should be above freezing to 6°C

Comments:	Yes	No	N/A	pH paper Lot# <u>10D3581</u>	Date and Initials of person examining contents: <u>DIC 10-10-19</u>
Chain of Custody Present:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Chain of Custody Filled Out:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Chain of Custody Relinquished:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Sampler Name & Signature on COC:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Sample Labels match COC:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
-Includes date/time/ID Matrix: <u>6.5</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Samples Arrived within Hold Time:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Short Hold Time Analysis (<72hr remaining):	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Rush Turn Around Time Requested:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Sufficient Volume:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Correct Containers Used:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
-Pace Containers Used:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Containers Intact:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Orthophosphate field filtered	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Hex Cr Aqueous sample field filtered	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Organic Samples checked for dechlorination:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Filtered volume received for Dissolved tests	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
All containers have been checked for preservation.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
exceptions: VOA, coliform, TOC, O&G, Phenolics, Radon, Non-aqueous matrix	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
All containers meet method preservation requirements.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Initial when completed <u>DIC</u>	Date/time of preservation
				Lot # of added preservative	
Headspace in VOA Vials (>6mm):	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Trip Blank Present:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Trip Blank Custody Seals Present	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Rad Samples Screened < 0.5 mrem/hr	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Initial when completed <u>DIC</u>	Date: <u>10-10-19</u>

Client Notification/ Resolution:

Person Contacted: _____ Date/Time: _____ Contacted By: _____

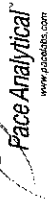
Comments/ Resolution: _____

☐ A check in this box indicates that additional information has been stored in ereports.

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

*PM review is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

Quality Control Sample Performance Assessment



Analyst Must Manually Enter All Fields Highlighted in Yellow.

Test: Ra-226
Analyst: MK1
Date: 10/30/2019
Batch ID: 50408
Matrix: DW

Method Blank Assessment

MB Sample ID: 1777686
MB Concentration: 0.038
MB Counting Uncertainty: 0.225
MB MDC: 0.460
MB Numerical Performance Indicator: 0.33
MB Status vs. Numerical Indicator: N/A
MB Status vs. MDC: Pass

Laboratory Control Sample Assessment

LCSD (Y or N)?	Y
LCSD50408	10/30/2019
Count Date:	10/30/2019
Spike I.D.:	19-022
Spike Concentration (pCi/mL):	32.117
Volume Used (mL):	0.10
Aliquot Volume (L, g, F):	0.653
Target Conc. (pCi/L, g, F):	4.920
Uncertainty (Calculated):	0.231
Result (pCi/L, g, F):	3.734
LCSD Counting Uncertainty (pCi/L, g, F):	0.783
Numerical Performance Indicator:	-2.85
Percent Recovery:	75.89%
Status vs. Numerical Indicator:	N/A
Status vs. Recovery:	Pass
Upper % Recovery Limits:	135%
Lower % Recovery Limits:	73%

Duplicate Sample Assessment

Sample I.D.:
Duplicate Sample I.D.:
Sample Result (pCi/L, g, F):
Sample Result Counting Uncertainty (pCi/L, g, F):
Sample Duplicate Result (pCi/L, g, F):
Sample Duplicate Result Counting Uncertainty (pCi/L, g, F):
Are sample and/or duplicate results below RL?
Duplicate Numerical Performance Indicator:
(Based on the LCSD/LCSD Percent Recoveries) Duplicate RPD:
Duplicate Status vs. Numerical Indicator:
Duplicate Status vs. RPD:
% RPD Limit:

LCSD50408
LCSD50408
3.734
0.783
4.001
0.838
NO
-0.457
6.69%
N/A
Pass
32%

Evaluation of duplicate precision is not applicable if either the sample or duplicate results are below the RL.

Comments:

Sample Matrix Spike Control Assessment

Sample Collection Date:
Sample I.D.:
Sample MS I.D.:
Sample MSD I.D.:

MS/MSD Decay Corrected Spike Concentration (pCi/mL):
Spike Volume Used in MS (mL):
Spike Volume Used in MSD (mL):
MS Aliquot (L, g, F):
MS Target Conc. (pCi/L, g, F):
MSD Aliquot (L, g, F):
MSD Target Conc. (pCi/L, g, F):
MS Spike Uncertainty (calculated):
MSD Spike Uncertainty (calculated):

MS/MSD 1
10/10/2019
70108023001
70108023001MS

19-022
32.117
0.10
0.503
6.388
0.300

Sample Result:
Sample Result Counting Uncertainty (pCi/L, g, F):
Sample Matrix Spike Result:
Sample Matrix Spike Duplicate Result:
Sample Matrix Spike Duplicate Counting Uncertainty (pCi/L, g, F):
MS Numerical Performance Indicator:
MSD Numerical Performance Indicator:

0.254
0.263
7.744
1.459
1.429
117.26%

MS Status vs. Numerical Indicator:
MS Status vs. Recovery:
MS/MSD Upper % Recovery Limits:
MS/MSD Lower % Recovery Limits:

N/A
Pass
136%
71%

Matrix Spike/Matrix Spike Duplicate Sample Assessment

Sample I.D.:
Sample MS I.D.:
Sample MSD I.D.:
Sample Matrix Spike Result:
Sample Matrix Spike Duplicate Result:
Sample Matrix Spike Duplicate Counting Uncertainty (pCi/L, g, F):
Duplicate Numerical Performance Indicator:
(Based on the Percent Recoveries) MS/MSD Duplicate RPD:
MS/MSD Duplicate Status vs. Numerical Indicator:
MS/MSD Duplicate Status vs. RPD:
% RPD Limit:

10/30/2019

10-30-19

Quality Control Sample Performance Assessment



Analyst Must Manually Enter All Fields Highlighted in Yellow.

Test: Ra-228
Analyst: VAL
Date: 10/23/2019
Worklist: 50409
Matrix: WT

Method Blank Assessment	
MB Sample ID	1777689
MB concentration:	0.114
MB 2 Sigma CSU:	0.363
MB MDC:	0.818
MB Numerical Performance Indicator:	0.62
MB Status vs Numerical Indicator:	Pass
MB Status vs. MDC:	Pass

Laboratory Control Sample Assessment	
LCS (Y or N)?	Y
LCS50409	LCS50409
Count Date:	10/29/2019
Spike I.D.:	19-026
Decay Corrected Spike Concentration (pCi/mL):	34.899
Volume Used (mL):	0.10
Aliquot Volume (L, g, F):	0.815
Target Conc. (pCi/L, g, F):	4.280
Uncertainty (Calculated):	0.210
Result (pCi/L, g, F):	3.512
LCS/LCSD 2 Sigma CSU (pCi/L, g, F):	4.120
Numerical Performance Indicator:	1.014
Percent Recovery:	-0.38
Status vs Numerical Indicator:	95.36%
Status vs Recovery:	N/A
Upper % Recovery Limits:	Pass
Lower % Recovery Limits:	135%
	60%

Sample Matrix Spike Control Assessment	
Sample Collection Date:	MS/MSD 1
Sample I.D.:	10/10/2019
Sample MS I.D.:	70108023001
Sample MSD I.D.:	70108023001MS
MS/MSD Decay Corrected Spike Concentration (pCi/mL):	19-026
Spike Volume Used in MS (mL):	35.121
Spike Volume Used in MSD (mL):	0.20
MS Aliquot (L, g, F):	0.655
MS Target Conc. (pCi/L, g, F):	10.722
MSD Aliquot (L, g, F):	
MSD Target Conc. (pCi/L, g, F):	
MS Spike Uncertainty (calculated):	0.525
MSD Spike Uncertainty (calculated):	
Sample Result:	0.653
Sample Result 2 Sigma CSU (pCi/L, g, F):	0.427
Sample Matrix Spike Result:	8.486
Matrix Spike Result 2 Sigma CSU (pCi/L, g, F):	1.710
Sample Matrix Spike Duplicate Result:	
Matrix Spike Duplicate Result 2 Sigma CSU (pCi/L, g, F):	-3.079
MS Numerical Performance Indicator:	
MSD Numerical Performance Indicator:	73.06%
MS Percent Recovery:	
MSD Percent Recovery:	Fail****
MS Status vs Numerical Indicator:	
MSD Status vs Numerical Indicator:	Pass
MS Status vs Recovery:	
MSD Status vs Recovery:	135%
MS/MSD Upper % Recovery Limits:	60%
MS/MSD Lower % Recovery Limits:	

Duplicate Sample Assessment	
Sample I.D.:	Enter Duplicate sample IDs if other than LCS/LCSD in the space below.
Duplicate Sample I.D.:	
Sample Result (pCi/L, g, F):	LCS50409
Sample Result 2 Sigma CSU (pCi/L, g, F):	LCS50409
Sample Duplicate Result (pCi/L, g, F):	3.512
Sample Duplicate Result 2 Sigma CSU (pCi/L, g, F):	0.875
Are sample and/or duplicate results below RL?	4.120
Duplicate Numerical Performance Indicator:	1.014
Duplicate Status vs Numerical Indicator:	NO
Duplicate Percent Recoveries:	-0.890
Duplicate RPD:	15.01%
Duplicate Status vs Numerical Indicator:	Pass
Duplicate Status vs RPD:	Pass
% RPD Limit:	36%

Matrix Spike/Matrix Spike Duplicate Sample Assessment	
Sample I.D.:	Sample I.D.
Sample MS I.D.:	Sample MS I.D.
Sample MSD I.D.:	Sample MSD I.D.
Sample Matrix Spike Result:	Sample Matrix Spike Result
Matrix Spike Result 2 Sigma CSU (pCi/L, g, F):	Matrix Spike Result 2 Sigma CSU (pCi/L, g, F):
Sample Matrix Spike Duplicate Result:	Sample Matrix Spike Duplicate Result
Sample Duplicate Result 2 Sigma CSU (pCi/L, g, F):	Sample Duplicate Result 2 Sigma CSU (pCi/L, g, F):
Duplicate Numerical Performance Indicator:	Duplicate Numerical Performance Indicator
(Based on the Percent Recoveries) MS/MSD Duplicate RPD:	(Based on the Percent Recoveries) MS/MSD Duplicate RPD:
MS/MSD Duplicate Status vs Numerical Indicator:	MS/MSD Duplicate Status vs Numerical Indicator
MS/MSD Duplicate Status vs RPD:	MS/MSD Duplicate Status vs RPD
% RPD Limit:	% RPD Limit

Evaluation of duplicate precision is not applicable if either the sample or duplicate results are below the MDC.

Comments:

****If all other QC criteria pass, this batch is acceptable. The matrix spike duplicate result indicates a possible bias for this sample only and may not be applicable to any other samples in this analytical batch.

Platte River Power Authority – Rawhide DATA REVIEW CHECK

Data Package: 60317817

Sampling Event: October 9, 2019

Data Reviewer: Brian Rothmeyer

Peer Reviewer: Steve Szocik

Date Completed: December 6, 2019

Date Completed: December 19, 2019

This report contains the final results of the data validation conducted for the water samples collected October 9, 2019. The data review was conducted in accordance with the method and laboratory criteria, as applicable. The data review was conducted in accordance with method requirements and laboratory limits using guidance from USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540-R-2017-001 (January 2017).

General Overall Assessment:

- _____ Data are usable without qualification.
- X Data are usable with qualification (noted below).
- _____ Some or all data are unusable for any purpose (detailed below).

Data Review Checklist

Review Parameter	Criteria	Criteria Met?												
Sample-specific Parameters	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA										
Chain of Custody, Sample Identification, & Sample Receipt	Samples were received intact and the cooler temperature was <6 degree Celsius upon arrival at the laboratory.	X												
Holding Times	The samples were analyzed within the method required holding times.	X												
Method Blanks (MB)	<div>No target analytes reported in the associated MB.</div> <table><tr><th>Analyte</th><th>Concentration</th></tr><tr><td>MB 1777686</td><td></td></tr><tr><td>Radium-226</td><td>0.0383 ± 0.225 pCi/L</td></tr><tr><td>MB 1777689</td><td></td></tr><tr><td>Radium-228</td><td>0.114 ± 0.363 pCi/L</td></tr></table> <div>± – Plus or Minus pCi/L – Picocuries Per Liter MB – Method Blank</div>	Analyte	Concentration	MB 1777686		Radium-226	0.0383 ± 0.225 pCi/L	MB 1777689		Radium-228	0.114 ± 0.363 pCi/L		X ¹	
Analyte	Concentration													
MB 1777686														
Radium-226	0.0383 ± 0.225 pCi/L													
MB 1777689														
Radium-228	0.114 ± 0.363 pCi/L													
Quality Control Samples: Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD)	The LCS/LCSD recoveries were within the laboratory determined acceptance limits.	X												
Matrix Spike / Matrix Spike Duplicate (MS/MSD)	The recoveries and relative percent differences for the matrix spike and matrix spike duplicate analyses were within the laboratory-determined acceptance ranges.			X										
Laboratory Duplicate	<div>The laboratory duplicate samples were within the laboratory determined acceptance limits. The following concentration dependent criteria were used to evaluate laboratory duplicates:</div> <ul style="list-style-type: none">The agreement between parent sample results and the lab duplicate sample results were evaluated. The duplicate error ratios (DER) met the criterion of a DER ≤1.			X										

Review Parameter	Criteria	Criteria Met?																				
Sample-specific Parameters	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA																		
Field Duplicate	The field duplicate sample results satisfied the evaluation criteria below: <ul style="list-style-type: none">The agreement between parent sample results and the lab duplicate sample results were evaluated. The DER met the criterion of a DER ≤1.			X																		
Equipment Blanks	No target analytes reported in the associated equipment blank. <table><tr><th>Analyte</th><th>Concentration</th></tr><tr><td colspan="2">EB-2 (60318035)</td></tr><tr><td>Radium-226</td><td>0.150 ± 0.361 pCi/L</td></tr><tr><td>Radium-228</td><td>0.169 ± 0.653 pCi/L</td></tr><tr><td>Radium, Total</td><td>0.319 ± 1.01 pCi/L</td></tr><tr><td colspan="2">EB-4 (60318083)</td></tr><tr><td>Radium-226</td><td>0.276 ± 0.447 pCi/L</td></tr><tr><td>Radium-228</td><td>1.82 ± 0.614 pCi/L</td></tr><tr><td>Radium, Total</td><td>2.10 ± 1.06 pCi/L</td></tr></table> ± – Plus or Minus pCi/L – Picocuries Per Liter	Analyte	Concentration	EB-2 (60318035)		Radium-226	0.150 ± 0.361 pCi/L	Radium-228	0.169 ± 0.653 pCi/L	Radium, Total	0.319 ± 1.01 pCi/L	EB-4 (60318083)		Radium-226	0.276 ± 0.447 pCi/L	Radium-228	1.82 ± 0.614 pCi/L	Radium, Total	2.10 ± 1.06 pCi/L		X ²	
Analyte	Concentration																					
EB-2 (60318035)																						
Radium-226	0.150 ± 0.361 pCi/L																					
Radium-228	0.169 ± 0.653 pCi/L																					
Radium, Total	0.319 ± 1.01 pCi/L																					
EB-4 (60318083)																						
Radium-226	0.276 ± 0.447 pCi/L																					
Radium-228	1.82 ± 0.614 pCi/L																					
Radium, Total	2.10 ± 1.06 pCi/L																					
Reporting Limits Met (Non –Radiochemistry)	No samples performed at dilutions or reported as non-detect at elevated method detection limits/reporting limits.			X																		
Detection Limits Mets (Radiochemistry)	For radiochemical results if the associated uncertainty was greater than the reported result, the 2 sigma (σ) uncertainty multiplied by 1.65 was less than or equal to the specified detection limit. <table><tr><th>Sample</th><th>Analyte</th><th>Result (pCi/L)</th><th>2 Sigma (σ) Uncertainty</th><th>MDC (pCi/L)</th></tr><tr><td>ASH-07</td><td>Radium-226</td><td>0.292</td><td>± 0.304</td><td>0.452</td></tr></table> ± – Plus or Minus pCi/L – Picocuries Per Liter MDC – Minimum Detectable Concentration	Sample	Analyte	Result (pCi/L)	2 Sigma (σ) Uncertainty	MDC (pCi/L)	ASH-07	Radium-226	0.292	± 0.304	0.452		X ³									
Sample	Analyte	Result (pCi/L)	2 Sigma (σ) Uncertainty	MDC (pCi/L)																		
ASH-07	Radium-226	0.292	± 0.304	0.452																		
Tracer and/or Carrier Recovery	The sample specific recoveries were within the laboratory limits.	X																				
Reporting	No reporting issues were found and further qualification was not considered necessary.		X ⁴																			
Package Completeness	No results were qualified as unusable and the data are 100% complete.	X																				
Comments																						
1 – The associated radium-226 results for samples ASH-05 and ASH-08 were reported at concentrations <5x the concentration of the blank contamination and were qualified as estimated (J+ bl) to reflect the potential high bias indicated by the blank contamination. The associated radium-228 sample results reported at concentrations <5x the concentration of the blank contamination were qualified as estimated (J+ bl) to reflect the potential high bias indicated by the blank contamination. 2 – The associated radium-226, radium-228, and total radium results reported at concentrations <5x the concentration of the blank contamination were qualified as estimated (J+ be) to reflect the potential high bias indicated by the blank contamination. 3 – For the detected radium-226 result for sample ASH-07, the 2 sigma (σ) uncertainty multiplied by 1.65 was greater than the reported minimum detectable concentration (MDC) and was qualified as estimated (J v) indicating the detection limit criteria was not met.																						

Review Parameter	Criteria	Criteria Met?		
<i>Sample-specific Parameters</i>	For each “No” response, list qualified data and bias direction in Table 1 or explain no qualification in comments.	Yes	No	NA
4 – During review of the data package it was noted that the radium-226 and radium-228 LCS/LCSD results, LCS/LCSD recovery limits, MS/MSD sample result concentrations, and MS/MSD recovery limits were not provided. The laboratory revised and reissued the data package to include these parameters. Therefore, no further action was required.				

< – Less Than

pCi/L – Picocuries Per Liter

be – Equipment Blank Contamination

J – Estimated

MDC – Minimum Detectable Concentration

v – Compound Identification Issue

≤ – Less Than or Equal To

% – Percent

bl – Laboratory Blank Contamination

LCS – Laboratory Control Sample

MS/MSD – Matrix Spike/Matrix Spike Duplicate

σ – Sigma

± – Plus or Minus/ High or Low Bias

DER – Duplicate Error Ration

LCSD – Laboratory Control Sample Duplicate

NA – Not Applicable

Appendix E

Slug Test Output and Field Forms

PUMPING TEST DATA FORM

Well ID ASH-6 Personnel W Weichert
 Location Wellington CO Static Water Level 62.75
 Type of Well Monitoring Extraction Well Distance NA
 Test Date 5-2-2018 Total Casing Depth 70.08
 Measuring Point Elevation _____ Borehole Diameter 8"
 Type of Test Slug Casing Diameter 2"
 Step Number NA Screened Interval _____
 Data logger Test Run No. 1 Sand Pack Interval _____
 Pumping Rate NA Lithology Tested Shale
 Test Start Time 9:50 Test End Time 14:20

Slug In @ 9:50

Slug out @ 12:30

Time	Elapsed Time (min)	Water Depth (ft)
9:50.30	0.5	6
9:51	1	62.21
9:52	2	62.22
9:53	3	62.23
9:54	4	62.23
9:55	5	62.23
10:21	30	62.24
10:47		62.24
12:29		62.25

Time	Elapsed Time (min)	Water Depth (ft)
12:32		62.80
12:33		62.76
12:34		62.75
12:35		62.75
12:40		62.73
13:48		62.71
14:19		62.71

Used 4.5 ft Slug.

PZ-1 10.19 ft BTOC
 MW-5 Draw - 71.67 ft BTOC

PUMPING TEST DATA FORM

Well ID	<u>ASH-07</u>	Personnel	<u>Jessie Woodruff</u>
Location	<u>PRPA Rawhide</u>	Static Water Level	<u>15.1</u>
Type of Well	<u>2" stick-up</u>	Extraction Well Distance	<u>-</u>
Test Date	<u>05/08/19</u>	Total Casing Depth	<u>30.20</u>
Measuring Point Elevation	<u>-</u>	Borehole Diameter	<u>8"</u>
Type of Test	<u>SLUG</u>	Casing Diameter	<u>2"</u>
Step Number	<u>-</u>	Screened Interval	<u>-</u>
Data logger Test Run No.	<u>-</u>	Sand Pack Interval	<u>-</u>
Pumping Rate	<u>-</u>	Lithology Tested	<u>SHALE</u>
Test Start Time	<u>0915</u>	Test End Time	<u>1026</u>

Time	Elapsed Time (min)	Water Depth (ft)
slug in @ 0918		
0918.30	0.5	13.32
0919	1	13.58
0920	2	13.70
0921	3	13.86
0922	4	14.05
0923	5	14.20
0928	10	14.69
0937	19	14.85
0948	30	14.86
0956	42	14.86
- Stabilized -		

Time	Elapsed Time (min)	Water Depth (ft)
slug out @ 0957		
0957.30	0.5	16.44
0958	1	16.30
0959	2	16.05
1000	3	15.74
1001	4	15.66
1002	5	15.50
1005	8	15.18
1007	10	15.17
1025		14.86

~~sta~~ Test done

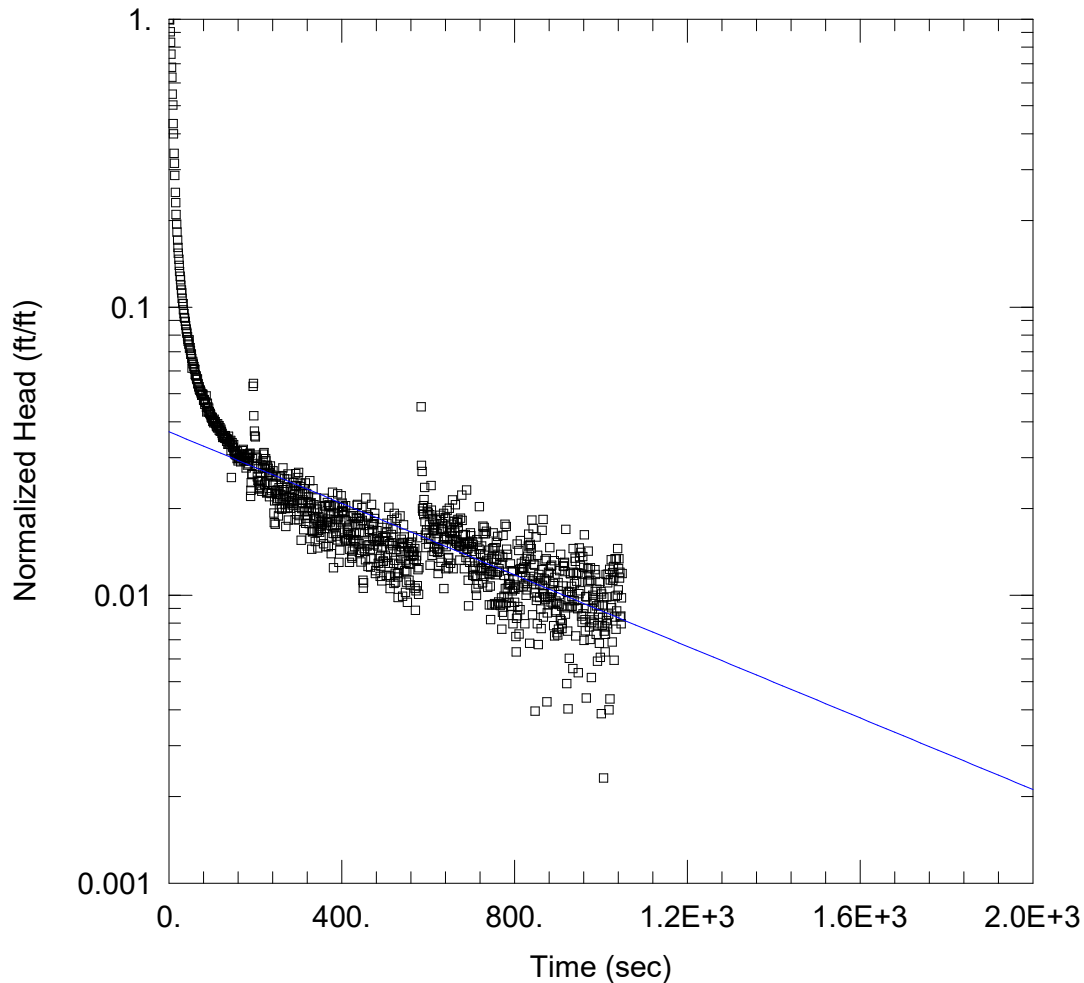
PUMPING TEST DATA FORM

Well ID ASH-8 Personnel W Weichert
 Location Wellington, CO Static Water Level 11.02
 Type of Well Monitoring Extraction Well Distance NA
 Test Date 5-2-2019 Total Casing Depth 29 32
 Measuring Point Elevation _____ Borehole Diameter 8"
 Type of Test Slug Casing Diameter 2"
 Step Number NA Screened Interval _____
 Data logger Test Run No. 1 Sand Pack Interval _____
 Pumping Rate NA Lithology Tested Shale / siltstone
 Test Start Time 12:10 Test End Time 18:15

Slug In @ 12:10 DTW @ $t_i = 10.82\text{ft}$ Slug Out @ 18:15

Time	Elapsed Time (min)	Water Depth (ft)	Time	Elapsed Time (min)	Water Depth (ft)
12:10.30	0.5	8.40	12:32 ww		62.80 ww
12:11	1	8.44	12:33 ww		
12:12	2	8.49	15:36		13.25
12:13	3	8.56	15:37		13.18
12:14	4	8.63	15:38		13.13
12:15	5	8.67	15:39		13.10
12:20	10	9.00	15:40		13.04
12:25	15	9.15	15:45		12.98
12:27 ww			15:50		12.75
13:03	53	9.99	17:12		11.56
13:10	60	10.10	17:32		11.42
13:20	70	10.19	18:00		11.28
13:30	80	10.28	18:10		11.23
13:40	90	10.38	18:15		11.22
14:30	140	10.63			
15:35		10.79			

Use 6.5 ft slug



ASH-06 SLUG TEST

Data Set: M:\...\ASH-06_SlugOut.aqt

Date: 01/21/20

Time: 17:27:27

PROJECT INFORMATION

Company: AECOM

Client: PRPA Rawhide

Project: 60588513

Location: Wellington, CO

Test Well: ASH-06

Test Date: 5/2/2019

AQUIFER DATA

Saturated Thickness: 4.25 ft

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (ASH-06)

Initial Displacement: 1.283 ft

Static Water Column Height: 2.25 ft

Total Well Penetration Depth: 65. ft

Screen Length: 15. ft

Casing Radius: 0.1667 ft

Well Radius: 0.6667 ft

Gravel Pack Porosity: 0.

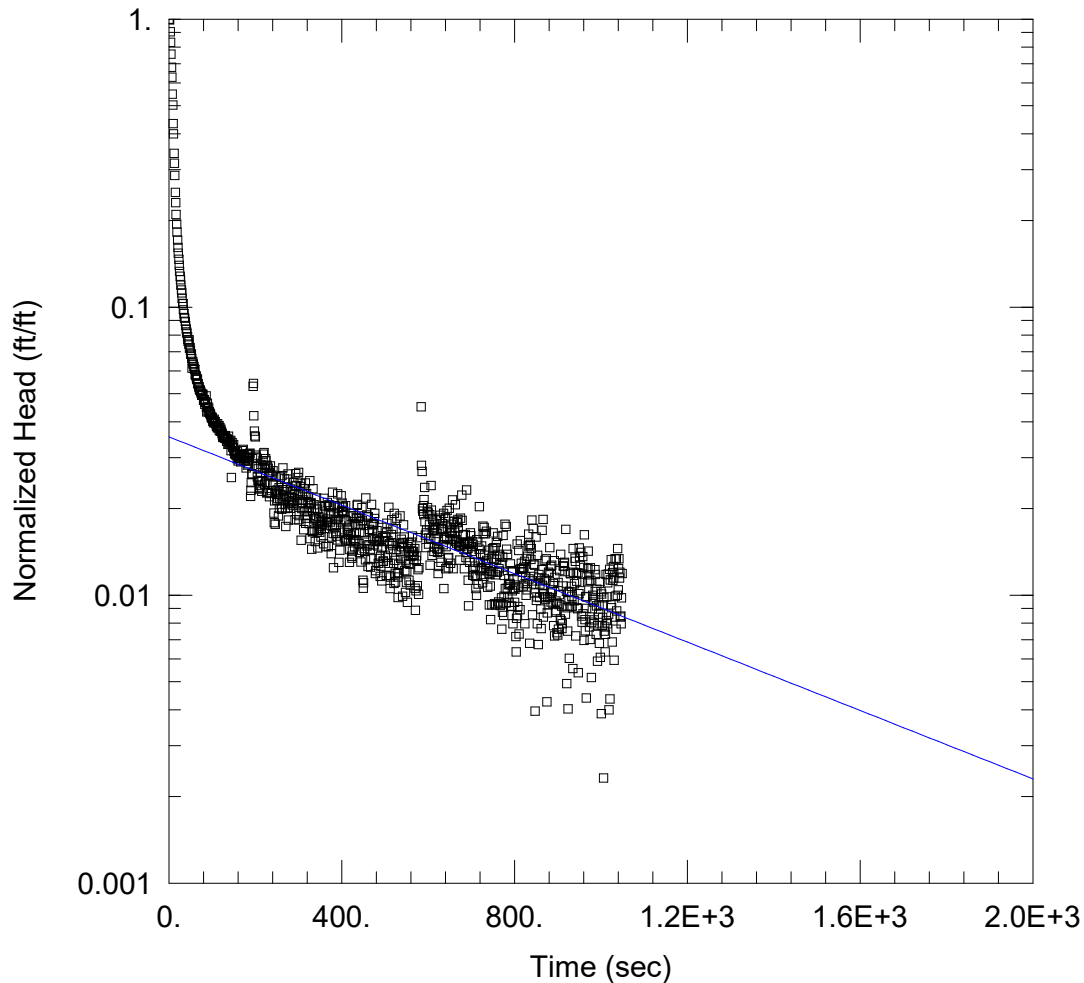
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 0.000356$ cm/sec

$y_0 = 0.04734$ ft



ASH-06 SLUG TEST

Data Set: M:\...\ASH-06_SlugOut.aqt

Date: 01/21/20

Time: 17:28:14

PROJECT INFORMATION

Company: AECOM

Client: PRPA Rawhide

Project: 60588513

Location: Wellington, CO

Test Well: ASH-06

Test Date: 5/2/2019

AQUIFER DATA

Saturated Thickness: 4.25 ft

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (ASH-06)

Initial Displacement: 1.283 ft

Static Water Column Height: 2.25 ft

Total Well Penetration Depth: 65. ft

Screen Length: 15. ft

Casing Radius: 0.1667 ft

Well Radius: 0.6667 ft

Gravel Pack Porosity: 0.

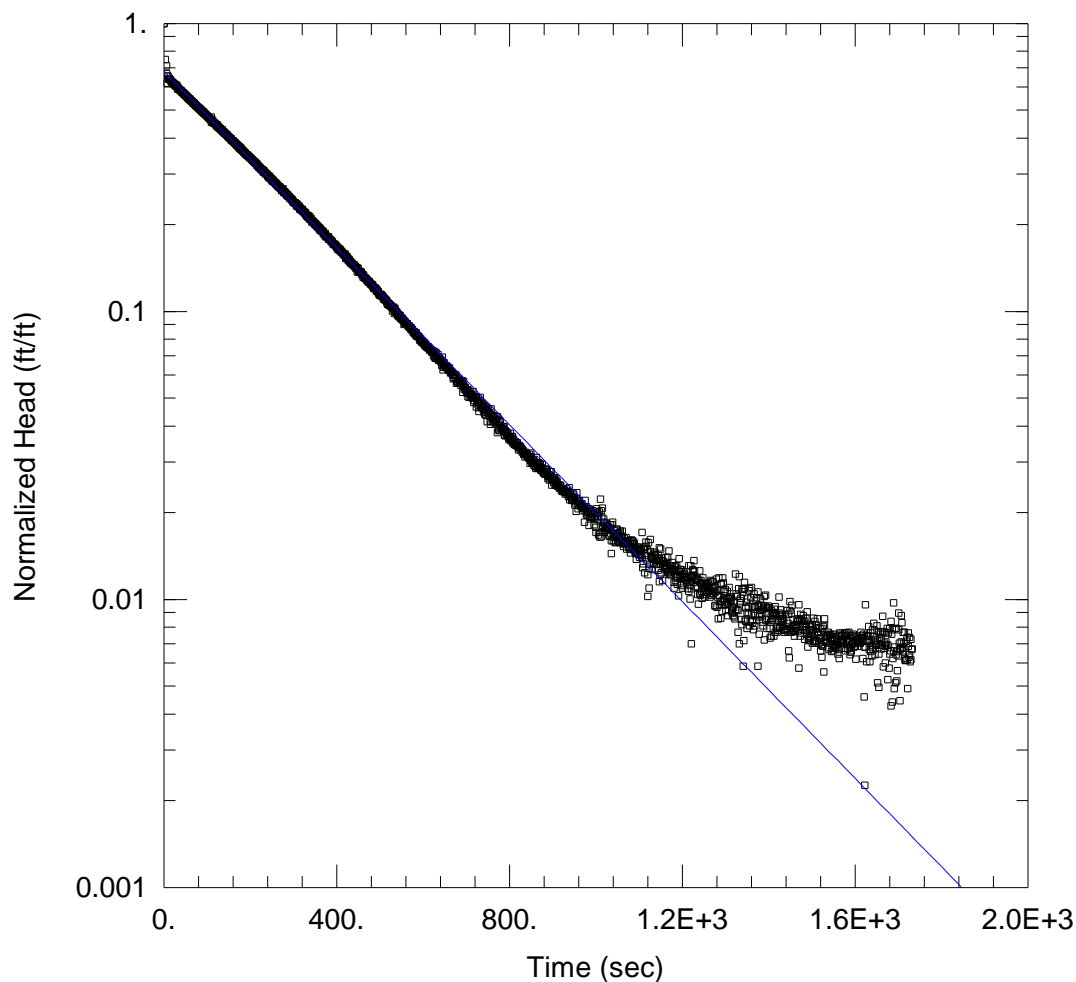
SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 0.0007216$ cm/sec

$y_0 = 0.04546$ ft



ASH-07 SLUG TEST

Data Set: C:\Users\wesley.weichert\Desktop\PRPA Drilling April 2019\SlugTesting\AQT\ASH-07_SlugIn.aqt
 Date: 05/17/19 Time: 12:59:30

PROJECT INFORMATION

Company: AECOM
 Client: PRPA Rawhide
 Project: 60588513
 Location: Wellington, CO
 Test Well: ASH-07
 Test Date: 5/8/2019

AQUIFER DATA

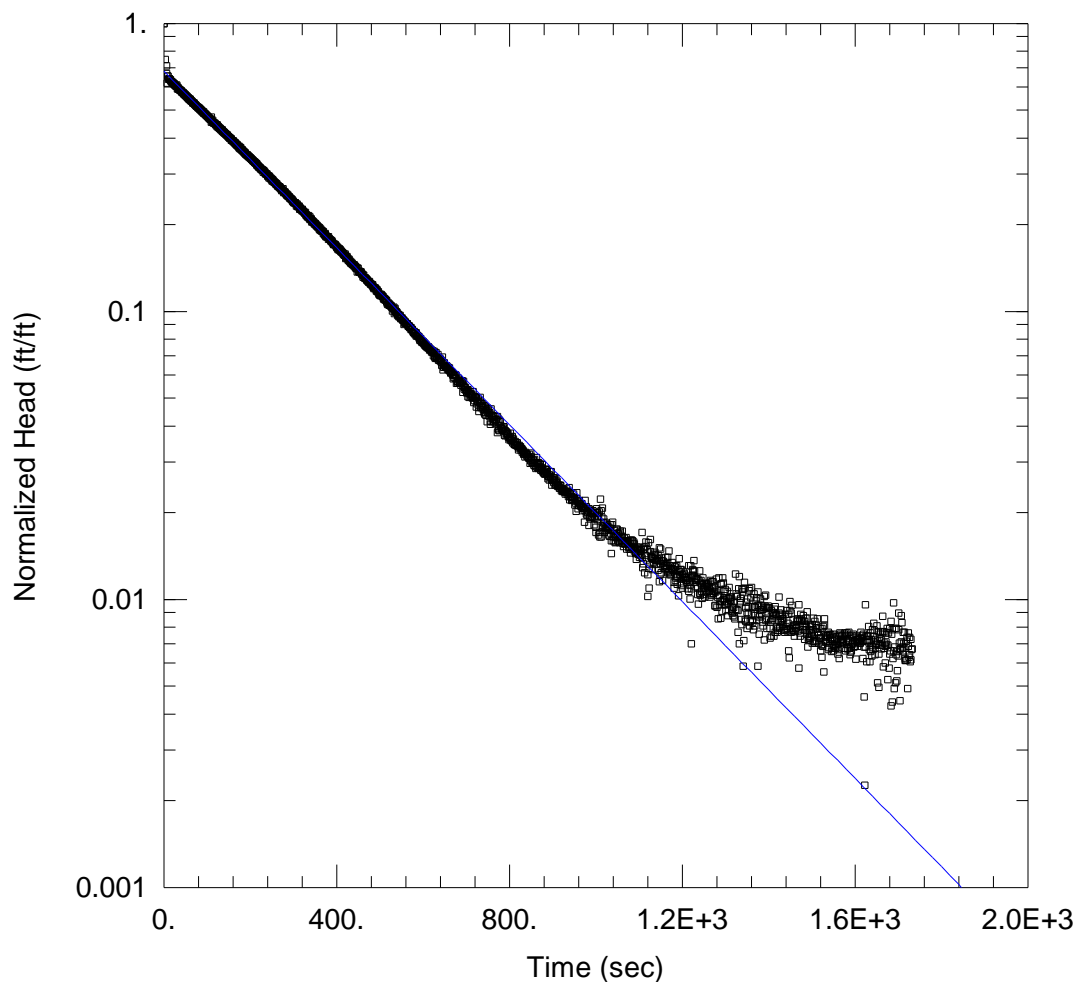
Saturated Thickness: 14.88 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (New Well)

Initial Displacement: 2.571 ft Static Water Column Height: 12.88 ft
 Total Well Penetration Depth: 25. ft Screen Length: 10. ft
 Casing Radius: 0.1667 ft Well Radius: 0.6667 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice
 K = 0.0003709 cm/sec $y_0 =$ 1.757 ft



ASH-07 SLUG TEST

Data Set: C:\Users\wesley.weichert\Desktop\PRPA Drilling April 2019\SlugTesting\AQT\ASH-07_SlugIn.aqt
 Date: 05/17/19 Time: 12:57:57

PROJECT INFORMATION

Company: AECOM
 Client: PRPA Rawhide
 Project: 60588513
 Location: Wellington, CO
 Test Well: ASH-07
 Test Date: 5/8/2019

AQUIFER DATA

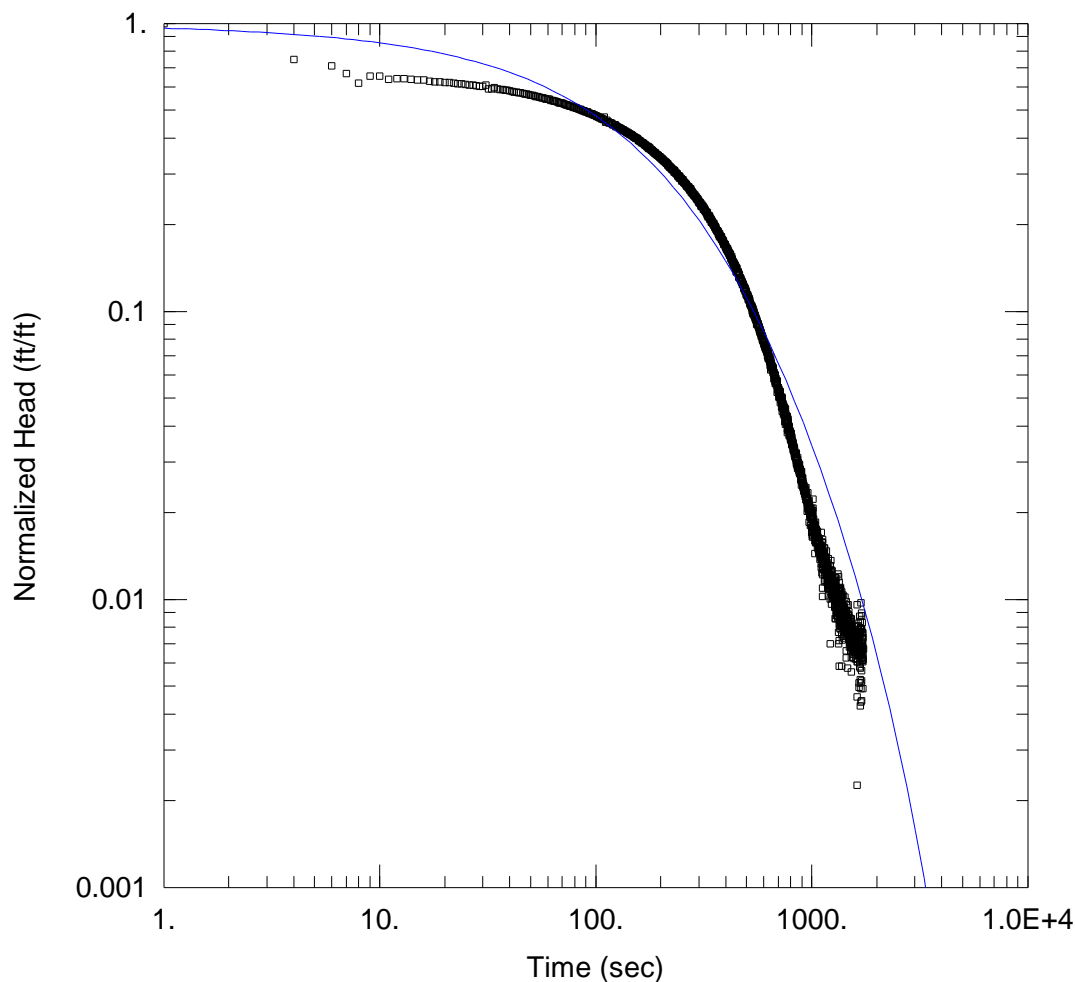
Saturated Thickness: 14.88 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (New Well)

Initial Displacement: 2.571 ft Static Water Column Height: 12.88 ft
 Total Well Penetration Depth: 25. ft Screen Length: 10. ft
 Casing Radius: 0.1667 ft Well Radius: 0.6667 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev
 K = 0.0005091 cm/sec $y_0 =$ 1.757 ft



ASH-07 SLUG TEST

Data Set: C:\Users\wesley.weichert\Desktop\PRPA Drilling April 2019\SlugTesting\AQT\ASH-07_SlugIn.aqt
 Date: 05/17/19 Time: 13:08:12

PROJECT INFORMATION

Company: AECOM
 Client: PRPA Rawhide
 Project: 60588513
 Location: Wellington, CO
 Test Well: ASH-07
 Test Date: 5/8/2019

AQUIFER DATA

Saturated Thickness: 14.88 ft

WELL DATA (New Well)

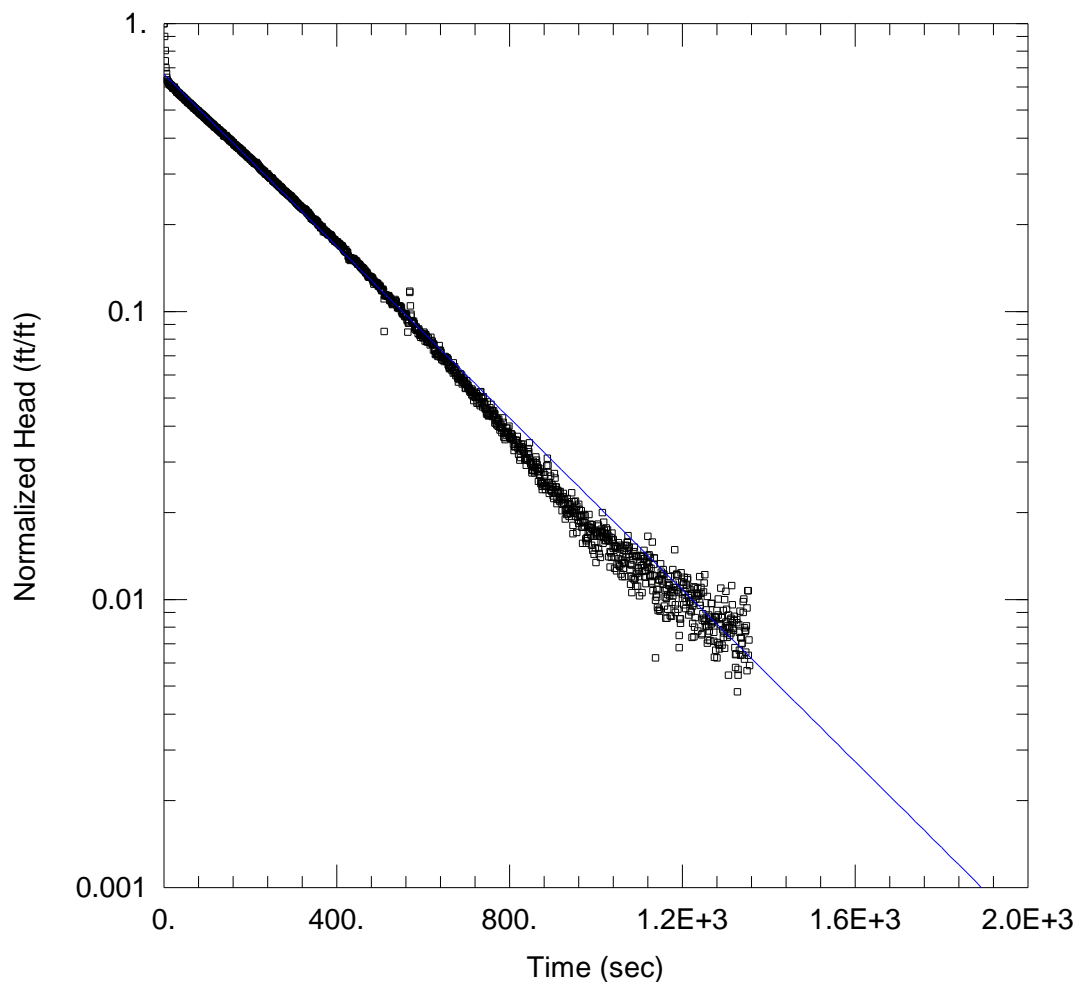
Initial Displacement: 2.571 ft
 Total Well Penetration Depth: 25. ft
 Casing Radius: 0.1667 ft

Static Water Column Height: 12.88 ft
 Screen Length: 10. ft
 Well Radius: 0.6667 ft

SOLUTION

Aquifer Model: Unconfined
 Kr = 0.000522 cm/sec
 Kz/Kr = 1.

Solution Method: KGS Model
 Ss = 0.0002175 ft⁻¹



ASH-07 SLUG TEST

Data Set: C:\...\ASH-07_SlugOut.aqt

Date: 05/17/19

Time: 13:35:58

PROJECT INFORMATION

Company: AECOM

Client: PRPA Rawhide

Project: 60588513

Location: Wellington, CO

Test Well: ASH-07

Test Date: 5/8/2019

AQUIFER DATA

Saturated Thickness: 14.88 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (New Well)

Initial Displacement: 2.765 ft

Static Water Column Height: 12.88 ft

Total Well Penetration Depth: 25. ft

Screen Length: 10. ft

Casing Radius: 0.1667 ft

Well Radius: 0.6667 ft

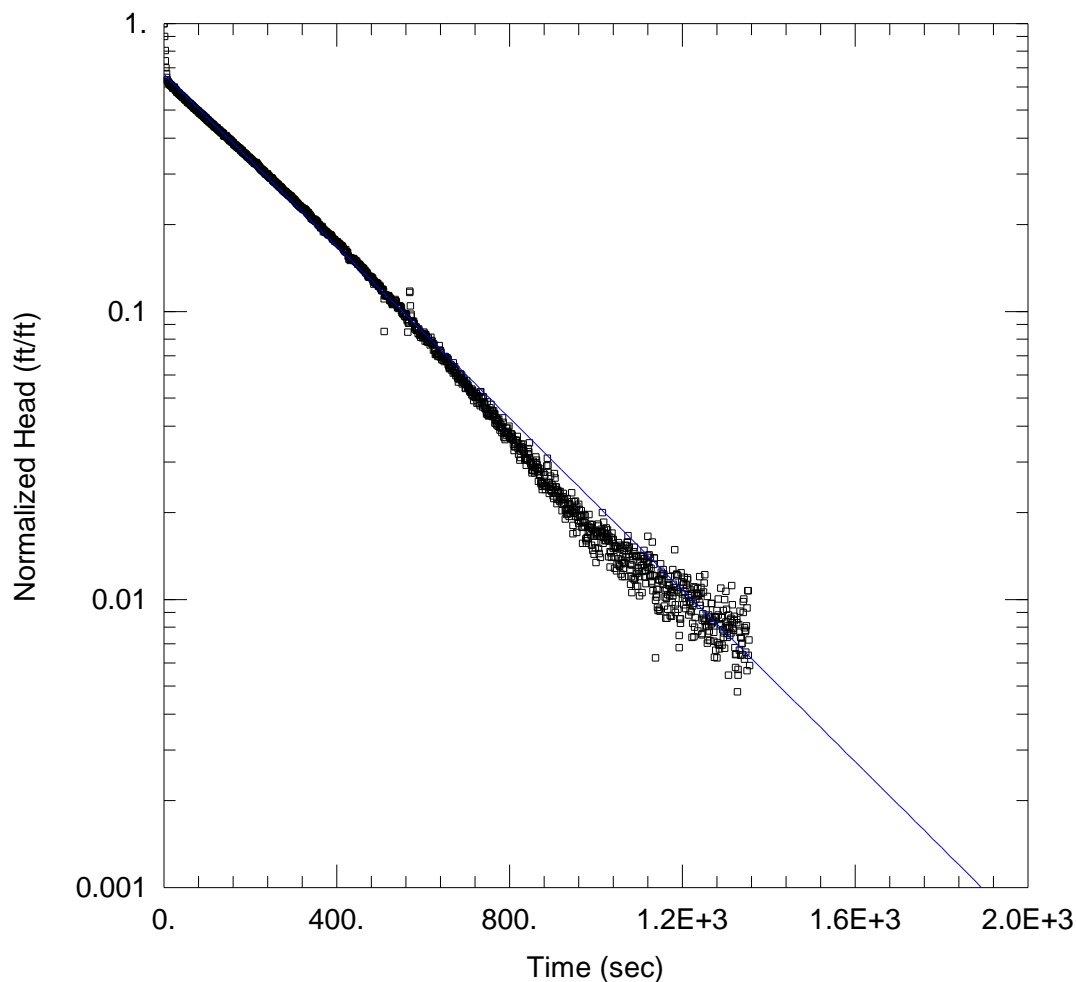
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

K = 0.0003604 cm/sec

y0 = 1.84 ft



ASH-07 SLUG TEST

Data Set: C:\...\ASH-07_SlugOut.aqt

Date: 05/17/19

Time: 13:37:52

PROJECT INFORMATION

Company: AECOM

Client: PRPA Rawhide

Project: 60588513

Location: Wellington, CO

Test Well: ASH-07

Test Date: 5/8/2019

AQUIFER DATA

Saturated Thickness: 14.88 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (New Well)

Initial Displacement: 2.765 ft

Static Water Column Height: 12.88 ft

Total Well Penetration Depth: 25. ft

Screen Length: 10. ft

Casing Radius: 0.1667 ft

Well Radius: 0.6667 ft

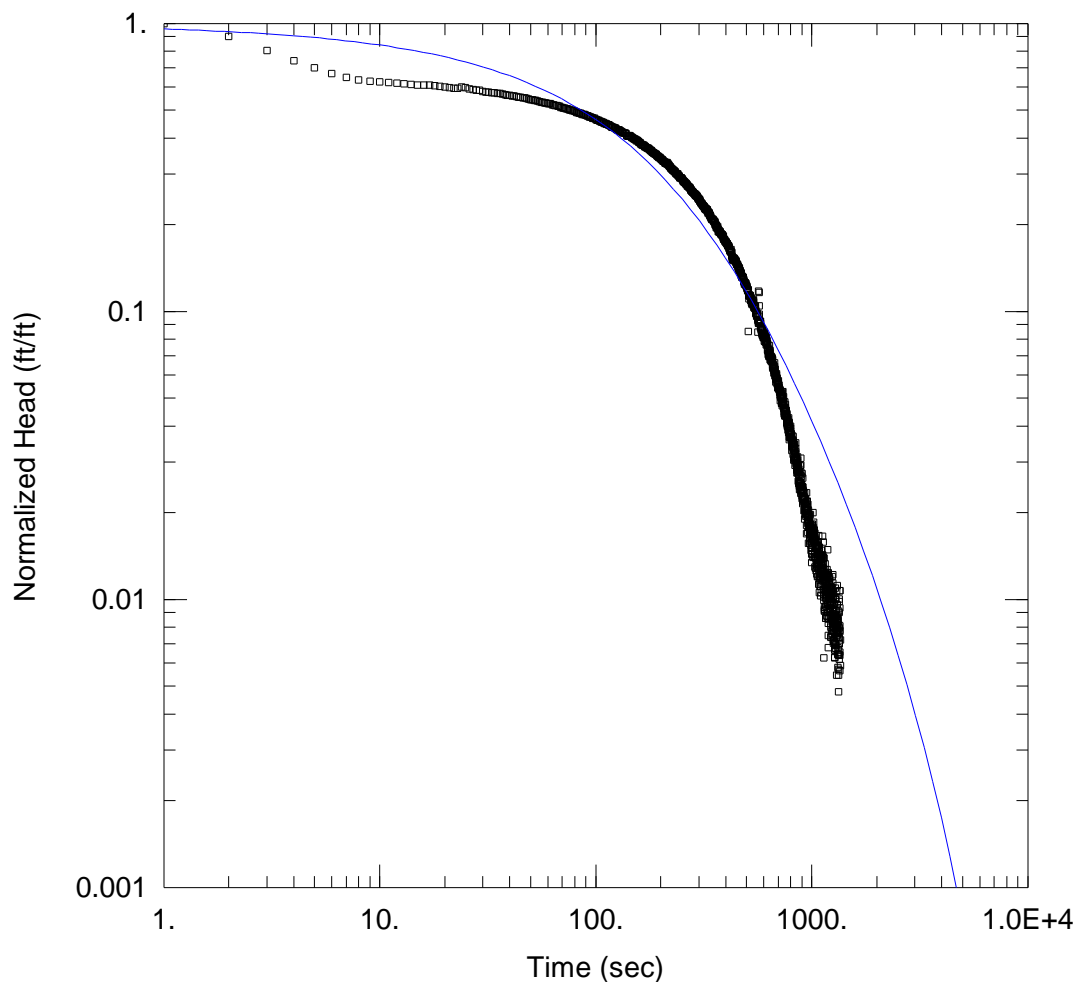
SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

K = 0.0004947 cm/sec

y0 = 1.84 ft



ASH-07 SLUG TEST

Data Set: C:\...\ASH-07_SlugOut.aqt

Date: 05/17/19

Time: 13:40:04

PROJECT INFORMATION

Company: AECOM

Client: PRPA Rawhide

Project: 60588513

Location: Wellington, CO

Test Well: ASH-07

Test Date: 5/8/2019

AQUIFER DATA

Saturated Thickness: 14.88 ft

WELL DATA (New Well)

Initial Displacement: 2.765 ft

Total Well Penetration Depth: 25. ft

Casing Radius: 0.1667 ft

Static Water Column Height: 12.88 ft

Screen Length: 10. ft

Well Radius: 0.6667 ft

SOLUTION

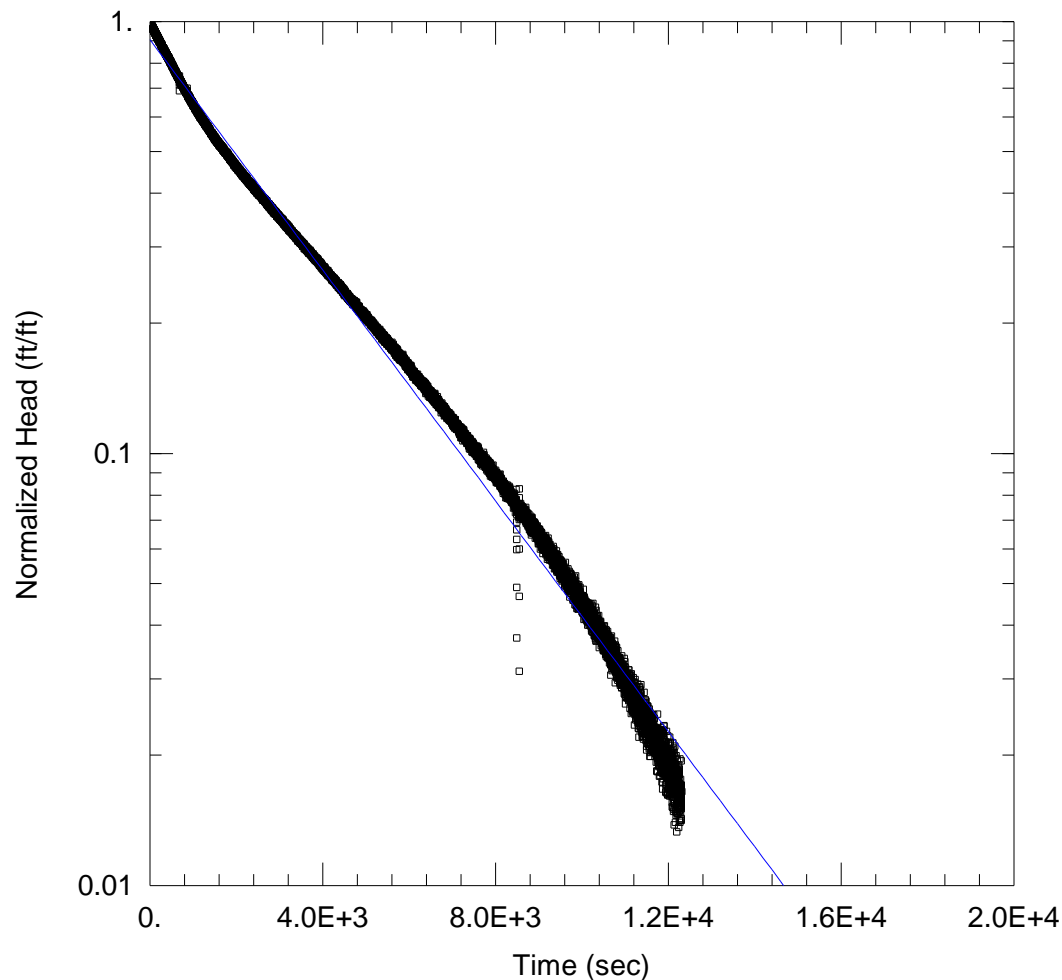
Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 0.0004888 cm/sec

Ss = 0.0003334 ft⁻¹

Kz/Kr = 1.



ASH-08 SLUG TEST

Data Set: C:\Users\wesley.weichert\Desktop\PRPA Drilling April 2019\SlugTesting\AQT\ASH-08_SlugIn.aqt
 Date: 05/15/19 Time: 13:05:28

PROJECT INFORMATION

Company: AECOM
 Client: PRPA Rawhide
 Project: 60588513
 Location: Wellington, CO
 Test Well: ASH-08
 Test Date: 5/2/2019

AQUIFER DATA

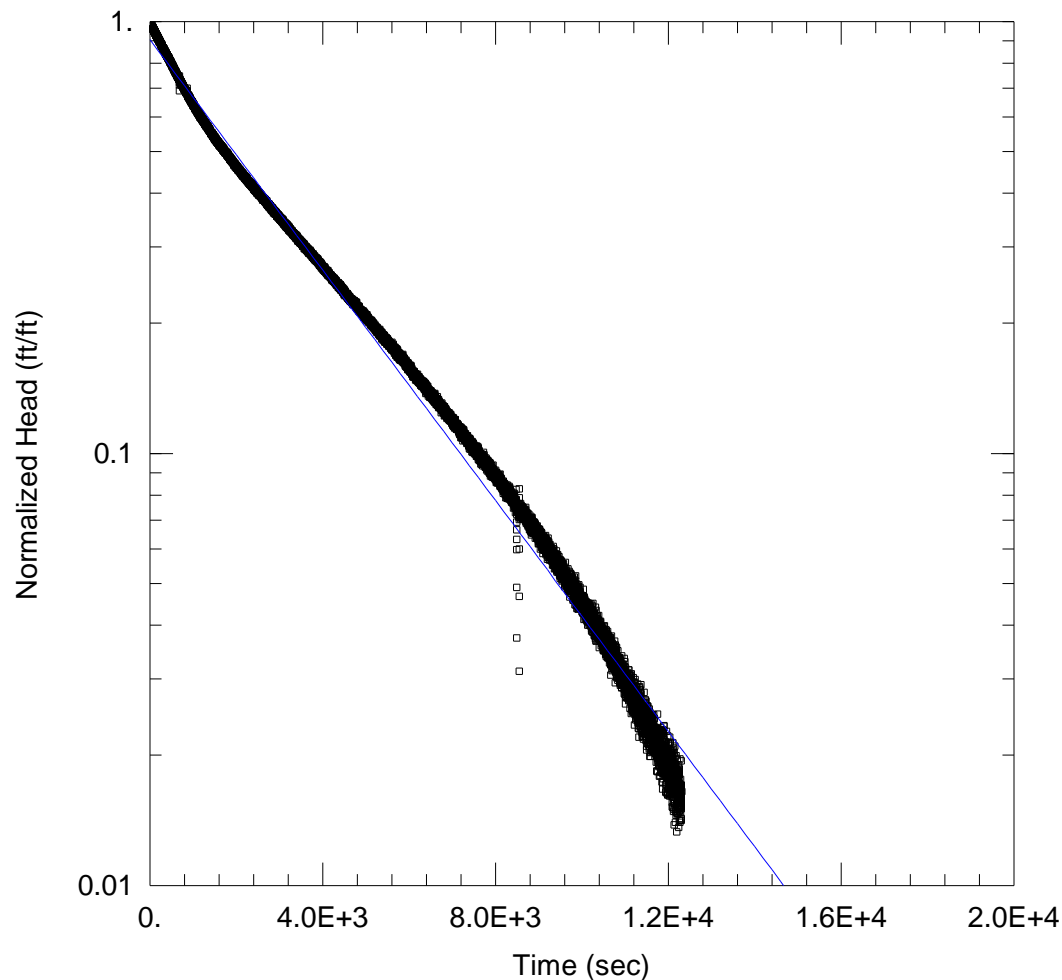
Saturated Thickness: 20.98 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (New Well)

Initial Displacement: 2.469 ft Static Water Column Height: 20.98 ft
 Total Well Penetration Depth: 29. ft Screen Length: 10. ft
 Casing Radius: 0.1667 ft Well Radius: 0.6667 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice
 K = 3.324E-5 cm/sec y_0 = 2.243 ft



ASH-08 SLUG TEST

Data Set: C:\Users\wesley.weichert\Desktop\PRPA Drilling April 2019\SlugTesting\AQT\ASH-08_SlugIn.aqt
 Date: 05/15/19 Time: 13:01:29

PROJECT INFORMATION

Company: AECOM
 Client: PRPA Rawhide
 Project: 60588513
 Location: Wellington, CO
 Test Well: ASH-08
 Test Date: 5/2/2019

AQUIFER DATA

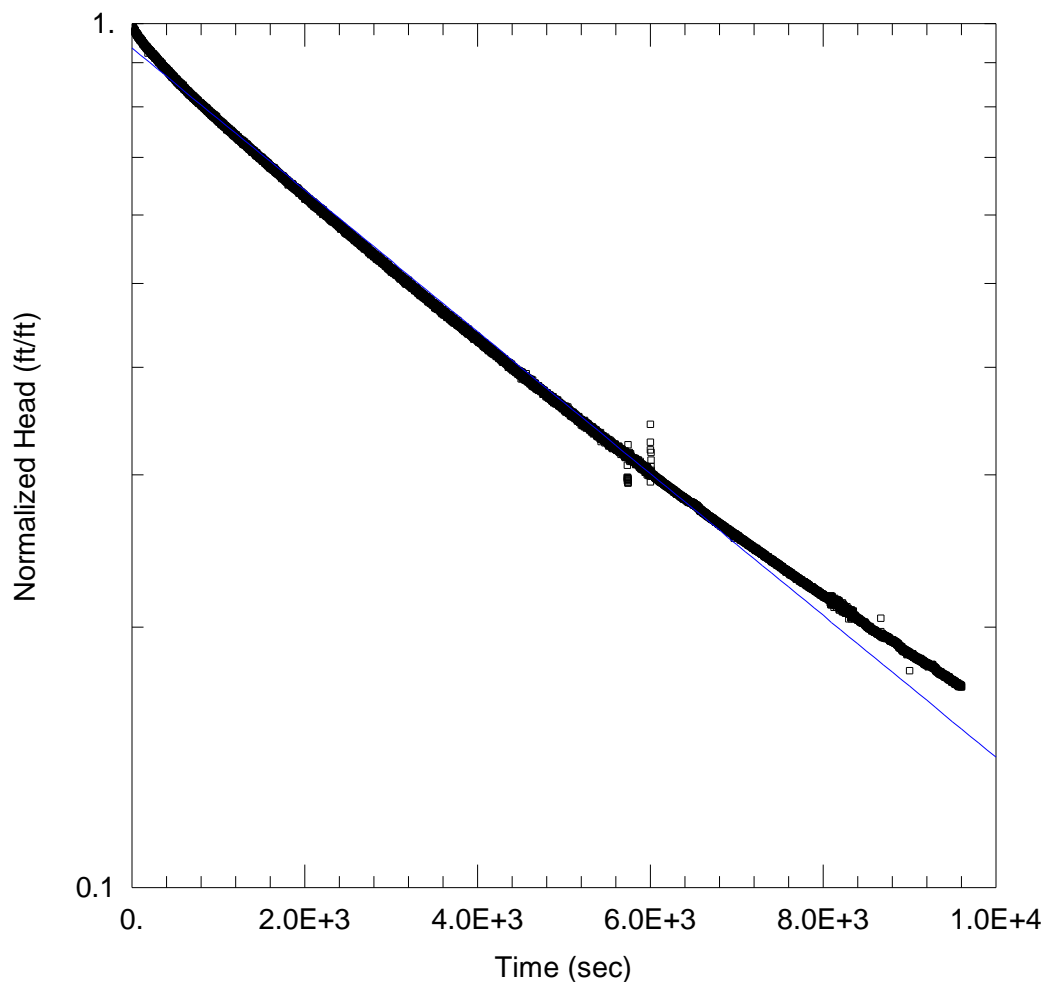
Saturated Thickness: 20.98 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (New Well)

Initial Displacement: 2.469 ft Static Water Column Height: 20.98 ft
 Total Well Penetration Depth: 29. ft Screen Length: 10. ft
 Casing Radius: 0.1667 ft Well Radius: 0.6667 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev
 K = 4.426E-5 cm/sec $y_0 =$ 2.243 ft



ASH-08 SLUG TEST

Data Set: C:\...\ASH-08_SlugOut.aqt

Date: 05/15/19

Time: 13:18:27

PROJECT INFORMATION

Company: AECOM

Client: PRPA Rawhide

Project: 60588513

Location: Wellington, CO

Test Well: ASH-08

Test Date: 5/2/2019

AQUIFER DATA

Saturated Thickness: 20.98 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (New Well)

Initial Displacement: 2.506 ft

Static Water Column Height: 20.98 ft

Total Well Penetration Depth: 29. ft

Screen Length: 10. ft

Casing Radius: 0.1667 ft

Well Radius: 0.6667 ft

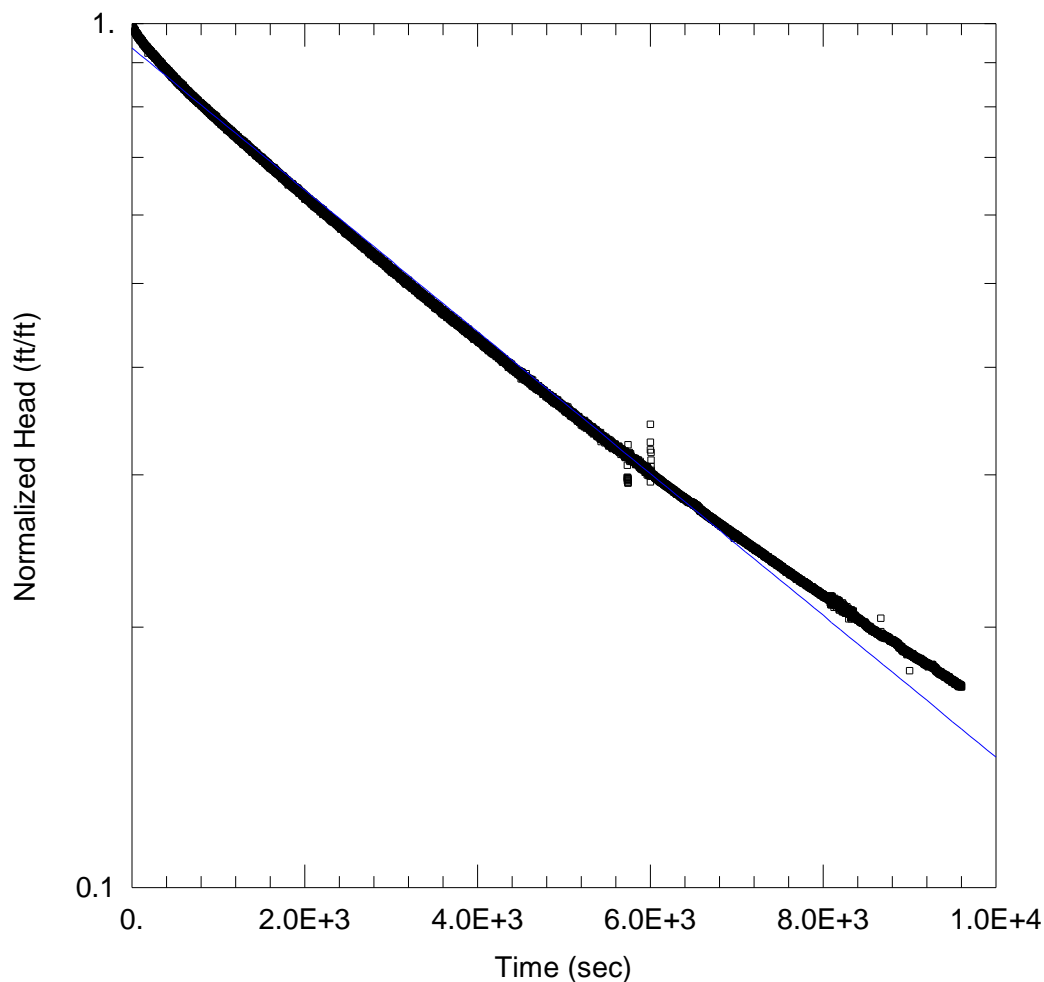
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

K = 2.044E-5 cm/sec

y0 = 2.346 ft



ASH-08 SLUG TEST

Data Set: C:\...\ASH-08_SlugOut.aqt

Date: 05/15/19

Time: 13:08:04

PROJECT INFORMATION

Company: AECOM

Client: PRPA Rawhide

Project: 60588513

Location: Wellington, CO

Test Well: ASH-08

Test Date: 5/2/2019

AQUIFER DATA

Saturated Thickness: 20.98 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (New Well)

Initial Displacement: 2.506 ft

Total Well Penetration Depth: 29. ft

Casing Radius: 0.1667 ft

Static Water Column Height: 20.98 ft

Screen Length: 10. ft

Well Radius: 0.6667 ft

SOLUTION

Aquifer Model: Unconfined

K = 2.722E-5 cm/sec

Solution Method: Hvorslev

y0 = 2.346 ft

Appendix F

Statistical Analysis Results

	A	B	C	D	E	F	G	H	I	J	K	L
1				Background Statistics for Data Sets with Non-Detects								
2	User Selected Options											
3	Date/Time of Computation			ProUCL 5.11/27/2020 11:02:24 AM								
4	From File			Ash Landfill ProUCL Input 2019_a.xls								
5	Full Precision			OFF								
6	Confidence Coefficient			95%								
7	Coverage			95%								
8	Different or Future K Observations			1								
9	Number of Bootstrap Operations			2000								
10												
11	B											
12												
13	General Statistics											
14	Total Number of Observations				17		Number of Distinct Observations				16	
15	Minimum				0.283		First Quartile				0.45	
16	Second Largest				0.58		Median				0.471	
17	Maximum				0.63		Third Quartile				0.5	
18	Mean				0.457		SD				0.0984	
19	Coefficient of Variation				0.215		Skewness				-0.488	
20	Mean of logged Data				-0.808		SD of logged Data				0.236	
21												
22	Critical Values for Background Threshold Values (BTVs)											
23	Tolerance Factor K (For UTL)				2.486		d2max (for USL)				2.475	
24												
25	Normal GOF Test											
26	Shapiro Wilk Test Statistic				0.91		Shapiro Wilk GOF Test					
27	5% Shapiro Wilk Critical Value				0.892		Data appear Normal at 5% Significance Level					
28	Lilliefors Test Statistic				0.237		Lilliefors GOF Test					
29	5% Lilliefors Critical Value				0.207		Data Not Normal at 5% Significance Level					
30	Data appear Approximate Normal at 5% Significance Level											
31												
32	Background Statistics Assuming Normal Distribution											
33	95% UTL with		95% Coverage		0.702		90% Percentile (z)				0.583	
34			95% UPL (t)		0.634		95% Percentile (z)				0.619	
35			95% USL		0.701		99% Percentile (z)				0.686	
36												
37	Gamma GOF Test											
38	A-D Test Statistic				1.027		Anderson-Darling Gamma GOF Test					
39	5% A-D Critical Value				0.738		Data Not Gamma Distributed at 5% Significance Level					
40	K-S Test Statistic				0.267		Kolmogorov-Smirnov Gamma GOF Test					
41	5% K-S Critical Value				0.209		Data Not Gamma Distributed at 5% Significance Level					
42	Data Not Gamma Distributed at 5% Significance Level											
43												
44	Gamma Statistics											
45	k hat (MLE)				20.47		k star (bias corrected MLE)				16.9	
46	Theta hat (MLE)				0.0223		Theta star (bias corrected MLE)				0.027	
47	nu hat (MLE)				696		nu star (bias corrected)				574.5	
48	MLE Mean (bias corrected)				0.457		MLE Sd (bias corrected)				0.111	
49												
50	Background Statistics Assuming Gamma Distribution											
51	95% Wilson Hilferty (WH) Approx. Gamma UPL				0.661		90% Percentile				0.604	
52	95% Hawkins Wixley (HW) Approx. Gamma UPL				0.666		95% Percentile				0.654	
53	95% WH Approx. Gamma UTL with		95% Coverage		0.757		99% Percentile				0.754	
54	95% HW Approx. Gamma UTL with		95% Coverage		0.767							

55	A	B	C	D	E	F	G	H	I	J	K	L
56	95% WH USL					0.756	95% HW USL					0.765
57	Lognormal GOF Test											
58	Shapiro Wilk Test Statistic					0.865	Shapiro Wilk Lognormal GOF Test					
59	5% Shapiro Wilk Critical Value					0.892	Data Not Lognormal at 5% Significance Level					
60	Lilliefors Test Statistic					0.281	Lilliefors Lognormal GOF Test					
61	5% Lilliefors Critical Value					0.207	Data Not Lognormal at 5% Significance Level					
62	Data Not Lognormal at 5% Significance Level											
63												
64	Background Statistics assuming Lognormal Distribution											
65	95% UTL with 95% Coverage					0.802	90% Percentile (z)					0.603
66	95% UPL (t)					0.681	95% Percentile (z)					0.658
67	95% USL					0.8	99% Percentile (z)					0.772
68												
69	Nonparametric Distribution Free Background Statistics											
70	Data appear Approximate Normal at 5% Significance Level											
71												
72	Nonparametric Upper Limits for Background Threshold Values											
73	Order of Statistic, r					17	95% UTL with 95% Coverage					0.63
74	Approx, f used to compute achieved CC					0.895	Approximate Actual Confidence Coefficient achieved by UTL					0.582
75							Approximate Sample Size needed to achieve specified CC					59
76	95% Percentile Bootstrap UTL with 95% Coverage					0.63	95% BCA Bootstrap UTL with 95% Coverage					0.63
77	95% UPL					0.63	90% Percentile					0.556
78	90% Chebyshev UPL					0.761	95% Percentile					0.59
79	95% Chebyshev UPL					0.898	99% Percentile					0.622
80	95% USL					0.63						
81												
82	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
83	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
84	and consists of observations collected from clean unimpacted locations.											
85	The use of USL tends to provide a balance between false positives and false negatives provided the data											
86	represents a background data set and when many onsite observations need to be compared with the BTV.											
87												
88	Ca											
89												
90	General Statistics											
91	Total Number of Observations					17	Number of Distinct Observations					15
92	Minimum					26.7	First Quartile					320
93	Second Largest					375	Median					346
94	Maximum					380	Third Quartile					363
95	Mean					276.9	SD					143.5
96	Coefficient of Variation					0.518	Skewness					-1.326
97	Mean of logged Data					5.266	SD of logged Data					1.118
98												
99	Critical Values for Background Threshold Values (BTVs)											
100	Tolerance Factor K (For UTL)					2.486	d2max (for USL)					2.475
101												
102	Normal GOF Test											
103	Shapiro Wilk Test Statistic					0.63	Shapiro Wilk GOF Test					
104	5% Shapiro Wilk Critical Value					0.892	Data Not Normal at 5% Significance Level					
105	Lilliefors Test Statistic					0.383	Lilliefors GOF Test					
106	5% Lilliefors Critical Value					0.207	Data Not Normal at 5% Significance Level					
107	Data Not Normal at 5% Significance Level											
108												

	A	B	C	D	E	F	G	H	I	J	K	L
109	Background Statistics Assuming Normal Distribution											
110	95% UTL with 95% Coverage				633.7	90% Percentile (z)						460.9
111	95% UPL (t)				534.8	95% Percentile (z)						513
112	95% USL				632.1	99% Percentile (z)						610.8
113												
114	Gamma GOF Test											
115	A-D Test Statistic				3.686	Anderson-Darling Gamma GOF Test						
116	5% A-D Critical Value				0.755	Data Not Gamma Distributed at 5% Significance Level						
117	K-S Test Statistic				0.439	Kolmogorov-Smirnov Gamma GOF Test						
118	5% K-S Critical Value				0.213	Data Not Gamma Distributed at 5% Significance Level						
119	Data Not Gamma Distributed at 5% Significance Level											
120												
121	Gamma Statistics											
122	k hat (MLE)				1.543	k star (bias corrected MLE)						1.31
123	Theta hat (MLE)				179.5	Theta star (bias corrected MLE)						211.4
124	nu hat (MLE)				52.46	nu star (bias corrected)						44.53
125	MLE Mean (bias corrected)				276.9	MLE Sd (bias corrected)						242
126												
127	Background Statistics Assuming Gamma Distribution											
128	95% Wilson Hilferty (WH) Approx. Gamma UPL				806	90% Percentile						596.6
129	95% Hawkins Wixley (HW) Approx. Gamma UPL				891.6	95% Percentile						755.2
130	95% WH Approx. Gamma UTL with 95% Coverage				1168	99% Percentile						1117
131	95% HW Approx. Gamma UTL with 95% Coverage				1369							
132	95% WH USL				1161	95% HW USL						1360
133												
134	Lognormal GOF Test											
135	Shapiro Wilk Test Statistic				0.572	Shapiro Wilk Lognormal GOF Test						
136	5% Shapiro Wilk Critical Value				0.892	Data Not Lognormal at 5% Significance Level						
137	Lilliefors Test Statistic				0.438	Lilliefors Lognormal GOF Test						
138	5% Lilliefors Critical Value				0.207	Data Not Lognormal at 5% Significance Level						
139	Data Not Lognormal at 5% Significance Level											
140												
141	Background Statistics assuming Lognormal Distribution											
142	95% UTL with 95% Coverage				3121	90% Percentile (z)						811.7
143	95% UPL (t)				1444	95% Percentile (z)						1219
144	95% USL				3083	99% Percentile (z)						2611
145												
146	Nonparametric Distribution Free Background Statistics											
147	Data do not follow a Discernible Distribution (0.05)											
148												
149	Nonparametric Upper Limits for Background Threshold Values											
150	Order of Statistic, r				17	95% UTL with 95% Coverage						380
151	Approx, f used to compute achieved CC				0.895	Approximate Actual Confidence Coefficient achieved by UTL						0.582
152						Approximate Sample Size needed to achieve specified CC						59
153	95% Percentile Bootstrap UTL with 95% Coverage				380	95% BCA Bootstrap UTL with 95% Coverage						380
154	95% UPL				380	90% Percentile						372
155	90% Chebyshev UPL				720	95% Percentile						376
156	95% Chebyshev UPL				920.6	99% Percentile						379.2
157	95% USL				380							
158												
159	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
160	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
161	and consists of observations collected from clean unimpacted locations.											
162	The use of USL tends to provide a balance between false positives and false negatives provided the data											

	A	B	C	D	E	F	G	H	I	J	K	L
163	represents a background data set and when many onsite observations need to be compared with the BTV.											
164												
165	CI											
166												
167	General Statistics											
168	Total Number of Observations				15		Number of Distinct Observations				12	
169							Number of Missing Observations				1	
170	Minimum				7.8		First Quartile				19.2	
171	Second Largest				25		Median				20.2	
172	Maximum				29		Third Quartile				24.5	
173	Mean				19.63		SD				6.438	
174	Coefficient of Variation				0.328		Skewness				-0.899	
175	Mean of logged Data				2.907		SD of logged Data				0.424	
176												
177	Critical Values for Background Threshold Values (BTVs)											
178	Tolerance Factor K (For UTL)				2.566		d2max (for USL)				2.409	
179												
180	Normal GOF Test											
181	Shapiro Wilk Test Statistic				0.867		Shapiro Wilk GOF Test					
182	5% Shapiro Wilk Critical Value				0.881		Data Not Normal at 5% Significance Level					
183	Lilliefors Test Statistic				0.261		Lilliefors GOF Test					
184	5% Lilliefors Critical Value				0.22		Data Not Normal at 5% Significance Level					
185	Data Not Normal at 5% Significance Level											
186												
187	Background Statistics Assuming Normal Distribution											
188	95% UTL with		95% Coverage		36.15		90% Percentile (z)				27.88	
189			95% UPL (t)		31.34		95% Percentile (z)				30.22	
190			95% USL		35.14		99% Percentile (z)				34.61	
191												
192	Gamma GOF Test											
193	A-D Test Statistic				1.37		Anderson-Darling Gamma GOF Test					
194	5% A-D Critical Value				0.738		Data Not Gamma Distributed at 5% Significance Level					
195	K-S Test Statistic				0.314		Kolmogorov-Smirnov Gamma GOF Test					
196	5% K-S Critical Value				0.222		Data Not Gamma Distributed at 5% Significance Level					
197	Data Not Gamma Distributed at 5% Significance Level											
198												
199	Gamma Statistics											
200	k hat (MLE)				7.279		k star (bias corrected MLE)				5.868	
201	Theta hat (MLE)				2.697		Theta star (bias corrected MLE)				3.346	
202	nu hat (MLE)				218.4		nu star (bias corrected)				176	
203	MLE Mean (bias corrected)				19.63		MLE Sd (bias corrected)				8.105	
204												
205	Background Statistics Assuming Gamma Distribution											
206	95% Wilson Hilferty (WH) Approx. Gamma UPL				35.46		90% Percentile				30.47	
207	95% Hawkins Wixley (HW) Approx. Gamma UPL				36.29		95% Percentile				34.58	
208	95% WH Approx. Gamma UTL with		95% Coverage		44.47		99% Percentile				43.2	
209	95% HW Approx. Gamma UTL with		95% Coverage		46.31							
210			95% WH USL		42.46		95% HW USL				44.05	
211												
212	Lognormal GOF Test											
213	Shapiro Wilk Test Statistic				0.768		Shapiro Wilk Lognormal GOF Test					
214	5% Shapiro Wilk Critical Value				0.881		Data Not Lognormal at 5% Significance Level					
215	Lilliefors Test Statistic				0.335		Lilliefors Lognormal GOF Test					
216	5% Lilliefors Critical Value				0.22		Data Not Lognormal at 5% Significance Level					

	A	B	C	D	E	F	G	H	I	J	K	L							
217	Data Not Lognormal at 5% Significance Level																		
218																			
219	Background Statistics assuming Lognormal Distribution																		
220	95% UTL with		95% Coverage	54.3	90% Percentile (z)						31.5								
221			95% UPL (t)	39.57	95% Percentile (z)						36.75								
222			95% USL	50.81	99% Percentile (z)						49.06								
223																			
224	Nonparametric Distribution Free Background Statistics																		
225	Data do not follow a Discernible Distribution (0.05)																		
226																			
227	Nonparametric Upper Limits for Background Threshold Values																		
228	Order of Statistic, r			15	95% UTL with 95% Coverage						29								
229	Approx, f used to compute achieved CC			0.789	Approximate Actual Confidence Coefficient achieved by UTL						0.537								
230					Approximate Sample Size needed to achieve specified CC						59								
231	95% Percentile Bootstrap UTL with		95% Coverage	29	95% BCA Bootstrap UTL with 95% Coverage						29								
232			95% UPL	29	90% Percentile						25								
233			90% Chebyshev UPL	39.58	95% Percentile						26.2								
234			95% Chebyshev UPL	48.62	99% Percentile						28.44								
235			95% USL	29															
236																			
237	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.																		
238	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers																		
239	and consists of observations collected from clean unimpacted locations.																		
240	The use of USL tends to provide a balance between false positives and false negatives provided the data																		
241	represents a background data set and when many onsite observations need to be compared with the BTV.																		
242																			
243	F																		
244																			
245	General Statistics																		
246	Total Number of Observations			17	Number of Missing Observations						0								
247	Number of Distinct Observations			12															
248	Number of Detects			12	Number of Non-Detects						5								
249	Number of Distinct Detects			12	Number of Distinct Non-Detects						1								
250	Minimum Detect			0.12	Minimum Non-Detect						0.2								
251	Maximum Detect			1.65	Maximum Non-Detect						0.2								
252	Variance Detected			0.172	Percent Non-Detects						29.41%								
253	Mean Detected			0.593	SD Detected						0.415								
254	Mean of Detected Logged Data			-0.743	SD of Detected Logged Data						0.719								
255																			
256	Critical Values for Background Threshold Values (BTVs)																		
257	Tolerance Factor K (For UTL)			2.486	d2max (for USL)						2.475								
258																			
259	Normal GOF Test on Detects Only																		
260	Shapiro Wilk Test Statistic			0.866	Shapiro Wilk GOF Test														
261	5% Shapiro Wilk Critical Value			0.859	Detected Data appear Normal at 5% Significance Level														
262	Lilliefors Test Statistic			0.193	Lilliefors GOF Test														
263	5% Lilliefors Critical Value			0.243	Detected Data appear Normal at 5% Significance Level														
264	Detected Data appear Normal at 5% Significance Level																		
265																			
266	Kaplan Meier (KM) Background Statistics Assuming Normal Distribution																		
267	KM Mean			0.454	KM SD						0.397								
268	95% UTL95% Coverage			1.442	95% KM UPL (t)						1.168								
269	90% KM Percentile (z)			0.963	95% KM Percentile (z)						1.107								
270	99% KM Percentile (z)			1.378	95% KM USL						1.437								

	A	B	C	D	E	F	G	H	I	J	K	L
271												
272	DL/2 Substitution Background Statistics Assuming Normal Distribution											
273	Mean				0.448	SD				0.415		
274	95% UTL95% Coverage				1.479	95% UPL (t)				1.193		
275	90% Percentile (z)				0.98	95% Percentile (z)				1.13		
276	99% Percentile (z)				1.413	95% USL				1.474		
277	DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons											
278												
279	Gamma GOF Tests on Detected Observations Only											
280	A-D Test Statistic				0.214	Anderson-Darling GOF Test						
281	5% A-D Critical Value				0.74	Detected data appear Gamma Distributed at 5% Significance Level						
282	K-S Test Statistic				0.133	Kolmogorov-Smirnov GOF						
283	5% K-S Critical Value				0.248	Detected data appear Gamma Distributed at 5% Significance Level						
284	Detected data appear Gamma Distributed at 5% Significance Level											
285												
286	Gamma Statistics on Detected Data Only											
287	k hat (MLE)				2.418	k star (bias corrected MLE)				1.869		
288	Theta hat (MLE)				0.245	Theta star (bias corrected MLE)				0.317		
289	nu hat (MLE)				58.03	nu star (bias corrected)				44.86		
290	MLE Mean (bias corrected)				0.593							
291	MLE Sd (bias corrected)				0.434	95% Percentile of Chisquare (2kstar)				9.06		
292												
293	Gamma ROS Statistics using Imputed Non-Detects											
294	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
295	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
296	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
297	This is especially true when the sample size is small.											
298	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
299	Minimum				0.01	Mean				0.429		
300	Maximum				1.65	Median				0.33		
301	SD				0.433	CV				1.008		
302	k hat (MLE)				0.743	k star (bias corrected MLE)				0.651		
303	Theta hat (MLE)				0.578	Theta star (bias corrected MLE)				0.66		
304	nu hat (MLE)				25.25	nu star (bias corrected)				22.12		
305	MLE Mean (bias corrected)				0.429	MLE Sd (bias corrected)				0.532		
306	95% Percentile of Chisquare (2kstar)				4.548	90% Percentile				1.096		
307	95% Percentile				1.501	99% Percentile				2.472		
308	The following statistics are computed using Gamma ROS Statistics on Imputed Data											
309	Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods											
310		WH	HW			WH	HW					
311	95% Approx. Gamma UTL with 95% Coverage	2.591	3.163		95% Approx. Gamma UPL	1.616						
312	95% Gamma USL	2.573	3.137									
313												
314	Estimates of Gamma Parameters using KM Estimates											
315	Mean (KM)				0.454	SD (KM)				0.397		
316	Variance (KM)				0.158	SE of Mean (KM)				0.101		
317	k hat (KM)				1.307	k star (KM)				1.116		
318	nu hat (KM)				44.44	nu star (KM)				37.93		
319	theta hat (KM)				0.347	theta star (KM)				0.407		
320	80% gamma percentile (KM)				0.724	90% gamma percentile (KM)				1.018		
321	95% gamma percentile (KM)				1.309	99% gamma percentile (KM)				1.98		
322												
323	The following statistics are computed using gamma distribution and KM estimates											
324	Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods											

	A	B	C	D	E	F	G	H	I	J	K	L
325					WH	HW					WH	HW
326	95% Approx. Gamma UTL with 95% Coverage				1.829	1.952	95% Approx. Gamma UPL				1.263	1.297
327	95% KM Gamma Percentile				1.156	1.179	95% Gamma USL				1.819	1.94
328												
329	Lognormal GOF Test on Detected Observations Only											
330	Shapiro Wilk Test Statistic				0.976	Shapiro Wilk GOF Test						
331	5% Shapiro Wilk Critical Value				0.859	Detected Data appear Lognormal at 5% Significance Level						
332	Lilliefors Test Statistic				0.134	Lilliefors GOF Test						
333	5% Lilliefors Critical Value				0.243	Detected Data appear Lognormal at 5% Significance Level						
334	Detected Data appear Lognormal at 5% Significance Level											
335												
336	Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects											
337	Mean in Original Scale				0.455	Mean in Log Scale				-1.162		
338	SD in Original Scale				0.41	SD in Log Scale				0.919		
339	95% UTL95% Coverage				3.076	95% BCA UTL95% Coverage				1.65		
340	95% Bootstrap (%) UTL95% Coverage				1.65	95% UPL (t)				1.632		
341	90% Percentile (z)				1.016	95% Percentile (z)				1.42		
342	99% Percentile (z)				2.656	95% USL				3.045		
343												
344	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
345	KM Mean of Logged Data				-1.148	95% KM UTL (Lognormal)95% Coverage				2.649		
346	KM SD of Logged Data				0.854	95% KM UPL (Lognormal)				1.47		
347	95% KM Percentile Lognormal (z)				1.292	95% KM USL (Lognormal)				2.624		
348												
349	Background DL/2 Statistics Assuming Lognormal Distribution											
350	Mean in Original Scale				0.448	Mean in Log Scale				-1.202		
351	SD in Original Scale				0.415	SD in Log Scale				0.945		
352	95% UTL95% Coverage				3.148	95% UPL (t)				1.641		
353	90% Percentile (z)				1.009	95% Percentile (z)				1.422		
354	99% Percentile (z)				2.707	95% USL				3.115		
355	DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.											
356												
357	Nonparametric Distribution Free Background Statistics											
358	Data appear to follow a Discernible Distribution at 5% Significance Level											
359												
360	Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)											
361	Order of Statistic, r				17	95% UTL with95% Coverage				1.65		
362	Approx, f used to compute achieved CC				0.895	Approximate Actual Confidence Coefficient achieved by UTL				0.582		
363	Approximate Sample Size needed to achieve specified CC				59	95% UPL				1.65		
364	95% USL				1.65	95% KM Chebyshev UPL				2.236		
365												
366	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
367	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
368	and consists of observations collected from clean unimpacted locations.											
369	The use of USL tends to provide a balance between false positives and false negatives provided the data											
370	represents a background data set and when many onsite observations need to be compared with the BTV.											
371												
372	pH											
373												
374	General Statistics											
375	Total Number of Observations				15	Number of Distinct Observations				15		
376						Number of Missing Observations				2		
377	Minimum				6.55	First Quartile				6.985		
378	Second Largest				9.25	Median				7.24		

	A	B	C	D	E	F	G	H	I	J	K	L
379	Maximum					9.63	Third Quartile					8.13
380	Mean					7.591	SD					0.909
381	Coefficient of Variation					0.12	Skewness					1.209
382	Mean of logged Data					2.021	SD of logged Data					0.114
383												
384	Critical Values for Background Threshold Values (BTVs)											
385	Tolerance Factor K (For UTL)					2.566	d2max (for USL)					2.409
386												
387	Normal GOF Test											
388	Shapiro Wilk Test Statistic					0.856	Shapiro Wilk GOF Test					
389	5% Shapiro Wilk Critical Value					0.881	Data Not Normal at 5% Significance Level					
390	Lilliefors Test Statistic					0.288	Lilliefors GOF Test					
391	5% Lilliefors Critical Value					0.22	Data Not Normal at 5% Significance Level					
392	Data Not Normal at 5% Significance Level											
393												
394	Background Statistics Assuming Normal Distribution											
395	95% UTL with		95% Coverage		9.924	90% Percentile (z)					8.757	
396			95% UPL (t)		9.245	95% Percentile (z)					9.087	
397			95% USL		9.782	99% Percentile (z)					9.706	
398												
399	Gamma GOF Test											
400	A-D Test Statistic					0.856	Anderson-Darling Gamma GOF Test					
401	5% A-D Critical Value					0.734	Data Not Gamma Distributed at 5% Significance Level					
402	K-S Test Statistic					0.284	Kolmogorov-Smirnov Gamma GOF Test					
403	5% K-S Critical Value					0.221	Data Not Gamma Distributed at 5% Significance Level					
404	Data Not Gamma Distributed at 5% Significance Level											
405												
406	Gamma Statistics											
407	k hat (MLE)					80.13	k star (bias corrected MLE)					64.15
408	Theta hat (MLE)					0.0947	Theta star (bias corrected MLE)					0.118
409	nu hat (MLE)					2404	nu star (bias corrected)					1925
410	MLE Mean (bias corrected)					7.591	MLE Sd (bias corrected)					0.948
411												
412	Background Statistics Assuming Gamma Distribution											
413	95% Wilson Hilferty (WH) Approx. Gamma UPL					9.266	90% Percentile					8.828
414	95% Hawkins Wixley (HW) Approx. Gamma UPL					9.269	95% Percentile					9.215
415	95% WH Approx. Gamma UTL with		95% Coverage		10.04	99% Percentile					9.969	
416	95% HW Approx. Gamma UTL with		95% Coverage		10.05							
417			95% WH USL		9.87	95% HW USL					9.883	
418												
419	Lognormal GOF Test											
420	Shapiro Wilk Test Statistic					0.882	Shapiro Wilk Lognormal GOF Test					
421	5% Shapiro Wilk Critical Value					0.881	Data appear Lognormal at 5% Significance Level					
422	Lilliefors Test Statistic					0.276	Lilliefors Lognormal GOF Test					
423	5% Lilliefors Critical Value					0.22	Data Not Lognormal at 5% Significance Level					
424	Data appear Approximate Lognormal at 5% Significance Level											
425												
426	Background Statistics assuming Lognormal Distribution											
427	95% UTL with		95% Coverage		10.1	90% Percentile (z)					8.729	
428			95% UPL (t)		9.28	95% Percentile (z)					9.098	
429			95% USL		9.924	99% Percentile (z)					9.831	
430												
431	Nonparametric Distribution Free Background Statistics											
432	Data appear Approximate Lognormal at 5% Significance Level											

	A	B	C	D	E	F	G	H	I	J	K	L
433												
434	Nonparametric Upper Limits for Background Threshold Values											
435	Order of Statistic, r					15	95% UTL with 95% Coverage					9.63
436	Approx, f used to compute achieved CC					0.789	Approximate Actual Confidence Coefficient achieved by UTL					0.537
437							Approximate Sample Size needed to achieve specified CC					59
438	95% Percentile Bootstrap UTL with 95% Coverage					9.63	95% BCA Bootstrap UTL with 95% Coverage					9.63
439	95% UPL					9.63	90% Percentile					8.862
440	90% Chebyshev UPL					10.41	95% Percentile					9.364
441	95% Chebyshev UPL					11.68	99% Percentile					9.577
442	95% USL					9.63						
443												
444	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
445	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
446	and consists of observations collected from clean unimpacted locations.											
447	The use of USL tends to provide a balance between false positives and false negatives provided the data											
448	represents a background data set and when many onsite observations need to be compared with the BTV.											
449												
450	SO4											
451												
452	General Statistics											
453	Total Number of Observations					15	Number of Missing Observations					1
454	Number of Distinct Observations					10						
455	Number of Detects					14	Number of Non-Detects					1
456	Number of Distinct Detects					9	Number of Distinct Non-Detects					1
457	Minimum Detect					75.7	Minimum Non-Detect					1
458	Maximum Detect					2740	Maximum Non-Detect					1
459	Variance Detected					794198	Percent Non-Detects					6.667%
460	Mean Detected					1717	SD Detected					891.2
461	Mean of Detected Logged Data					7.043	SD of Detected Logged Data					1.26
462												
463	Critical Values for Background Threshold Values (BTVs)											
464	Tolerance Factor K (For UTL)					2.566	d2max (for USL)					2.409
465												
466	Normal GOF Test on Detects Only											
467	Shapiro Wilk Test Statistic					0.732	Shapiro Wilk GOF Test					
468	5% Shapiro Wilk Critical Value					0.874	Data Not Normal at 5% Significance Level					
469	Lilliefors Test Statistic					0.367	Lilliefors GOF Test					
470	5% Lilliefors Critical Value					0.226	Data Not Normal at 5% Significance Level					
471	Data Not Normal at 5% Significance Level											
472												
473	Kaplan Meier (KM) Background Statistics Assuming Normal Distribution											
474	KM Mean					1603	KM SD					933.5
475	95% UTL95% Coverage					3998	95% KM UPL (t)					3301
476	90% KM Percentile (z)					2799	95% KM Percentile (z)					3138
477	99% KM Percentile (z)					3774	95% KM USL					3851
478												
479	DL/2 Substitution Background Statistics Assuming Normal Distribution											
480	Mean					1602	SD					966.4
481	95% UTL95% Coverage					4082	95% UPL (t)					3360
482	90% Percentile (z)					2841	95% Percentile (z)					3192
483	99% Percentile (z)					3851	95% USL					3931
484	DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons											
485												
486	Gamma GOF Tests on Detected Observations Only											

	A	B	C	D	E	F	G	H	I	J	K	L	
487	A-D Test Statistic					2.687	Anderson-Darling GOF Test						
488	5% A-D Critical Value					0.753	Data Not Gamma Distributed at 5% Significance Level						
489	K-S Test Statistic					0.443	Kolmogorov-Smirnov GOF						
490	5% K-S Critical Value					0.233	Data Not Gamma Distributed at 5% Significance Level						
491	Data Not Gamma Distributed at 5% Significance Level												
492													
493	Gamma Statistics on Detected Data Only												
494	k hat (MLE)					1.376	k star (bias corrected MLE)					1.129	
495	Theta hat (MLE)					1248	Theta star (bias corrected MLE)					1521	
496	nu hat (MLE)					38.54	nu star (bias corrected)					31.61	
497	MLE Mean (bias corrected)					1717							
498	MLE Sd (bias corrected)					1616	95% Percentile of Chisquare (2kstar)					6.482	
499													
500	Gamma ROS Statistics using Imputed Non-Detects												
501	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs												
502	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)												
503	For such situations, GROS method may yield incorrect values of UCLs and BTVs												
504	This is especially true when the sample size is small.												
505	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates												
506	Minimum					75.7	Mean					1656	
507	Maximum					2740	Median					2000	
508	SD					890.3	CV					0.538	
509	k hat (MLE)					1.417	k star (bias corrected MLE)					1.178	
510	Theta hat (MLE)					1169	Theta star (bias corrected MLE)					1406	
511	nu hat (MLE)					42.51	nu star (bias corrected)					35.34	
512	MLE Mean (bias corrected)					1656	MLE Sd (bias corrected)					1526	
513	95% Percentile of Chisquare (2kstar)					6.664	90% Percentile					3663	
514	95% Percentile					4685	99% Percentile					7032	
515	The following statistics are computed using Gamma ROS Statistics on Imputed Data												
516	Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods												
517					WH	HW					WH	HW	
518	95% Approx. Gamma UTL with 95% Coverage				7584	9109	95% Approx. Gamma UPL				5041	5659	
519	95% Gamma USL				6991	8280							
520													
521	Estimates of Gamma Parameters using KM Estimates												
522	Mean (KM)					1603	SD (KM)					933.5	
523	Variance (KM)					871508	SE of Mean (KM)					250.1	
524	k hat (KM)					2.947	k star (KM)					2.402	
525	nu hat (KM)					88.4	nu star (KM)					72.05	
526	theta hat (KM)					543.8	theta star (KM)					667.2	
527	80% gamma percentile (KM)					2347	90% gamma percentile (KM)					2987	
528	95% gamma percentile (KM)					3591	99% gamma percentile (KM)					4917	
529													
530	The following statistics are computed using gamma distribution and KM estimates												
531	Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods												
532					WH	HW					WH	HW	
533	95% Approx. Gamma UTL with 95% Coverage				9244	12436	95% Approx. Gamma UPL				5770	7008	
534	95% KM Gamma Percentile				5110	6054	95% Gamma USL				8422	11098	
535													
536	Lognormal GOF Test on Detected Observations Only												
537	Shapiro Wilk Test Statistic					0.615	Shapiro Wilk GOF Test						
538	5% Shapiro Wilk Critical Value					0.874	Data Not Lognormal at 5% Significance Level						
539	Lilliefors Test Statistic					0.442	Lilliefors GOF Test						
540	5% Lilliefors Critical Value					0.226	Data Not Lognormal at 5% Significance Level						

	A	B	C	D	E	F	G	H	I	J	K	L
541	Data Not Lognormal at 5% Significance Level											
542												
543	Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects											
544	Mean in Original Scale				1610	Mean in Log Scale				6.885		
545	SD in Original Scale				954.1	SD in Log Scale				1.36		
546	95% UTL95% Coverage				32012	95% BCA UTL95% Coverage				2740		
547	95% Bootstrap (%) UTL95% Coverage				2740	95% UPL (t)				11595		
548	90% Percentile (z)				5583	95% Percentile (z)				9149		
549	99% Percentile (z)				23110	95% USL				25860		
550												
551	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
552	KM Mean of Logged Data				6.573	95% KM UTL (Lognormal)95% Coverage				161793		
553	KM SD of Logged Data				2.113	95% KM UPL (Lognormal)				33396		
554	95% KM Percentile Lognormal (z)				23113	95% KM USL (Lognormal)				116133		
555												
556	Background DL/2 Statistics Assuming Lognormal Distribution											
557	Mean in Original Scale				1602	Mean in Log Scale				6.527		
558	SD in Original Scale				966.4	SD in Log Scale				2.338		
559	95% UTL95% Coverage				275256	95% UPL (t)				48023		
560	90% Percentile (z)				13670	95% Percentile (z)				31958		
561	99% Percentile (z)				157195	95% USL				190716		
562	DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.											
563												
564	Nonparametric Distribution Free Background Statistics											
565	Data do not follow a Discernible Distribution (0.05)											
566												
567	Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)											
568	Order of Statistic, r				15	95% UTL with95% Coverage				2740		
569	Approx, f used to compute achieved CC				0.789	Approximate Actual Confidence Coefficient achieved by UTL				0.537		
570	Approximate Sample Size needed to achieve specified CC				59	95% UPL				2740		
571	95% USL				2740	95% KM Chebyshev UPL				5805		
572												
573	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
574	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
575	and consists of observations collected from clean unimpacted locations.											
576	The use of USL tends to provide a balance between false positives and false negatives provided the data											
577	represents a background data set and when many onsite observations need to be compared with the BTV.											
578												
579	TDS											
580												
581	General Statistics											
582	Total Number of Observations				17	Number of Distinct Observations				13		
583	Minimum				384	First Quartile				3250		
584	Second Largest				3600	Median				3400		
585	Maximum				3900	Third Quartile				3600		
586	Mean				2788	SD				1315		
587	Coefficient of Variation				0.472	Skewness				-1.324		
588	Mean of logged Data				7.698	SD of logged Data				0.857		
589												
590	Critical Values for Background Threshold Values (BTVs)											
591	Tolerance Factor K (For UTL)				2.486	d2max (for USL)				2.475		
592												
593	Normal GOF Test											
594	Shapiro Wilk Test Statistic				0.647	Shapiro Wilk GOF Test						

	A	B	C	D	E	F	G	H	I	J	K	L		
595	5% Shapiro Wilk Critical Value					0.892	Data Not Normal at 5% Significance Level							
596	Lilliefors Test Statistic					0.402	Lilliefors GOF Test							
597	5% Lilliefors Critical Value					0.207	Data Not Normal at 5% Significance Level							
598	Data Not Normal at 5% Significance Level													
599														
600	Background Statistics Assuming Normal Distribution													
601	95% UTL with		95% Coverage		6056	90% Percentile (z)							4473	
602			95% UPL (t)		5150	95% Percentile (z)							4950	
603			95% USL		6041	99% Percentile (z)							5846	
604														
605	Gamma GOF Test													
606	A-D Test Statistic					3.421	Anderson-Darling Gamma GOF Test							
607	5% A-D Critical Value					0.748	Data Not Gamma Distributed at 5% Significance Level							
608	K-S Test Statistic					0.441	Kolmogorov-Smirnov Gamma GOF Test							
609	5% K-S Critical Value					0.211	Data Not Gamma Distributed at 5% Significance Level							
610	Data Not Gamma Distributed at 5% Significance Level													
611														
612	Gamma Statistics													
613	k hat (MLE)					2.283	k star (bias corrected MLE)							1.919
614	Theta hat (MLE)					1221	Theta star (bias corrected MLE)							1452
615	nu hat (MLE)					77.62	nu star (bias corrected)							65.25
616	MLE Mean (bias corrected)					2788	MLE Sd (bias corrected)							2012
617														
618	Background Statistics Assuming Gamma Distribution													
619	95% Wilson Hilferty (WH) Approx. Gamma UPL					7046	90% Percentile							5475
620	95% Hawkins Wixley (HW) Approx. Gamma UPL					7559	95% Percentile							6699
621	95% WH Approx. Gamma UTL with		95% Coverage		9748	99% Percentile							9422	
622	95% HW Approx. Gamma UTL with		95% Coverage		10913									
623			95% WH USL		9699	95% HW USL							10851	
624														
625	Lognormal GOF Test													
626	Shapiro Wilk Test Statistic					0.607	Shapiro Wilk Lognormal GOF Test							
627	5% Shapiro Wilk Critical Value					0.892	Data Not Lognormal at 5% Significance Level							
628	Lilliefors Test Statistic					0.439	Lilliefors Lognormal GOF Test							
629	5% Lilliefors Critical Value					0.207	Data Not Lognormal at 5% Significance Level							
630	Data Not Lognormal at 5% Significance Level													
631														
632	Background Statistics assuming Lognormal Distribution													
633	95% UTL with		95% Coverage		18576	90% Percentile (z)							6614	
634			95% UPL (t)		10285	95% Percentile (z)							9031	
635			95% USL		18399	99% Percentile (z)							16200	
636														
637	Nonparametric Distribution Free Background Statistics													
638	Data do not follow a Discernible Distribution (0.05)													
639														
640	Nonparametric Upper Limits for Background Threshold Values													
641	Order of Statistic, r					17	95% UTL with 95% Coverage							3900
642	Approx, f used to compute achieved CC					0.895	Approximate Actual Confidence Coefficient achieved by UTL							0.582
643							Approximate Sample Size needed to achieve specified CC							59
644	95% Percentile Bootstrap UTL with		95% Coverage		3900	95% BCA Bootstrap UTL with 95% Coverage							3900	
645			95% UPL		3900	90% Percentile							3600	
646			90% Chebyshev UPL		6846	95% Percentile							3660	
647			95% Chebyshev UPL		8685	99% Percentile							3852	
648			95% USL		3900									

	A	B	C	D	E	F	G	H	I	J	K	L
649												
650	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
651	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
652	and consists of observations collected from clean unimpacted locations.											
653	The use of USL tends to provide a balance between false positives and false negatives provided the data											
654	represents a background data set and when many onsite observations need to be compared with the BTV.											
655												

	A	B	C	D	E	F	G	H	I	J	K	L
1				Background Statistics for Data Sets with Non-Detects								
2	User Selected Options											
3	Date/Time of Computation			ProUCL 5.11/27/2020 11:03:25 AM								
4	From File			Ash Landfill ProUCL Input 2019.xls								
5	Full Precision			OFF								
6	Confidence Coefficient			95%								
7	Coverage			95%								
8	Different or Future K Observations			1								
9	Number of Bootstrap Operations			2000								
10												
11	As											
12												
13	General Statistics											
14	Total Number of Observations				17	Number of Missing Observations					0	
15	Number of Distinct Observations				3							
16	Number of Detects				3	Number of Non-Detects					14	
17	Number of Distinct Detects				1	Number of Distinct Non-Detects					3	
18	Minimum Detect				0.001	Minimum Non-Detect					0.001	
19	Maximum Detect				0.001	Maximum Non-Detect					0.004	
20	Variance Detected				0	Percent Non-Detects					82.35%	
21	Mean Detected				0.001	SD Detected					0	
22	Mean of Detected Logged Data				-6.908	SD of Detected Logged Data					0	
23												
24	Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!											
25	It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).											
26												
27	The data set for variable As was not processed!											
28												
29												
30	Ba											
31												
32	General Statistics											
33	Total Number of Observations				17	Number of Distinct Observations					8	
34	Minimum				0.008	First Quartile					0.009	
35	Second Largest				0.067	Median					0.01	
36	Maximum				0.072	Third Quartile					0.012	
37	Mean				0.0232	SD					0.025	
38	Coefficient of Variation				1.079	Skewness					1.389	
39	Mean of logged Data				-4.182	SD of logged Data					0.849	
40												
41	Critical Values for Background Threshold Values (BTVs)											
42	Tolerance Factor K (For UTL)				2.486	d2max (for USL)					2.475	
43												
44	Normal GOF Test											
45	Shapiro Wilk Test Statistic				0.59	Shapiro Wilk GOF Test						
46	5% Shapiro Wilk Critical Value				0.892	Data Not Normal at 5% Significance Level						
47	Lilliefors Test Statistic				0.437	Lilliefors GOF Test						
48	5% Lilliefors Critical Value				0.207	Data Not Normal at 5% Significance Level						
49	Data Not Normal at 5% Significance Level											
50												
51	Background Statistics Assuming Normal Distribution											
52	95% UTL with 95% Coverage				0.0854	90% Percentile (z)					0.0552	
53	95% UPL (t)				0.0681	95% Percentile (z)					0.0643	
54	95% USL				0.0851	99% Percentile (z)					0.0814	

	A	B	C	D	E	F	G	H	I	J	K	L
55												
56	Gamma GOF Test											
57	A-D Test Statistic					3.26	Anderson-Darling Gamma GOF Test					
58	5% A-D Critical Value					0.759	Data Not Gamma Distributed at 5% Significance Level					
59	K-S Test Statistic					0.414	Kolmogorov-Smirnov Gamma GOF Test					
60	5% K-S Critical Value					0.214	Data Not Gamma Distributed at 5% Significance Level					
61	Data Not Gamma Distributed at 5% Significance Level											
62												
63	Gamma Statistics											
64	k hat (MLE)					1.341	k star (bias corrected MLE)					1.143
65	Theta hat (MLE)					0.0173	Theta star (bias corrected MLE)					0.0203
66	nu hat (MLE)					45.58	nu star (bias corrected)					38.87
67	MLE Mean (bias corrected)					0.0232	MLE Sd (bias corrected)					0.0217
68												
69	Background Statistics Assuming Gamma Distribution											
70	95% Wilson Hilferty (WH) Approx. Gamma UPL					0.069	90% Percentile					0.0516
71	95% Hawkins Wixley (HW) Approx. Gamma UPL					0.0693	95% Percentile					0.0662
72	95% WH Approx. Gamma UTL with 95% Coverage					0.103	99% Percentile					0.0998
73	95% HW Approx. Gamma UTL with 95% Coverage					0.107						
74	95% WH USL					0.102	95% HW USL					0.106
75												
76	Lognormal GOF Test											
77	Shapiro Wilk Test Statistic					0.65	Shapiro Wilk Lognormal GOF Test					
78	5% Shapiro Wilk Critical Value					0.892	Data Not Lognormal at 5% Significance Level					
79	Lilliefors Test Statistic					0.376	Lilliefors Lognormal GOF Test					
80	5% Lilliefors Critical Value					0.207	Data Not Lognormal at 5% Significance Level					
81	Data Not Lognormal at 5% Significance Level											
82												
83	Background Statistics assuming Lognormal Distribution											
84	95% UTL with 95% Coverage					0.126	90% Percentile (z)					0.0453
85	95% UPL (t)					0.0702	95% Percentile (z)					0.0617
86	95% USL					0.125	99% Percentile (z)					0.11
87												
88	Nonparametric Distribution Free Background Statistics											
89	Data do not follow a Discernible Distribution (0.05)											
90												
91	Nonparametric Upper Limits for Background Threshold Values											
92	Order of Statistic, r					17	95% UTL with 95% Coverage					0.072
93	Approx, f used to compute achieved CC					0.895	Approximate Actual Confidence Coefficient achieved by UTL					0.582
94							Approximate Sample Size needed to achieve specified CC					59
95	95% Percentile Bootstrap UTL with 95% Coverage					0.072	95% BCA Bootstrap UTL with 95% Coverage					0.072
96	95% UPL					0.072	90% Percentile					0.067
97	90% Chebyshev UPL					0.1	95% Percentile					0.068
98	95% Chebyshev UPL					0.135	99% Percentile					0.0712
99	95% USL					0.072						
100												
101	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
102	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
103	and consists of observations collected from clean unimpacted locations.											
104	The use of USL tends to provide a balance between false positives and false negatives provided the data											
105	represents a background data set and when many onsite observations need to be compared with the BTV.											
106												
107	Be											
108												

	A	B	C	D	E	F	G	H	I	J	K	L
109	General Statistics											
110	Total Number of Observations					17	Number of Missing Observations					0
111	Number of Distinct Observations					2						
112	Number of Detects					0	Number of Non-Detects					17
113	Number of Distinct Detects					0	Number of Distinct Non-Detects					2
114	Minimum Detect					N/A	Minimum Non-Detect					0.001
115	Maximum Detect					N/A	Maximum Non-Detect					0.002
116	Variance Detected					N/A	Percent Non-Detects					100%
117	Mean Detected					N/A	SD Detected					N/A
118	Mean of Detected Logged Data					N/A	SD of Detected Logged Data					N/A
119												
120	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
121	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
122	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
123												
124	The data set for variable Be was not processed!											
125												
126												
127	Cd											
128												
129	General Statistics											
130	Total Number of Observations					17	Number of Missing Observations					0
131	Number of Distinct Observations					4						
132	Number of Detects					0	Number of Non-Detects					17
133	Number of Distinct Detects					0	Number of Distinct Non-Detects					4
134	Minimum Detect					N/A	Minimum Non-Detect					1.0000E-4
135	Maximum Detect					N/A	Maximum Non-Detect					0.002
136	Variance Detected					N/A	Percent Non-Detects					100%
137	Mean Detected					N/A	SD Detected					N/A
138	Mean of Detected Logged Data					N/A	SD of Detected Logged Data					N/A
139												
140	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
141	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
142	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
143												
144	The data set for variable Cd was not processed!											
145												
146												
147	Co											
148												
149	General Statistics											
150	Total Number of Observations					17	Number of Missing Observations					0
151	Number of Distinct Observations					3						
152	Number of Detects					0	Number of Non-Detects					17
153	Number of Distinct Detects					0	Number of Distinct Non-Detects					3
154	Minimum Detect					N/A	Minimum Non-Detect					0.001
155	Maximum Detect					N/A	Maximum Non-Detect					0.004
156	Variance Detected					N/A	Percent Non-Detects					100%
157	Mean Detected					N/A	SD Detected					N/A
158	Mean of Detected Logged Data					N/A	SD of Detected Logged Data					N/A
159												
160	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
161	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
162	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											

	A	B	C	D	E	F	G	H	I	J	K	L
163												
164	The data set for variable Co was not processed!											
165												
166												
167	Cr											
168												
169	General Statistics											
170	Total Number of Observations					17	Number of Missing Observations					0
171	Number of Distinct Observations					5						
172	Number of Detects					4	Number of Non-Detects					13
173	Number of Distinct Detects					3	Number of Distinct Non-Detects					3
174	Minimum Detect					0.002	Minimum Non-Detect					0.001
175	Maximum Detect					0.042	Maximum Non-Detect					0.004
176	Variance Detected					3.9358E-4	Percent Non-Detects					76.47%
177	Mean Detected					0.0123	SD Detected					0.0198
178	Mean of Detected Logged Data					-5.352	SD of Detected Logged Data					1.467
179												
180	Critical Values for Background Threshold Values (BTVs)											
181	Tolerance Factor K (For UTL)					2.486	d2max (for USL)					2.475
182												
183	Normal GOF Test on Detects Only											
184	Shapiro Wilk Test Statistic					0.648	Shapiro Wilk GOF Test					
185	5% Shapiro Wilk Critical Value					0.748	Data Not Normal at 5% Significance Level					
186	Lilliefors Test Statistic					0.429	Lilliefors GOF Test					
187	5% Lilliefors Critical Value					0.375	Data Not Normal at 5% Significance Level					
188	Data Not Normal at 5% Significance Level											
189												
190	Kaplan Meier (KM) Background Statistics Assuming Normal Distribution											
191	KM Mean					0.00367	KM SD					0.0096
192	95% UTL95% Coverage					0.0275	95% KM UPL (t)					0.0209
193	90% KM Percentile (z)					0.016	95% KM Percentile (z)					0.0195
194	99% KM Percentile (z)					0.026	95% KM USL					0.0274
195												
196	DL/2 Substitution Background Statistics Assuming Normal Distribution											
197	Mean					0.00341	SD					0.00998
198	95% UTL95% Coverage					0.0282	95% UPL (t)					0.0213
199	90% Percentile (z)					0.0162	95% Percentile (z)					0.0198
200	99% Percentile (z)					0.0266	95% USL					0.0281
201	DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons											
202												
203	Gamma GOF Tests on Detected Observations Only											
204	A-D Test Statistic					0.797	Anderson-Darling GOF Test					
205	5% A-D Critical Value					0.675	Data Not Gamma Distributed at 5% Significance Level					
206	K-S Test Statistic					0.431	Kolmogorov-Smirnov GOF					
207	5% K-S Critical Value					0.407	Data Not Gamma Distributed at 5% Significance Level					
208	Data Not Gamma Distributed at 5% Significance Level											
209												
210	Gamma Statistics on Detected Data Only											
211	k hat (MLE)					0.644	k star (bias corrected MLE)					0.328
212	Theta hat (MLE)					0.019	Theta star (bias corrected MLE)					0.0374
213	nu hat (MLE)					5.151	nu star (bias corrected)					2.621
214	MLE Mean (bias corrected)					0.0123						
215	MLE Sd (bias corrected)					0.0214	95% Percentile of Chisquare (2kstar)					2.913
216												

	A	B	C	D	E	F	G	H	I	J	K	L
217	Gamma ROS Statistics using Imputed Non-Detects											
218	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
219	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
220	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
221	This is especially true when the sample size is small.											
222	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
223	Minimum				0.002		Mean				0.0105	
224	Maximum				0.042		Median				0.01	
225	SD				0.00865		CV				0.821	
226	k hat (MLE)				2.353		k star (bias corrected MLE)				1.977	
227	Theta hat (MLE)				0.00448		Theta star (bias corrected MLE)				0.00533	
228	nu hat (MLE)				79.99		nu star (bias corrected)				67.21	
229	MLE Mean (bias corrected)				0.0105		MLE Sd (bias corrected)				0.00749	
230	95% Percentile of Chisquare (2kstar)				9.412		90% Percentile				0.0205	
231	95% Percentile				0.0251		99% Percentile				0.0351	
232	The following statistics are computed using Gamma ROS Statistics on Imputed Data											
233	Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods											
234					WH	HW					WH	HW
235	95% Approx. Gamma UTL with 95% Coverage				0.0357	0.0376	95% Approx. Gamma UPL				0.0259	0.0265
236	95% Gamma USL				0.0355	0.0374						
237												
238	Estimates of Gamma Parameters using KM Estimates											
239	Mean (KM)				0.00367		SD (KM)				0.0096	
240	Variance (KM)				9.2127E-5		SE of Mean (KM)				0.00269	
241	k hat (KM)				0.146		k star (KM)				0.16	
242	nu hat (KM)				4.977		nu star (KM)				5.432	
243	theta hat (KM)				0.0251		theta star (KM)				0.023	
244	80% gamma percentile (KM)				0.0042		90% gamma percentile (KM)				0.011	
245	95% gamma percentile (KM)				0.02		99% gamma percentile (KM)				0.0457	
246												
247	The following statistics are computed using gamma distribution and KM estimates											
248	Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods											
249					WH	HW					WH	HW
250	95% Approx. Gamma UTL with 95% Coverage				0.0187	0.0174	95% Approx. Gamma UPL				0.0114	0.0103
251	95% KM Gamma Percentile				0.0102	0.00909	95% Gamma USL				0.0186	0.0173
252												
253	Lognormal GOF Test on Detected Observations Only											
254	Shapiro Wilk Test Statistic				0.723		Shapiro Wilk GOF Test					
255	5% Shapiro Wilk Critical Value				0.748		Data Not Lognormal at 5% Significance Level					
256	Lilliefors Test Statistic				0.372		Lilliefors GOF Test					
257	5% Lilliefors Critical Value				0.375		Detected Data appear Lognormal at 5% Significance Level					
258	Detected Data appear Approximate Lognormal at 5% Significance Level											
259												
260	Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects											
261	Mean in Original Scale				0.00298		Mean in Log Scale				-8.833	
262	SD in Original Scale				0.0101		SD in Log Scale				2.537	
263	95% UTL95% Coverage				0.0799		95% BCA UTL95% Coverage				0.042	
264	95% Bootstrap (%) UTL95% Coverage				0.042		95% UPL (t)				0.0139	
265	90% Percentile (z)				0.00376		95% Percentile (z)				0.00946	
266	99% Percentile (z)				0.0533		95% USL				0.0777	
267												
268	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
269	KM Mean of Logged Data				-6.525		95% KM UTL (Lognormal)95% Coverage				0.0139	
270	KM SD of Logged Data				0.903		95% KM UPL (Lognormal)				0.00743	

	A	B	C	D	E	F	G	H	I	J	K	L
271	95% KM Percentile Lognormal (z)					0.00648	95% KM USL (Lognormal)					0.0137
272												
273	Background DL/2 Statistics Assuming Lognormal Distribution											
274	Mean in Original Scale				0.00341	Mean in Log Scale				-6.926		
275	SD in Original Scale				0.00998	SD in Log Scale				1.174		
276	95% UTL95% Coverage				0.0182	95% UPL (t)				0.0081		
277	90% Percentile (z)				0.00442	95% Percentile (z)				0.00678		
278	99% Percentile (z)				0.0151	95% USL				0.018		
279	DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.											
280												
281	Nonparametric Distribution Free Background Statistics											
282	Data appear to follow a Discernible Distribution at 5% Significance Level											
283												
284	Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)											
285	Order of Statistic, r				17	95% UTL with95% Coverage				0.042		
286	Approx, f used to compute achieved CC				0.895	Approximate Actual Confidence Coefficient achieved by UTL				0.582		
287	Approximate Sample Size needed to achieve specified CC				59	95% UPL				0.042		
288	95% USL				0.042	95% KM Chebyshev UPL				0.0467		
289												
290	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
291	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
292	and consists of observations collected from clean unimpacted locations.											
293	The use of USL tends to provide a balance between false positives and false negatives provided the data											
294	represents a background data set and when many onsite observations need to be compared with the BTV.											
295												
296	F											
297												
298	General Statistics											
299	Total Number of Observations				17	Number of Missing Observations				0		
300	Number of Distinct Observations				12							
301	Number of Detects				12	Number of Non-Detects				5		
302	Number of Distinct Detects				12	Number of Distinct Non-Detects				1		
303	Minimum Detect				0.12	Minimum Non-Detect				0.2		
304	Maximum Detect				1.65	Maximum Non-Detect				0.2		
305	Variance Detected				0.172	Percent Non-Detects				29.41%		
306	Mean Detected				0.593	SD Detected				0.415		
307	Mean of Detected Logged Data				-0.743	SD of Detected Logged Data				0.719		
308												
309	Critical Values for Background Threshold Values (BTVs)											
310	Tolerance Factor K (For UTL)				2.486	d2max (for USL)				2.475		
311												
312	Normal GOF Test on Detects Only											
313	Shapiro Wilk Test Statistic				0.866	Shapiro Wilk GOF Test						
314	5% Shapiro Wilk Critical Value				0.859	Detected Data appear Normal at 5% Significance Level						
315	Lilliefors Test Statistic				0.193	Lilliefors GOF Test						
316	5% Lilliefors Critical Value				0.243	Detected Data appear Normal at 5% Significance Level						
317	Detected Data appear Normal at 5% Significance Level											
318												
319	Kaplan Meier (KM) Background Statistics Assuming Normal Distribution											
320	KM Mean				0.454	KM SD				0.397		
321	95% UTL95% Coverage				1.442	95% KM UPL (t)				1.168		
322	90% KM Percentile (z)				0.963	95% KM Percentile (z)				1.107		
323	99% KM Percentile (z)				1.378	95% KM USL				1.437		
324												

	A	B	C	D	E	F	G	H	I	J	K	L
325	DL/2 Substitution Background Statistics Assuming Normal Distribution											
326	Mean					0.448	SD					0.415
327	95% UTL95% Coverage					1.479	95% UPL (t)					1.193
328	90% Percentile (z)					0.98	95% Percentile (z)					1.13
329	99% Percentile (z)					1.413	95% USL					1.474
330	DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons											
331												
332	Gamma GOF Tests on Detected Observations Only											
333	A-D Test Statistic					0.214	Anderson-Darling GOF Test					
334	5% A-D Critical Value					0.74	Detected data appear Gamma Distributed at 5% Significance Level					
335	K-S Test Statistic					0.133	Kolmogorov-Smirnov GOF					
336	5% K-S Critical Value					0.248	Detected data appear Gamma Distributed at 5% Significance Level					
337	Detected data appear Gamma Distributed at 5% Significance Level											
338												
339	Gamma Statistics on Detected Data Only											
340	k hat (MLE)					2.418	k star (bias corrected MLE)					1.869
341	Theta hat (MLE)					0.245	Theta star (bias corrected MLE)					0.317
342	nu hat (MLE)					58.03	nu star (bias corrected)					44.86
343	MLE Mean (bias corrected)					0.593						
344	MLE Sd (bias corrected)					0.434	95% Percentile of Chisquare (2kstar)					9.06
345												
346	Gamma ROS Statistics using Imputed Non-Detects											
347	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
348	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
349	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
350	This is especially true when the sample size is small.											
351	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
352	Minimum					0.01	Mean					0.429
353	Maximum					1.65	Median					0.33
354	SD					0.433	CV					1.008
355	k hat (MLE)					0.743	k star (bias corrected MLE)					0.651
356	Theta hat (MLE)					0.578	Theta star (bias corrected MLE)					0.66
357	nu hat (MLE)					25.25	nu star (bias corrected)					22.12
358	MLE Mean (bias corrected)					0.429	MLE Sd (bias corrected)					0.532
359	95% Percentile of Chisquare (2kstar)					4.548	90% Percentile					1.096
360	95% Percentile					1.501	99% Percentile					2.472
361	The following statistics are computed using Gamma ROS Statistics on Imputed Data											
362	Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods											
363				WH	HW					WH	HW	
364	95% Approx. Gamma UTL with 95% Coverage			2.591	3.163	95% Approx. Gamma UPL			1.616	1.817		
365	95% Gamma USL			2.573	3.137							
366												
367	Estimates of Gamma Parameters using KM Estimates											
368	Mean (KM)					0.454	SD (KM)					0.397
369	Variance (KM)					0.158	SE of Mean (KM)					0.101
370	k hat (KM)					1.307	k star (KM)					1.116
371	nu hat (KM)					44.44	nu star (KM)					37.93
372	theta hat (KM)					0.347	theta star (KM)					0.407
373	80% gamma percentile (KM)					0.724	90% gamma percentile (KM)					1.018
374	95% gamma percentile (KM)					1.309	99% gamma percentile (KM)					1.98
375												
376	The following statistics are computed using gamma distribution and KM estimates											
377	Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods											
378				WH	HW					WH	HW	

	A	B	C	D	E	F	G	H	I	J	K	L
379	95% Approx. Gamma UTL with 95% Coverage				1.829	1.952	95% Approx. Gamma UPL				1.263	1.297
380	95% KM Gamma Percentile				1.156	1.179	95% Gamma USL				1.819	1.94
381												
382	Lognormal GOF Test on Detected Observations Only											
383	Shapiro Wilk Test Statistic				0.976		Shapiro Wilk GOF Test					
384	5% Shapiro Wilk Critical Value				0.859		Detected Data appear Lognormal at 5% Significance Level					
385	Lilliefors Test Statistic				0.134		Lilliefors GOF Test					
386	5% Lilliefors Critical Value				0.243		Detected Data appear Lognormal at 5% Significance Level					
387	Detected Data appear Lognormal at 5% Significance Level											
388												
389	Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects											
390	Mean in Original Scale				0.455		Mean in Log Scale				-1.162	
391	SD in Original Scale				0.41		SD in Log Scale				0.919	
392	95% UTL95% Coverage				3.076		95% BCA UTL95% Coverage				1.65	
393	95% Bootstrap (%) UTL95% Coverage				1.65		95% UPL (t)				1.632	
394	90% Percentile (z)				1.016		95% Percentile (z)				1.42	
395	99% Percentile (z)				2.656		95% USL				3.045	
396												
397	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
398	KM Mean of Logged Data				-1.148		95% KM UTL (Lognormal)95% Coverage				2.649	
399	KM SD of Logged Data				0.854		95% KM UPL (Lognormal)				1.47	
400	95% KM Percentile Lognormal (z)				1.292		95% KM USL (Lognormal)				2.624	
401												
402	Background DL/2 Statistics Assuming Lognormal Distribution											
403	Mean in Original Scale				0.448		Mean in Log Scale				-1.202	
404	SD in Original Scale				0.415		SD in Log Scale				0.945	
405	95% UTL95% Coverage				3.148		95% UPL (t)				1.641	
406	90% Percentile (z)				1.009		95% Percentile (z)				1.422	
407	99% Percentile (z)				2.707		95% USL				3.115	
408	DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.											
409												
410	Nonparametric Distribution Free Background Statistics											
411	Data appear to follow a Discernible Distribution at 5% Significance Level											
412												
413	Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)											
414	Order of Statistic, r				17		95% UTL with95% Coverage				1.65	
415	Approx, f used to compute achieved CC				0.895		Approximate Actual Confidence Coefficient achieved by UTL				0.582	
416	Approximate Sample Size needed to achieve specified CC				59		95% UPL				1.65	
417	95% USL				1.65		95% KM Chebyshev UPL				2.236	
418												
419	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
420	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
421	and consists of observations collected from clean unimpacted locations.											
422	The use of USL tends to provide a balance between false positives and false negatives provided the data											
423	represents a background data set and when many onsite observations need to be compared with the BTV.											
424												
425	Hg											
426												
427	General Statistics											
428	Total Number of Observations				17		Number of Missing Observations				0	
429	Number of Distinct Observations				2							
430	Number of Detects				0		Number of Non-Detects				17	
431	Number of Distinct Detects				0		Number of Distinct Non-Detects				2	
432	Minimum Detect				N/A		Minimum Non-Detect				1.0000E-4	

	A	B	C	D	E	F	G	H	I	J	K	L
433	Maximum Detect					N/A	Maximum Non-Detect					2.0000E-4
434	Variance Detected					N/A	Percent Non-Detects					100%
435	Mean Detected					N/A	SD Detected					N/A
436	Mean of Detected Logged Data					N/A	SD of Detected Logged Data					N/A
437												
438	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
439	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
440	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
441												
442	The data set for variable Hg was not processed!											
443												
444												
445	Li											
446												
447	General Statistics											
448	Total Number of Observations					17	Number of Distinct Observations					16
449	Minimum					0.052	First Quartile					0.387
450	Second Largest					0.525	Median					0.402
451	Maximum					0.57	Third Quartile					0.41
452	Mean					0.344	SD					0.166
453	Coefficient of Variation					0.484	Skewness					-1.018
454	Mean of logged Data					-1.298	SD of logged Data					0.842
455												
456	Critical Values for Background Threshold Values (BTVs)											
457	Tolerance Factor K (For UTL)					2.486	d2max (for USL)					2.475
458												
459	Normal GOF Test											
460	Shapiro Wilk Test Statistic					0.76	Shapiro Wilk GOF Test					
461	5% Shapiro Wilk Critical Value					0.892	Data Not Normal at 5% Significance Level					
462	Lilliefors Test Statistic					0.367	Lilliefors GOF Test					
463	5% Lilliefors Critical Value					0.207	Data Not Normal at 5% Significance Level					
464	Data Not Normal at 5% Significance Level											
465												
466	Background Statistics Assuming Normal Distribution											
467	95% UTL with 95% Coverage					0.757	90% Percentile (z)					0.557
468	95% UPL (t)					0.643	95% Percentile (z)					0.617
469	95% USL					0.755	99% Percentile (z)					0.731
470												
471	Gamma GOF Test											
472	A-D Test Statistic					2.796	Anderson-Darling Gamma GOF Test					
473	5% A-D Critical Value					0.748	Data Not Gamma Distributed at 5% Significance Level					
474	K-S Test Statistic					0.421	Kolmogorov-Smirnov Gamma GOF Test					
475	5% K-S Critical Value					0.211	Data Not Gamma Distributed at 5% Significance Level					
476	Data Not Gamma Distributed at 5% Significance Level											
477												
478	Gamma Statistics											
479	k hat (MLE)					2.321	k star (bias corrected MLE)					1.95
480	Theta hat (MLE)					0.148	Theta star (bias corrected MLE)					0.176
481	nu hat (MLE)					78.9	nu star (bias corrected)					66.31
482	MLE Mean (bias corrected)					0.344	MLE Sd (bias corrected)					0.246
483												
484	Background Statistics Assuming Gamma Distribution											
485	95% Wilson Hiferty (WH) Approx. Gamma UPL					0.864	90% Percentile					0.673
486	95% Hawkins Wixley (HW) Approx. Gamma UPL					0.924	95% Percentile					0.822

	A	B	C	D	E	F	G	H	I	J	K	L
487	95% WH Approx. Gamma UTL with 95% Coverage					1.193	99% Percentile					1.154
488	95% HW Approx. Gamma UTL with 95% Coverage					1.33						
489	95% WH USL					1.187	95% HW USL					1.323
490												
491	Lognormal GOF Test											
492	Shapiro Wilk Test Statistic					0.66	Shapiro Wilk Lognormal GOF Test					
493	5% Shapiro Wilk Critical Value					0.892	Data Not Lognormal at 5% Significance Level					
494	Lilliefors Test Statistic					0.425	Lilliefors Lognormal GOF Test					
495	5% Lilliefors Critical Value					0.207	Data Not Lognormal at 5% Significance Level					
496	Data Not Lognormal at 5% Significance Level											
497												
498	Background Statistics assuming Lognormal Distribution											
499	95% UTL with 95% Coverage					2.216	90% Percentile (z)					0.804
500	95% UPL (t)					1.24	95% Percentile (z)					1.091
501	95% USL					2.195	99% Percentile (z)					1.937
502												
503	Nonparametric Distribution Free Background Statistics											
504	Data do not follow a Discernible Distribution (0.05)											
505												
506	Nonparametric Upper Limits for Background Threshold Values											
507	Order of Statistic, r					17	95% UTL with 95% Coverage					0.57
508	Approx, f used to compute achieved CC					0.895	Approximate Actual Confidence Coefficient achieved by UTL					0.582
509							Approximate Sample Size needed to achieve specified CC					59
510	95% Percentile Bootstrap UTL with 95% Coverage					0.57	95% BCA Bootstrap UTL with 95% Coverage					0.57
511	95% UPL					0.57	90% Percentile					0.474
512	90% Chebyshev UPL					0.857	95% Percentile					0.534
513	95% Chebyshev UPL					1.09	99% Percentile					0.563
514	95% USL					0.57						
515												
516	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
517	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
518	and consists of observations collected from clean unimpacted locations.											
519	The use of USL tends to provide a balance between false positives and false negatives provided the data											
520	represents a background data set and when many onsite observations need to be compared with the BTV.											
521												
522	Mo											
523												
524	General Statistics											
525	Total Number of Observations					17	Number of Missing Observations					0
526	Number of Distinct Observations					8						
527	Number of Detects					5	Number of Non-Detects					12
528	Number of Distinct Detects					5	Number of Distinct Non-Detects					3
529	Minimum Detect					0.002	Minimum Non-Detect					0.001
530	Maximum Detect					0.056	Maximum Non-Detect					0.004
531	Variance Detected					4.4270E-4	Percent Non-Detects					70.59%
532	Mean Detected					0.0352	SD Detected					0.021
533	Mean of Detected Logged Data					-3.774	SD of Detected Logged Data					1.386
534												
535	Critical Values for Background Threshold Values (BTVs)											
536	Tolerance Factor K (For UTL)					2.486	d2max (for USL)					2.475
537												
538	Normal GOF Test on Detects Only											
539	Shapiro Wilk Test Statistic					0.925	Shapiro Wilk GOF Test					
540	5% Shapiro Wilk Critical Value					0.762	Detected Data appear Normal at 5% Significance Level					

	A	B	C	D	E	F	G	H	I	J	K	L	
541	Lilliefors Test Statistic					0.209	Lilliefors GOF Test						
542	5% Lilliefors Critical Value					0.343	Detected Data appear Normal at 5% Significance Level						
543	Detected Data appear Normal at 5% Significance Level												
544													
545	Kaplan Meier (KM) Background Statistics Assuming Normal Distribution												
546	KM Mean					0.0111	KM SD					0.0186	
547	95% UTL95% Coverage					0.0574	95% KM UPL (t)					0.0445	
548	90% KM Percentile (z)					0.0349	95% KM Percentile (z)					0.0417	
549	99% KM Percentile (z)					0.0544	95% KM USL					0.0572	
550													
551	DL/2 Substitution Background Statistics Assuming Normal Distribution												
552	Mean					0.0109	SD					0.0193	
553	95% UTL95% Coverage					0.0589	95% UPL (t)					0.0456	
554	90% Percentile (z)					0.0356	95% Percentile (z)					0.0426	
555	99% Percentile (z)					0.0558	95% USL					0.0587	
556	DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons												
557													
558	Gamma GOF Tests on Detected Observations Only												
559	A-D Test Statistic					0.692	Anderson-Darling GOF Test						
560	5% A-D Critical Value					0.688	Data Not Gamma Distributed at 5% Significance Level						
561	K-S Test Statistic					0.333	Kolmogorov-Smirnov GOF						
562	5% K-S Critical Value					0.363	Detected data appear Gamma Distributed at 5% Significance Level						
563	Detected data follow Appr. Gamma Distribution at 5% Significance Level												
564													
565	Gamma Statistics on Detected Data Only												
566	k hat (MLE)					1.313	k star (bias corrected MLE)					0.658	
567	Theta hat (MLE)					0.0268	Theta star (bias corrected MLE)					0.0535	
568	nu hat (MLE)					13.13	nu star (bias corrected)					6.585	
569	MLE Mean (bias corrected)					0.0352							
570	MLE Sd (bias corrected)					0.0434	95% Percentile of Chisquare (2kstar)					4.582	
571													
572	Gamma ROS Statistics using Imputed Non-Detects												
573	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs												
574	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)												
575	For such situations, GROS method may yield incorrect values of UCLs and BTVs												
576	This is especially true when the sample size is small.												
577	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates												
578	Minimum					0.002	Mean					0.0174	
579	Maximum					0.056	Median					0.01	
580	SD					0.0158	CV					0.909	
581	k hat (MLE)					1.761	k star (bias corrected MLE)					1.49	
582	Theta hat (MLE)					0.00989	Theta star (bias corrected MLE)					0.0117	
583	nu hat (MLE)					59.88	nu star (bias corrected)					50.65	
584	MLE Mean (bias corrected)					0.0174	MLE Sd (bias corrected)					0.0143	
585	95% Percentile of Chisquare (2kstar)					7.779	90% Percentile					0.0363	
586	95% Percentile					0.0455	99% Percentile					0.0661	
587	The following statistics are computed using Gamma ROS Statistics on Imputed Data												
588	Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods												
589					WH	HW					WH	HW	
590	95% Approx. Gamma UTL with 95% Coverage				0.0677	0.0712	95% Approx. Gamma UPL				0.0473	0.0481	
591	95% Gamma USL				0.0674	0.0708							
592													
593	Estimates of Gamma Parameters using KM Estimates												
594	Mean (KM)					0.0111	SD (KM)					0.0186	

	A	B	C	D	E	F	G	H	I	J	K	L
595	Variance (KM)					3.4679E-4	SE of Mean (KM)					0.00505
596	k hat (KM)					0.353	k star (KM)					0.33
597	nu hat (KM)					12.01	nu star (KM)					11.23
598	theta hat (KM)					0.0313	theta star (KM)					0.0335
599	80% gamma percentile (KM)					0.0173	90% gamma percentile (KM)					0.0322
600	95% gamma percentile (KM)					0.0491	99% gamma percentile (KM)					0.0923
601												
602	The following statistics are computed using gamma distribution and KM estimates											
603	Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods											
604					WH	HW					WH	HW
605	95% Approx. Gamma UTL with 95% Coverage				0.0761	0.0826	95% Approx. Gamma UPL				0.0432	0.043
606	95% KM Gamma Percentile				0.0375	0.0367	95% Gamma USL				0.0755	0.0818
607												
608	Lognormal GOF Test on Detected Observations Only											
609	Shapiro Wilk Test Statistic					0.71	Shapiro Wilk GOF Test					
610	5% Shapiro Wilk Critical Value					0.762	Data Not Lognormal at 5% Significance Level					
611	Lilliefors Test Statistic					0.367	Lilliefors GOF Test					
612	5% Lilliefors Critical Value					0.343	Data Not Lognormal at 5% Significance Level					
613	Data Not Lognormal at 5% Significance Level											
614												
615	Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects											
616	Mean in Original Scale					0.0109	Mean in Log Scale					-6.746
617	SD in Original Scale					0.0193	SD in Log Scale					2.428
618	95% UTL95% Coverage					0.492	95% BCA UTL95% Coverage					0.056
619	95% Bootstrap (%) UTL95% Coverage					0.056	95% UPL (t)					0.0923
620	90% Percentile (z)					0.0264	95% Percentile (z)					0.0638
621	99% Percentile (z)					0.334	95% USL					0.479
622												
623	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
624	KM Mean of Logged Data					-5.979	95% KM UTL (Lognormal)95% Coverage					0.127
625	KM SD of Logged Data					1.576	95% KM UPL (Lognormal)					0.0429
626	95% KM Percentile Lognormal (z)					0.0338	95% KM USL (Lognormal)					0.125
627												
628	Background DL/2 Statistics Assuming Lognormal Distribution											
629	Mean in Original Scale					0.0109	Mean in Log Scale					-6.329
630	SD in Original Scale					0.0193	SD in Log Scale					1.88
631	95% UTL95% Coverage					0.191	95% UPL (t)					0.0523
632	90% Percentile (z)					0.0198	95% Percentile (z)					0.0393
633	99% Percentile (z)					0.142	95% USL					0.187
634	DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.											
635												
636	Nonparametric Distribution Free Background Statistics											
637	Data appear to follow a Discernible Distribution at 5% Significance Level											
638												
639	Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)											
640	Order of Statistic, r					17	95% UTL with95% Coverage					0.056
641	Approx, f used to compute achieved CC					0.895	Approximate Actual Confidence Coefficient achieved by UTL					0.582
642	Approximate Sample Size needed to achieve specified CC					59	95% UPL					0.056
643	95% USL					0.056	95% KM Chebyshev UPL					0.0946
644												
645	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
646	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
647	and consists of observations collected from clean unimpacted locations.											
648	The use of USL tends to provide a balance between false positives and false negatives provided the data											

	A	B	C	D	E	F	G	H	I	J	K	L
649	represents a background data set and when many onsite observations need to be compared with the BTV.											
650												
651	Pb											
652												
653	General Statistics											
654	Total Number of Observations				17	Number of Missing Observations				0		
655	Number of Distinct Observations				4							
656	Number of Detects				2	Number of Non-Detects				15		
657	Number of Distinct Detects				2	Number of Distinct Non-Detects				3		
658	Minimum Detect				0.001	Minimum Non-Detect				0.001		
659	Maximum Detect				0.002	Maximum Non-Detect				0.004		
660	Variance Detected				5.0000E-7	Percent Non-Detects				88.24%		
661	Mean Detected				0.0015	SD Detected				7.0711E-4		
662	Mean of Detected Logged Data				-6.561	SD of Detected Logged Data				0.49		
663												
664	Warning: Data set has only 2 Detected Values.											
665	This is not enough to compute meaningful or reliable statistics and estimates.											
666												
667												
668	Critical Values for Background Threshold Values (BTVs)											
669	Tolerance Factor K (For UTL)				2.486	d2max (for USL)				2.475		
670												
671	Normal GOF Test on Detects Only											
672	Not Enough Data to Perform GOF Test											
673												
674	Kaplan Meier (KM) Background Statistics Assuming Normal Distribution											
675	KM Mean				0.00107	KM SD				2.4944E-4		
676	95% UTL95% Coverage				0.00169	95% KM UPL (t)				0.00151		
677	90% KM Percentile (z)				0.00139	95% KM Percentile (z)				0.00148		
678	99% KM Percentile (z)				0.00165	95% KM USL				0.00168		
679												
680	DL/2 Substitution Background Statistics Assuming Normal Distribution											
681	Mean				7.6471E-4	SD				5.3379E-4		
682	95% UTL95% Coverage				0.00209	95% UPL (t)				0.00172		
683	90% Percentile (z)				0.00145	95% Percentile (z)				0.00164		
684	99% Percentile (z)				0.00201	95% USL				0.00209		
685	DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons											
686												
687	Gamma GOF Tests on Detected Observations Only											
688	Not Enough Data to Perform GOF Test											
689												
690	Gamma Statistics on Detected Data Only											
691	k hat (MLE)				8.653	k star (bias corrected MLE)				N/A		
692	Theta hat (MLE)				1.7334E-4	Theta star (bias corrected MLE)				N/A		
693	nu hat (MLE)				34.61	nu star (bias corrected)				N/A		
694	MLE Mean (bias corrected)				N/A							
695	MLE Sd (bias corrected)				N/A	95% Percentile of Chisquare (2kstar)				N/A		
696												
697	Estimates of Gamma Parameters using KM Estimates											
698	Mean (KM)				0.00107	SD (KM)				2.4944E-4		
699	Variance (KM)				6.2222E-8	SE of Mean (KM)				9.1084E-5		
700	k hat (KM)				18.29	k star (KM)				15.1		
701	nu hat (KM)				621.7	nu star (KM)				513.3		
702	theta hat (KM)				5.8333E-5	theta star (KM)				7.0649E-5		

	A	B	C	D	E	F	G	H	I	J	K	L
703	80% gamma percentile (KM)					0.00129	90% gamma percentile (KM)					0.00143
704	95% gamma percentile (KM)					0.00155	99% gamma percentile (KM)					0.00181
705												
706	The following statistics are computed using gamma distribution and KM estimates											
707	Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods											
708					WH	HW					WH	HW
709	95% Approx. Gamma UTL with 95% Coverage				0.00164	0.00163	95% Approx. Gamma UPL				0.00146	0.00145
710	95% KM Gamma Percentile				0.00142	0.00141	95% Gamma USL				0.00163	0.00163
711												
712	Lognormal GOF Test on Detected Observations Only											
713	Not Enough Data to Perform GOF Test											
714												
715	Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects											
716	Mean in Original Scale				2.5953E-4		Mean in Log Scale				-9.526	
717	SD in Original Scale				5.0902E-4		SD in Log Scale				1.666	
718	95% UTL95% Coverage				0.00459		95% BCA UTL95% Coverage				0.002	
719	95% Bootstrap (%) UTL95% Coverage				0.002		95% UPL (t)				0.00145	
720	90% Percentile (z)				6.1669E-4		95% Percentile (z)				0.00113	
721	99% Percentile (z)				0.00351		95% USL				0.0045	
722												
723	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
724	KM Mean of Logged Data				-6.862		95% KM UTL (Lognormal)95% Coverage				0.00161	
725	KM SD of Logged Data				0.173		95% KM UPL (Lognormal)				0.00143	
726	95% KM Percentile Lognormal (z)				0.00139		95% KM USL (Lognormal)				0.00161	
727												
728	Background DL/2 Statistics Assuming Lognormal Distribution											
729	Mean in Original Scale				7.6471E-4		Mean in Log Scale				-7.332	
730	SD in Original Scale				5.3379E-4		SD in Log Scale				0.519	
731	95% UTL95% Coverage				0.00237		95% UPL (t)				0.00166	
732	90% Percentile (z)				0.00127		95% Percentile (z)				0.00154	
733	99% Percentile (z)				0.00219		95% USL				0.00236	
734	DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.											
735												
736	Nonparametric Distribution Free Background Statistics											
737	Data do not follow a Discernible Distribution (0.05)											
738												
739	Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)											
740	Order of Statistic, r				17		95% UTL with95% Coverage				0.004	
741	Approx, f used to compute achieved CC				0.895		Approximate Actual Confidence Coefficient achieved by UTL				0.582	
742	Approximate Sample Size needed to achieve specified CC				59		95% UPL				0.004	
743	95% USL				0.004		95% KM Chebyshev UPL				0.00219	
744												
745	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
746	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
747	and consists of observations collected from clean unimpacted locations.											
748	The use of USL tends to provide a balance between false positives and false negatives provided the data											
749	represents a background data set and when many onsite observations need to be compared with the BTV.											
750												
751	Ra											
752												
753	General Statistics											
754	Total Number of Observations				15		Number of Missing Observations				2	
755	Number of Distinct Observations				15							
756	Number of Detects				12		Number of Non-Detects				3	

	A	B	C	D	E	F	G	H	I	J	K	L
757	Number of Distinct Detects					12	Number of Distinct Non-Detects					3
758	Minimum Detect					0.797	Minimum Non-Detect					0.48
759	Maximum Detect					3	Maximum Non-Detect					1.66
760	Variance Detected					0.544	Percent Non-Detects					20%
761	Mean Detected					1.473	SD Detected					0.738
762	Mean of Detected Logged Data					0.289	SD of Detected Logged Data					0.447
763												
764	Critical Values for Background Threshold Values (BTVs)											
765	Tolerance Factor K (For UTL)					2.566	d2max (for USL)					2.409
766												
767	Normal GOF Test on Detects Only											
768	Shapiro Wilk Test Statistic					0.824	Shapiro Wilk GOF Test					
769	5% Shapiro Wilk Critical Value					0.859	Data Not Normal at 5% Significance Level					
770	Lilliefors Test Statistic					0.228	Lilliefors GOF Test					
771	5% Lilliefors Critical Value					0.243	Detected Data appear Normal at 5% Significance Level					
772	Detected Data appear Approximate Normal at 5% Significance Level											
773												
774	Kaplan Meier (KM) Background Statistics Assuming Normal Distribution											
775	KM Mean					1.309	KM SD					0.726
776	95% UTL95% Coverage					3.172	95% KM UPL (t)					2.63
777	90% KM Percentile (z)					2.24	95% KM Percentile (z)					2.504
778	99% KM Percentile (z)					2.998	95% KM USL					3.058
779												
780	DL/2 Substitution Background Statistics Assuming Normal Distribution											
781	Mean					1.274	SD					0.783
782	95% UTL95% Coverage					3.282	95% UPL (t)					2.697
783	90% Percentile (z)					2.277	95% Percentile (z)					2.561
784	99% Percentile (z)					3.094	95% USL					3.159
785	DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons											
786												
787	Gamma GOF Tests on Detected Observations Only											
788	A-D Test Statistic					0.625	Anderson-Darling GOF Test					
789	5% A-D Critical Value					0.732	Detected data appear Gamma Distributed at 5% Significance Level					
790	K-S Test Statistic					0.203	Kolmogorov-Smirnov GOF					
791	5% K-S Critical Value					0.246	Detected data appear Gamma Distributed at 5% Significance Level					
792	Detected data appear Gamma Distributed at 5% Significance Level											
793												
794	Gamma Statistics on Detected Data Only											
795	k hat (MLE)					5.236	k star (bias corrected MLE)					3.982
796	Theta hat (MLE)					0.281	Theta star (bias corrected MLE)					0.37
797	nu hat (MLE)					125.7	nu star (bias corrected)					95.58
798	MLE Mean (bias corrected)					1.473						
799	MLE Sd (bias corrected)					0.738	95% Percentile of Chisquare (2kstar)					15.46
800												
801	Gamma ROS Statistics using Imputed Non-Detects											
802	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
803	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
804	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
805	This is especially true when the sample size is small.											
806	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
807	Minimum					0.214	Mean					1.272
808	Maximum					3	Median					1
809	SD					0.793	CV					0.624
810	k hat (MLE)					2.456	k star (bias corrected MLE)					2.01

	A	B	C	D	E	F	G	H	I	J	K	L
811	Theta hat (MLE)					0.518	Theta star (bias corrected MLE)					0.633
812	nu hat (MLE)					73.69	nu star (bias corrected)					60.29
813	MLE Mean (bias corrected)					1.272	MLE Sd (bias corrected)					0.897
814	95% Percentile of Chisquare (2kstar)					9.519	90% Percentile					2.47
815	95% Percentile					3.012	99% Percentile					4.212
816	The following statistics are computed using Gamma ROS Statistics on Imputed Data											
817	Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods											
818					WH	HW					WH	HW
819	95% Approx. Gamma UTL with 95% Coverage				4.446	4.815	95% Approx. Gamma UPL				3.159	3.297
820	95% Gamma USL				4.151	4.459						
821												
822	Estimates of Gamma Parameters using KM Estimates											
823	Mean (KM)				1.309	SD (KM)				0.726		
824	Variance (KM)				0.527	SE of Mean (KM)				0.197		
825	k hat (KM)				3.253	k star (KM)				2.646		
826	nu hat (KM)				97.58	nu star (KM)				79.39		
827	theta hat (KM)				0.403	theta star (KM)				0.495		
828	80% gamma percentile (KM)				1.896	90% gamma percentile (KM)				2.388		
829	95% gamma percentile (KM)				2.85	99% gamma percentile (KM)				3.859		
830												
831	The following statistics are computed using gamma distribution and KM estimates											
832	Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods											
833					WH	HW					WH	HW
834	95% Approx. Gamma UTL with 95% Coverage				3.696	3.824	95% Approx. Gamma UPL				2.771	2.809
835	95% KM Gamma Percentile				2.581	2.604	95% Gamma USL				3.487	3.591
836												
837	Lognormal GOF Test on Detected Observations Only											
838	Shapiro Wilk Test Statistic				0.9	Shapiro Wilk GOF Test						
839	5% Shapiro Wilk Critical Value				0.859	Detected Data appear Lognormal at 5% Significance Level						
840	Lilliefors Test Statistic				0.178	Lilliefors GOF Test						
841	5% Lilliefors Critical Value				0.243	Detected Data appear Lognormal at 5% Significance Level						
842	Detected Data appear Lognormal at 5% Significance Level											
843												
844	Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects											
845	Mean in Original Scale				1.31	Mean in Log Scale				0.136		
846	SD in Original Scale				0.744	SD in Log Scale				0.529		
847	95% UTL95% Coverage				4.452	95% BCA UTL95% Coverage				3		
848	95% Bootstrap (%) UTL95% Coverage				3	95% UPL (t)				2.999		
849	90% Percentile (z)				2.257	95% Percentile (z)				2.735		
850	99% Percentile (z)				3.922	95% USL				4.097		
851												
852	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
853	KM Mean of Logged Data				0.129	95% KM UTL (Lognormal)95% Coverage				4.406		
854	KM SD of Logged Data				0.528	95% KM UPL (Lognormal)				2.971		
855	95% KM Percentile Lognormal (z)				2.71	95% KM USL (Lognormal)				4.056		
856												
857	Background DL/2 Statistics Assuming Lognormal Distribution											
858	Mean in Original Scale				1.274	Mean in Log Scale				0.0546		
859	SD in Original Scale				0.783	SD in Log Scale				0.671		
860	95% UTL95% Coverage				5.905	95% UPL (t)				3.578		
861	90% Percentile (z)				2.495	95% Percentile (z)				3.183		
862	99% Percentile (z)				5.028	95% USL				5.315		
863	DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.											
864												

	A	B	C	D	E	F	G	H	I	J	K	L
865	Nonparametric Distribution Free Background Statistics											
866	Data appear to follow a Discernible Distribution at 5% Significance Level											
867												
868	Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)											
869	Order of Statistic, r				15	95% UTL with95% Coverage					3	
870	Approx, f used to compute achieved CC				0.789	Approximate Actual Confidence Coefficient achieved by UTL					0.537	
871	Approximate Sample Size needed to achieve specified CC				59	95% UPL					3	
872	95% USL				3	95% KM Chebyshev UPL					4.578	
873												
874	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
875	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
876	and consists of observations collected from clean unimpacted locations.											
877	The use of USL tends to provide a balance between false positives and false negatives provided the data											
878	represents a background data set and when many onsite observations need to be compared with the BTV.											
879												
880	Sb											
881												
882	General Statistics											
883	Total Number of Observations				17	Number of Missing Observations					0	
884	Number of Distinct Observations				3							
885	Number of Detects				0	Number of Non-Detects					17	
886	Number of Distinct Detects				0	Number of Distinct Non-Detects					3	
887	Minimum Detect				N/A	Minimum Non-Detect					0.001	
888	Maximum Detect				N/A	Maximum Non-Detect					0.004	
889	Variance Detected				N/A	Percent Non-Detects					100%	
890	Mean Detected				N/A	SD Detected					N/A	
891	Mean of Detected Logged Data				N/A	SD of Detected Logged Data					N/A	
892												
893	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
894	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
895	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
896												
897	The data set for variable Sb was not processed!											
898												
899												
900	Se											
901												
902	General Statistics											
903	Total Number of Observations				17	Number of Missing Observations					0	
904	Number of Distinct Observations				8							
905	Number of Detects				11	Number of Non-Detects					6	
906	Number of Distinct Detects				7	Number of Distinct Non-Detects					3	
907	Minimum Detect				0.001	Minimum Non-Detect					0.001	
908	Maximum Detect				0.034	Maximum Non-Detect					0.004	
909	Variance Detected				1.5976E-4	Percent Non-Detects					35.29%	
910	Mean Detected				0.0108	SD Detected					0.0126	
911	Mean of Detected Logged Data				-5.311	SD of Detected Logged Data					1.34	
912												
913	Critical Values for Background Threshold Values (BTVs)											
914	Tolerance Factor K (For UTL)				2.486	d2max (for USL)					2.475	
915												
916	Normal GOF Test on Detects Only											
917	Shapiro Wilk Test Statistic				0.736	Shapiro Wilk GOF Test						
918	5% Shapiro Wilk Critical Value				0.85	Data Not Normal at 5% Significance Level						

	A	B	C	D	E	F	G	H	I	J	K	L	
919	Lilliefors Test Statistic					0.368	Lilliefors GOF Test						
920	5% Lilliefors Critical Value					0.251	Data Not Normal at 5% Significance Level						
921	Data Not Normal at 5% Significance Level												
922													
923	Kaplan Meier (KM) Background Statistics Assuming Normal Distribution												
924	KM Mean					0.00742	KM SD					0.0107	
925	95% UTL95% Coverage					0.0341	95% KM UPL (t)					0.0267	
926	90% KM Percentile (z)					0.0212	95% KM Percentile (z)					0.0251	
927	99% KM Percentile (z)					0.0324	95% KM USL					0.034	
928													
929	DL/2 Substitution Background Statistics Assuming Normal Distribution												
930	Mean					0.00732	SD					0.0111	
931	95% UTL95% Coverage					0.035	95% UPL (t)					0.0273	
932	90% Percentile (z)					0.0216	95% Percentile (z)					0.0256	
933	99% Percentile (z)					0.0332	95% USL					0.0349	
934	DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons												
935													
936	Gamma GOF Tests on Detected Observations Only												
937	A-D Test Statistic					1.372	Anderson-Darling GOF Test						
938	5% A-D Critical Value					0.762	Data Not Gamma Distributed at 5% Significance Level						
939	K-S Test Statistic					0.333	Kolmogorov-Smirnov GOF						
940	5% K-S Critical Value					0.265	Data Not Gamma Distributed at 5% Significance Level						
941	Data Not Gamma Distributed at 5% Significance Level												
942													
943	Gamma Statistics on Detected Data Only												
944	k hat (MLE)					0.762	k star (bias corrected MLE)					0.615	
945	Theta hat (MLE)					0.0142	Theta star (bias corrected MLE)					0.0176	
946	nu hat (MLE)					16.76	nu star (bias corrected)					13.52	
947	MLE Mean (bias corrected)					0.0108							
948	MLE Sd (bias corrected)					0.0138	95% Percentile of Chisquare (2kstar)					4.385	
949													
950	Gamma ROS Statistics using Imputed Non-Detects												
951	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs												
952	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)												
953	For such situations, GROS method may yield incorrect values of UCLs and BTVs												
954	This is especially true when the sample size is small.												
955	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates												
956	Minimum					0.001	Mean					0.0105	
957	Maximum					0.034	Median					0.01	
958	SD					0.01	CV					0.95	
959	k hat (MLE)					1.121	k star (bias corrected MLE)					0.963	
960	Theta hat (MLE)					0.00939	Theta star (bias corrected MLE)					0.0109	
961	nu hat (MLE)					38.12	nu star (bias corrected)					32.73	
962	MLE Mean (bias corrected)					0.0105	MLE Sd (bias corrected)					0.0107	
963	95% Percentile of Chisquare (2kstar)					5.846	90% Percentile					0.0245	
964	95% Percentile					0.032	99% Percentile					0.0494	
965	The following statistics are computed using Gamma ROS Statistics on Imputed Data												
966	Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods												
967					WH	HW					WH	HW	
968	95% Approx. Gamma UTL with 95% Coverage				0.0519	0.0578	95% Approx. Gamma UPL				0.0341	0.036	
969	95% Gamma USL				0.0515	0.0574							
970													
971	Estimates of Gamma Parameters using KM Estimates												
972	Mean (KM)					0.00742	SD (KM)					0.0107	

	A	B	C	D	E	F	G	H	I	J	K	L
973	Variance (KM)					1.1522E-4	SE of Mean (KM)					0.00273
974	k hat (KM)					0.478	k star (KM)					0.433
975	nu hat (KM)					16.24	nu star (KM)					14.71
976	theta hat (KM)					0.0155	theta star (KM)					0.0171
977	80% gamma percentile (KM)					0.0121	90% gamma percentile (KM)					0.0207
978	95% gamma percentile (KM)					0.03	99% gamma percentile (KM)					0.0533
979												
980	The following statistics are computed using gamma distribution and KM estimates											
981	Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods											
982					WH	HW					WH	HW
983	95% Approx. Gamma UTL with 95% Coverage				0.0438	0.0469	95% Approx. Gamma UPL				0.0266	0.0268
984	95% KM Gamma Percentile				0.0236	0.0234	95% Gamma USL				0.0435	0.0465
985												
986	Lognormal GOF Test on Detected Observations Only											
987	Shapiro Wilk Test Statistic					0.785	Shapiro Wilk GOF Test					
988	5% Shapiro Wilk Critical Value					0.85	Data Not Lognormal at 5% Significance Level					
989	Lilliefors Test Statistic					0.295	Lilliefors GOF Test					
990	5% Lilliefors Critical Value					0.251	Data Not Lognormal at 5% Significance Level					
991	Data Not Lognormal at 5% Significance Level											
992												
993	Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects											
994	Mean in Original Scale					0.00719	Mean in Log Scale					-6.199
995	SD in Original Scale					0.0112	SD in Log Scale					1.709
996	95% UTL95% Coverage					0.142	95% BCA UTL95% Coverage					0.034
997	95% Bootstrap (%) UTL95% Coverage					0.034	95% UPL (t)					0.0437
998	90% Percentile (z)					0.0181	95% Percentile (z)					0.0338
999	99% Percentile (z)					0.108	95% USL					0.139
1000												
1001	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
1002	KM Mean of Logged Data					-5.83	95% KM UTL (Lognormal)95% Coverage					0.0667
1003	KM SD of Logged Data					1.256	95% KM UPL (Lognormal)					0.0281
1004	95% KM Percentile Lognormal (z)					0.0232	95% KM USL (Lognormal)					0.0658
1005												
1006	Background DL/2 Statistics Assuming Lognormal Distribution											
1007	Mean in Original Scale					0.00732	Mean in Log Scale					-5.973
1008	SD in Original Scale					0.0111	SD in Log Scale					1.452
1009	95% UTL95% Coverage					0.094	95% UPL (t)					0.0346
1010	90% Percentile (z)					0.0164	95% Percentile (z)					0.0277
1011	99% Percentile (z)					0.0746	95% USL					0.0925
1012	DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.											
1013												
1014	Nonparametric Distribution Free Background Statistics											
1015	Data do not follow a Discernible Distribution (0.05)											
1016												
1017	Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)											
1018	Order of Statistic, r					17	95% UTL with95% Coverage					0.034
1019	Approx, f used to compute achieved CC					0.895	Approximate Actual Confidence Coefficient achieved by UTL					0.582
1020	Approximate Sample Size needed to achieve specified CC					59	95% UPL					0.034
1021	95% USL					0.034	95% KM Chebyshev UPL					0.0556
1022												
1023	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
1024	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
1025	and consists of observations collected from clean unimpacted locations.											
1026	The use of USL tends to provide a balance between false positives and false negatives provided the data											

	A	B	C	D	E	F	G	H	I	J	K	L
1027	represents a background data set and when many onsite observations need to be compared with the BTV.											
1028												
1029	TI											
1030												
1031	General Statistics											
1032	Total Number of Observations					17	Number of Missing Observations					0
1033	Number of Distinct Observations					3						
1034	Number of Detects					0	Number of Non-Detects					17
1035	Number of Distinct Detects					0	Number of Distinct Non-Detects					3
1036	Minimum Detect					N/A	Minimum Non-Detect					0.001
1037	Maximum Detect					N/A	Maximum Non-Detect					0.004
1038	Variance Detected					N/A	Percent Non-Detects					100%
1039	Mean Detected					N/A	SD Detected					N/A
1040	Mean of Detected Logged Data					N/A	SD of Detected Logged Data					N/A
1041												
1042	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
1043	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
1044	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
1045												
1046	The data set for variable TI was not processed!											
1047												
1048												

Appendix G

Modified Groundwater Monitoring Well Network Certification

(formerly Appendix F in the 2018 Annual Report)

Appendix F Modified Groundwater Monitoring System Certification

Certification Statement 40 CFR § 257.91(f) – Design and Construction of a Groundwater Monitoring System for the existing Coal Combustion Residuals (CCR) Ash Monofill, Rawhide Energy Station, Larimer County, CO, managed by the Platte River Power Authority (PRPA).

I, Gregg Somermeyer, being a Registered Professional Engineer in good standing in the State of Colorado, do hereby certify, to the best of my knowledge, information, and in accordance with the accepted practice of engineering, for the above-referenced CCR unit, that the design and construction of a modified groundwater monitoring system, as described in Section 4 of the Platte River Power Authority Ash Monofill Annual Groundwater Monitoring and Corrective Action Report for 2018, dated January 31, 2019, meets the requirements of 40 CFR § 257.91.

Gregg Somermeyer
January 31, 2019



Appendix H

Ash Monofill Assessment of Corrective Measures

Assessment of Corrective Measures at the Ash Monofill Under the Coal Combustion Residuals (CCR) Rule

Rawhide Power Plant
Larimer County, Colorado
Platte River Power Authority

August 15, 2019

Prepared for:

Platte River Power Authority
2000 East Horsetooth Road
Fort Collins, Colorado 80525

Prepared by:

AECOM
6200 South Quebec Street
Greenwood Village, CO 80111

T: +1 (303) 694 2770
F: +1 (303) 694 3946
www.aecom.com

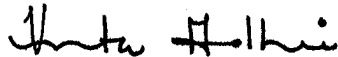
Assessment of Corrective Measures at the Ash Monofill Under the Coal Combustion Residuals (CCR) Rule



Prepared By
Naseem Hasan P.E. (CO)
Technical Leader 1



Reviewed By
Richard Henry Ph.D.
Principal Hydrogeologist



Approved By
Vasanta Kalluri P.E (MN, WI)
Project Manager

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Acronyms

µg/L	micrograms per liter
AECOM	AECOM Technical Services, Inc.
ACM	Assessment of Corrective Measures
ASD	Alternate Source Demonstration
amsl	above mean sea level
bgs	below ground surface
BNSF	Burlington Northern Santa Fe Railway Company
CAO	Corrective Action Objectives
CBR	Closure by Removal
CCR	Coal Combustion Residuals
CDPHE	Colorado Department of Public Health and Environment
CFR	Code of Federal Regulations
CIP	Closure in Place
cm	centimeter
COC	constituent of concern
DO	dissolved oxygen
EPA	United States. Environmental Protection Agency
FGD	flue gas desulfurization
ft	feet
ft/d	feet/day
ft/ft	feet/foot
GWPS	Groundwater Protection Standard
HASP	Health and Safety Plan
H ₂ O	water
LCL	lower confidence limit
LEAF	Leaching Environmental Assessment Framework
LTM	Long-Term Monitoring
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MNA	Monitored Natural Attenuation

O&M	Operations and Maintenance
ORP	oxidation-reduction potential
PO	Purchase Order
POTW	publicly owned treatment works
PPE	personal protective equipment
ppm	parts per million
PRB	Permeable Reactive Barrier
PRPA	Platte River Power Authority
PRS	Phosphorus Recovery System
RACER	Remedial Action Cost Engineering Requirements
SPLP	Synthetic Precipitation Leaching Procedure
SSI	statistically significant increase
SSL	statistically significant level
TDS	total dissolved solids
UPL	upper prediction limit
wt %	weight percent
WOCA	World of Coal Ash
ZVI	zero valent iron

1. Introduction

AECOM Technical Services, Inc. (AECOM) was retained by Platte River Power Authority (PRPA) to complete an Assessment of Corrective Measures (ACM) for groundwater contamination at the Ash Monofill at the PRPA Rawhide Energy Station in Larimer County, Colorado. This ACM presents an evaluation of Ash Monofill closure options to achieve source control and groundwater remedial alternatives to address selenium identified as a constituent of concern (COC) to be present in groundwater.

This ACM was prepared in accordance with 40 Code of Federal Regulations (CFR) Parts 257.96 and 257.97 requirements under the Coal Combustion Residuals (CCR) Rule. In addition, the United States Environmental Protection Agency (EPA) guidance documents (EPA, 1993; EPA, 2000) were used in this ACM.

1.1 Report Organization

This report is divided into nine sections as outlined below and includes tables and figures.

- Section 1.0 includes an introduction and report organization;
- Section 2.0 provides a site description that includes the facility location, Ash Monofill operational history, monitoring well network and sampling results, and source, nature and extent of contamination;
- Section 3.0 presents a qualitative risk assessment;
- Section 4.0 presents the corrective action objectives;
- Section 5.0 presents the source control measures that would be implemented prior to groundwater remediation;
- Section 6.0 presents the detailed evaluation of source control measures;
- Section 7.0 presents the technology/process options identification and assembly of corrective measure alternatives for groundwater;
- Section 8.0 presents the detailed evaluation of corrective measure alternative for groundwaters; and
- Section 9.0 provides a list of references cited in the report.

2. Site Description and Background

2.1 Site Description

The Rawhide Energy Station (the Site) encompasses approximately 4,560 acres north of Wellington in Larimer County, Colorado. In addition to the plant buildings, the major feature of the facility is an approximately 500 acre dry-land construction reservoir of reclaimed wastewater for the City of Fort Collins, also known as Hamilton Reservoir, which contains approximately 15,000 acre-feet of water that is used for cooling processes. The power block area contains the boiler and turbine buildings, the air quality control equipment, and the administrative offices. A rail spur along the northern edge of the Site connects the Rawhide Facility with the mainline of the Burlington Northern Santa Fe Railway Company (BNSF) Railway Company and is used to deliver coal and construction materials for plant operations. Six generating units are located at the Rawhide Station. Units A, B, C, D, and F are fueled by natural gas, and Unit 1 is fueled by coal from the Powder River Basin in Wyoming.

The Ash Monofill is located northwest of the main plant and north of Hamilton Reservoir. CCR solid waste from Unit 1 operations is disposed in the Ash Monofill. The existing Ash Monofill includes Cell 1 (approximately 47 acres) and Cell 2A (approximately 11 acres) as shown on **Figure 1**. Cell 1 was operated from approximately 1980 to 2007 and is no longer in use. It is capped with cover soils but has not undergone final closure. Cell 2 is active, lies to the west of Cell 1, and is progressively advancing northwards as further ash material is placed within the cell.

2.2 Ash Monofill Hydrogeology

The Ash Monofill is constructed within a narrow south-sloping valley with bedrock highs along both sides. The uppermost water-bearing stratum at the Ash Monofill was identified during groundwater monitoring well installation as the weathered and fractured Pierre Shale. Groundwater at the Ash Monofill is under water table conditions and in 2018 was at depths from approximately 14 to 40 feet (ft) below ground surface (bgs). Groundwater flow is generally from northwest to south-southeast, from the Ash Monofill towards Hamilton Reservoir following the topographic slope of the valley.

2.3 Monitoring Well Network and Sampling Results

A groundwater monitoring well system was installed at the Ash Monofill in 2016 to comply with 40 CFR 257.91(c). **Figure 1** shows the groundwater piezometers and monitoring wells comprising the current monitoring well network at the Ash Monofill and two borings drilled to characterize Cell 1. The monitoring well network was modified in 2018 to add three new wells, one upgradient and two downgradient. The Ash Monofill network currently includes two upgradient wells, ASH-01 and ASH-06, used to establish background groundwater constituent concentrations, and five downgradient wells, ASH-03, ASH-04, ASH-05, ASH-07 and ASH-08, along the southern edge of the Ash Monofill designated as compliance monitoring wells. Monitoring well ASH-01 was installed in 1980 as MW-01 for a site-wide monitoring well network. Monitoring wells ASH-03, ASH-04, and ASH-05 were installed in 2016 to comply with the CCR Rule. Per 40 CFR 257.95(g)(1), monitoring wells ASH-07 and ASH-08 were installed to characterize the extent of Appendix IV statistically significant increases (SSIs) downgradient of the Ash Monofill. This network satisfies the requirements of 40 CFR 257.91 because the Ash Monofill is constructed within a narrow valley that is sloped to the south that constrains groundwater flow that may have been affected by a release from the landfill. The downgradient monitoring wells extend across the width of the valley mouth and allow detection of potentially impacted groundwater from beneath the Ash Monofill.

Groundwater beneath the Ash Monofill occurs under water-table conditions in partings, joints, and fractures in the underlying variably weathered Pierre Shale. Groundwater elevations range from

approximately 5,746 ft above mean sea level (amsl) at ASH-01 at the north end of the Ash Monofill to approximately 5,676 ft amsl at ASH-05 at the south end of the Ash Monofill, resulting in a horizontal hydraulic gradient of approximately 0.007 ft/ft (feet/foot). Annual groundwater elevations measured at monitoring well ASH-01 since 1984 have fluctuated about 6 feet, ranging from 5,742 to 5,748 ft amsl.

Figure 2 shows a potentiometric surface for the Ash Monofill for January 17, 2019.

Eight rounds of baseline detection monitoring data were collected at the Ash Monofill between September 2016 and July 2017 for Appendix III and IV constituents to comply with the CCR Rule. Based on statistical analysis results, SSIs over background were found for Appendix III constituents boron, calcium, chloride, sulfate, and total dissolved solids (TDS) at downgradient monitoring wells ASH-03, ASH-04, and ASH-05 (AECOM, 2018). An Alternate Source Demonstration (ASD) was performed to assess whether the observed Appendix III SSIs are from an alternative source other than the Ash Monofill. The ASD did not find any likely natural variations in groundwater quality or anthropogenic (agricultural or industrial) sources other than the Ash Monofill that caused the SSIs. The lack of a successful ASD required that assessment monitoring be initiated at the Ash Monofill.

Statistical analyses of the assessment monitoring data identified Appendix IV SSIs over background upper prediction limits (UPLs) for barium at monitoring wells ASH-03 and ASH-05, and selenium at monitoring wells ASH-03, ASH-04, ASH-05, and ASH-07. No other Appendix IV constituents exhibited SSIs. A constituent is considered present at a statistically significant level (SSL) over the groundwater protection standard (GWPS) if the 95 percent lower confidence limit (LCL) is greater than the GWPS. Selenium at monitoring wells ASH-05 and ASH-07 were found to exhibit an SSL above its GWPS because their 95% LCLs [0.067 and 0.050 milligrams per liter (mg/L), respectively] were greater than or equal to the GWPS of 0.05 mg/L. Selenium and barium were not present at a SSL above the GWPS at any of the other wells because their 95% LCLs were less than their respective GWPS.

Based on the above findings, selenium is the only Appendix IV constituent present at concentrations above the GWPS at the Site that requires an ACM per 40 CFR 257.96.

2.4 Source, Nature and Extent of Contamination

The Ash Monofill is underlain by the variably weathered and fractured Pierre Shale, an upper Cretaceous marine shale formation. The Pierre Shale is recognized by the United States Geological Survey (Schultz et al., 1980) to be composed of many of the Appendix III constituents, including calcium [2.7 ± 0.48 weight percent (wt %)], sulfur (0.37 ± 1.1 wt %), fluorine (0.71 ± 0.15 wt %), chlorine (0.16 ± 0.024 wt %), and boron [99 ± 49 parts per million (ppm)]; and, groundwater in the shale is known to have poor water quality with high TDS concentrations. These constituents are largely derived from the clays, plagioclase feldspars, calcite, dolomite, and pyrite minerals in the shale. All of these constituents are present in groundwater at upgradient (background) well ASH-01 (AECOM, 2018).

2.4.1 Ash Monofill Cell 1 Investigation

Closed Cell 1 was investigated to chemically and hydrologically characterize the ash stored within it. Two borings were drilled using a Central Mine Equipment hollow-stem auger rig by Drilling Engineers, Inc. of Fort Collins, Colorado on April 23, 2019. The borings were logged and sampled by AECOM field geologists as the borings were drilled. The locations of the borings (CELL1-1 and CELL1-2) are shown on **Figure 1**. Borings CELL1-1 and CELL 1-2 were drilled to a total depth of 79 ft bgs and terminated in the Pierre Shale.

Soil and ash materials encountered in boring CELL1-1 included an approximately 4-ft thick vegetated soil cover, 0.5-ft thick layer of lithified coal ash, 32 ft of unconsolidated to lithified coal ash, 18 ft of interbedded sand and clay alluvium, and 29 ft of variably weathered Pierre Shale. Groundwater was not

found in boring CELL1-1 after it stood open overnight. The base of the coal ash at boring CELL1-1 lies about 44 ft above the potentiometric surface shown in **Figure 2**.

Soil and ash materials encountered in boring CELL1-2 included an approximate 2-ft thick vegetated soil cover, 0.5-ft thick layer of lithified coal ash, 50 ft of unconsolidated to lithified coal ash, and 27 ft of variably weathered Pierre Shale. Visual observation of the unlithified coal ash encountered during drilling suggested that it was typically dry. A grab sample of groundwater was collected in boring CELL1-2 after it stood open overnight. Selenium was not detected (< 5 micrograms per liter [$\mu\text{g/L}$]) in the sample. The base of the coal ash at boring CELL1-2 lies about 5 ft above the potentiometric surface depicted in **Figure 2**. However, it is possible that the capillary fringe along the water table in the southern portion of the Ash Monofill may periodically extend into the lower portion of the coal ash in this area. It is also possible that waters discharged to the unlined Phosphorus Recovery System (PRS) Impoundments may influence groundwater elevations beneath the southern portion of the Ash Monofill.

2.4.2 Coal Ash Moisture Content

Coal ash samples collected during drilling were submitted to D. B. Stephens & Associates in Albuquerque, New Mexico for gravimetric moisture analysis to confirm visual moisture observations. The moisture content analysis results are listed on **Table 1**. Two coal ash samples [CELL1-1 (10 to 20 ft bgs) and CELL1-2 (30 to 40 ft bgs)] were also selected to determine moisture characteristic curves (**Figure 1**). The highest moisture contents were noted in coal ash from boring CELL1-2 at a depth of 5 to 10 ft bgs (35%) and near the base of the ash at a depth of 45 to 50 ft bgs (38%). The moisture characteristic curves shown in **Figure 3** show the coal ash moisture contents range from saturated at atmospheric pressure (0 centimeter [cm] water [H_2O]) and steadily decreases below saturation at successively lower negative pressure heads ($-\text{cm H}_2\text{O}$).

Figure 3 shows that all of the coal ash samples had moisture contents less than field capacity (approximately $-300 \text{ cm H}_2\text{O}$). Field capacity is the amount of water remaining in the ash a few days after having been wetted and after free drainage has ceased. Four of the coal ash samples had moisture contents less than the permanent wilting point (approximately $-15,000 \text{ cm H}_2\text{O}$). The permanent wilting point is the water content of a soil when most plants (corn, wheat, sunflowers) growing in that soil wilt and fail to recover their turgor upon rewetting. The coal ash moisture contents measured during this investigation indicate that the ash is dry to extremely dry and that little moisture movement, i.e. percolation, occurs at these moisture contents. This also suggests that the existing vegetative soil cover, as well as the lithified coal ash layer immediately below the cover soils, appears effective at limiting moisture influx. The potential for leaching of coal ash constituents at these moisture contents is likely minimal.

Table 1. Gravimetric Moisture Content of Coal Ash

Boring Number	Sample Depth (ft bgs)	Gravimetric Moisture Content (%)
CELL 1-1	5-10	29.3
CELL 1-1	10-20	18.2
CELL 1-1	20-25	18.8
CELL 1-1	30-35	28.4
CELL 1-2	5-10	35.0
CELL 1-2	20-25	17.1
CELL 1-2	30-40	25.0
CELL 1-2	45-50	38.2

Notes:

% = percent

ft bgs = feet below ground surface

2.4.3 Coal Ash and Pierre Shale Leaching Characteristics

Ten samples of coal ash from borings CELL1-1 and CELL1-2 in Cell 1 of the Ash Monofill were collected during drilling and submitted for total and synthetic precipitation leaching procedure (SPLP) EPA Method 1312 analysis for selenium. Two coal ash samples were submitted for Leaching Environmental Assessment Framework (LEAF – EPA Methods 1313 and 1316) analysis for selenium. Pierre Shale samples were also collected during drilling from the borings in Cell 1, and monitoring well ASH-08, and submitted for total and SPLP (7 samples) and LEAF (1 sample) analyses. The analyses were performed by Eurofins TestAmerica in Pittsburgh, Pennsylvania.

Total analyses indicate that selenium concentrations ranged from 3.6 to 15 milligrams per kilogram (mg/kg) and averaged 8.6 mg/kg. Total concentration of selenium in the Pierre Shale was lower than those in the coal ash and ranged from 2.6 to 4.4 mg/kg, respectively, averaging 3.1 mg/kg.

SPLP analyses indicate that selenium concentrations in coal ash leachate ranged from < 2.6 to 13 µg/L and averaged 7.7 µg/L. SPLP concentrations of selenium in the Pierre Shale were similar to those in the coal ash and ranged from <2.6 to 5.3 µg/L, averaging 3.5 µg/L, respectively. **Figure 4** shows boxplot of selenium concentrations in SPLP leachates for the coal ash and Pierre Shale compared to groundwater concentrations. This figure shows that selenium SPLP leachate concentrations in coal ash and Pierre Shale are similar, but are less than the observed groundwater concentrations. SPLP analyses are extracted at a 20:1 liquid to solid ratio which likely reduces constituent concentrations in leachates from what would be expected under actual field leaching conditions.

The results of the LEAF tests for coal ash are summarized in **Figures 5** (LEAF Method 1313) and **Figure 6** (LEAF Method 1316). LEAF Method 1313 leaches solids at various pH values and a fixed liquid to solid ratio of 10:1. LEAF Method 1316 leaches solids at varying liquid to solid ratios and the natural pH of the liquid-solid mixture (approximately 10 for the coal ash and 8 for the Pierre Shale). **Figure 5** shows that selenium concentrations in the LEAF leachates (200 to 16 µg/L) decrease with increasing pH but increase above pH 10. For the typical pH (approximately 8) in groundwater beneath the Ash Monofill, **Figure 5** suggests that selenium could be leached from the coal ash at constituent concentrations consistent with those found in groundwater. **Figure 6** shows that the concentrations of selenium decrease with increasing liquid to solid leaching ratios. Liquid to solid leaching ratios less than 2 would likely be needed to achieve the observed groundwater concentrations, while accounting for dilution as the leachate is released to groundwater.

2.4.4 Source of Contamination

An ASD was performed to assess whether a natural or other anthropogenic source, other than the Ash Monofill, is responsible for the SSIs over background for Appendix III constituents boron, calcium, chloride, sulfate, and TDS at downgradient monitoring wells ASH-03, ASH-04, and ASH-05. The Appendix III constituents are also present in the coal ash. To distinguish constituent sources derived from the Pierre Shale or coal ash, molar concentration ratios of some of the Appendix III constituents were calculated for average constituent concentrations in upgradient and downgradient groundwater and are presented in the ASD. The average molar ratios varied considerably between the upgradient and downgradient groundwaters, suggesting that a source other than the Pierre Shale is likely causing the Appendix III SSIs. Some of the molar ratios (boron/chloride, fluoride/chloride, calcium/chloride, sulfate/chloride) decreased in response to increased chloride and sulfate concentrations, whereas other molar ratios (boron/fluoride and calcium/sulfate) increased in response to increased boron and calcium concentrations. The most likely source for the increased boron, calcium, chloride, and sulfate concentrations is the coal ash disposed in the Ash Monofill. Coal ash, particularly fly ash, and comingled flue gas desulfurization (FGD) wastes are known to contain elevated concentrations of boron, calcium, chloride, and sulfate (AECOM, 2018).

3. Risk Assessment

This qualitative risk assessment discusses potential risks posed by selenium, the only COC, considering the human and environmental receptor groundwater exposure pathways present at the Ash Monofill site.

3.1 Constituents of Concern

Selenium is the only Appendix IV constituent under the CCR Rule that has been detected at a SSL exceeding the GWPS of 0.05 mg/L as defined under 40 CFR 257.95(h) (Federal Register, 2018). Therefore, selenium has been identified as a COC in groundwater. Based on assessment monitoring results, selenium was detected at an SSL above or equal to its GWPS at monitoring wells ASH-05 and ASH-07.

Recent groundwater monitoring data for selenium in groundwater is tabulated below.

Table 2. Summary of Groundwater Selenium Concentrations

Monitoring Well (sampled on June and October 2018)	Selenium Concentration Range (mg/L)	Maximum Background Concentration (mg/L)	GWPS (mg/L)	Cleanup Level (mg/L)
Upgradient Wells		0.0228	0.05	0.05
ASH-01	<0.001-<0.003			
ASH-06	0.0206-0.0228			
Downgradient Wells				
ASH-02	< 0.0005-<0.003			
ASH-03	0.0406-0.0747			
ASH-04	0.0426-0.0554			
ASH-05	0.0924-0.105			
ASH-07	0.0688-0.0919 ¹			
ASH-08	0.0073 ¹			

Notes:

¹denotes 2019 data

Green highlight denotes SSL exceedance of GWPS

mg/L = milligrams per liter

3.2 Exposure Pathways

Selenium is detected in groundwater at the Ash Monofill at downgradient monitoring wells ASH-03, ASH-04, ASH-05, ASH-07 and ASH-08 and upgradient monitoring well ASH-06. Selenium was not detected in upgradient well ASH-01 or downgradient well ASH-02 (which is MW-2 under sitewide monitoring program). All of these wells are completed in the Pierre Shale. Selenium exceeds the GWPS at a SSL at monitoring wells ASH-05 and ASH-07. Groundwater in this area occurs at an approximate potentiometric elevation of 5676 ft amsl (**Figure 2**). Depths to groundwater in this area range from approximately 3 to 40 ft bgs, averaging approximately 18 ft bgs.

Groundwater in the Pierre Shale is naturally of poor quality, thus it has no current or planned future use as a source of domestic or agricultural water supply. The affected groundwater is primarily confined to an approximate depth of 20 to 40 ft bgs. Incidental construction or excavation activities are not likely to occur at such a depth that would expose human or environmental receptors to groundwater. Accordingly, the groundwater exposure pathway is considered incomplete which eliminates any potential exposure risk. Furthermore, the inherent non-volatile nature of metals such as selenium eliminates also eliminates the

vapor intrusion pathway. There is no known contaminated groundwater discharge or seepage to surface water; therefore, potential surface water exposure pathways are also eliminated.

4. Corrective Action Objectives

This section presents the corrective action objectives (CAOs) that were developed to address selenium in groundwater above the GWPS downgradient of the Ash Monofill. The CAOs are response action completion criteria that can be practicably achieved to ensure reliable protection of human health and the environment within a reasonable time. Factors considered during the selection of the CAOs included constituents characteristics, the medium of concern, current and future exposure pathways, and regulatory requirements under the CCR Rule (40 CFR Part 257).

40 CFR 257.96(a) in the CCR Rule specifies that an owner or operator must initiate an ACM to prevent further releases, to remediate any releases and to restore the affected area to original conditions. While conducting the ACM, the owner or operator of the CCR unit must continue to monitor groundwater in accordance with the assessment monitoring program as specified in 40 CFR 257.95. CAOs for the ACM are specified in 40 CFR 257.97(b) which states that the selected corrective measures remedy must:

- Be protective of human health and the environment;
- Attain the GWPS as specified pursuant to 40 CFR 257.95(h);
- Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in Appendix IV to this part into the environment;
- Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems; and
- Comply with standards for management of wastes as specified in 40 CFR 257.98(d).

5. Source Control Measures

CCR solid waste from Unit 1 operations is disposed in the existing Ash Monofill which is comprised of two cells, Cell 1 and Cell 2A. Cell 1 is capped with a vegetated soil cover while Cell 2A is currently active. Ash Monofill appears to be the source of selenium identified as a COC in groundwater.

Future development of Cell 2B at the Ash Monofill will be lined to protect groundwater. The design of Cell 2B will comply with applicable requirements under the CCR Rule as well as the Colorado Department of Public Health and Environment (CDPHE) "Regulations Pertaining to Solid Waste Sites and Facilities", 6 Code of Colorado Regulations 1007-2, Part 1.

Source control would be achieved by closure of Ash Monofill Cells 1 and 2A prior to groundwater remediation. Closure would be performed in compliance with the requirements specified under 40 CFR 257 Part 102. This CCR Rule provides two basic closure options: closure in place (CIP) and closure by removal (CBR) as summarized below.

Closure in Place (CIP): CIP is accomplished by covering the CCR in place with a final cover designed to control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground to meet the closure performance requirements specified under 40 CFR 257 Part 102(d)(3)(i).

Closure by Removal (CBR): CBR is accomplished by excavating and removing the disposed CCR, and decontaminating all areas affected by releases from the CCR unit. CCR removal and decontamination are considered complete when COC concentrations throughout the CCR unit and any areas affected by releases from the CCR unit have been removed and groundwater concentrations do not exceed GWPS established pursuant to 40 CFR part 257.95(h). The excavated CCR would be disposed of in an appropriately designed on-site or off-site landfill, or recycled or reused for beneficial use in lieu of disposal. The excavated CCR would be transported to a Subtitle D landfill for disposal or to a beneficial use location. CBR is not subject to post-closure care requirements per 40 CFR Part 257 paragraph 104 (a)(2).

The alternatives for source closure of the Ash Monofill are:

- Alternative S-1: Ash Monofill Closure in Place
- Alternative S-2: Ash Monofill Closure by Removal

6. Detailed Evaluation of Ash Monofill Closure Alternatives

A detailed evaluation of the closure options in Section 5.0 is presented in the following subsections. Each alternative is evaluated against the requirements specified in 40 CFR 257.96 and 257.97. The cost for each alternative is estimated using the Remedial Action Engineering and Requirements (RACER) version 11.4, AECOM's in-house cost-estimating software. These costs are for the evaluation of the alternatives. Actual costs of implementation may vary from -30 to +50 percent. The alternative evaluation criteria are broadly categorized under effectiveness, implementability and cost as listed in **Table 3** below.

Table 3. Criteria for Evaluation of Alternatives

Effectiveness
Protective of Human Health and the Environment
Attain GWPS
Control the Source of Release
Comply with Standards for Management of Wastes
Long-Term Effectiveness and Permanence
Reduction of Toxicity, Mobility or Volume through Treatment
Short-Term Effectiveness
Implementability
Technical Feasibility
Administrative Feasibility
Availability of Services and Materials
Cost
Capital Cost
Operations and Maintenance (O&M) Cost
Total Cost

Notes:

GWPS = Groundwater Protection Standard

O&M = Operations and Maintenance

6.1 Alternative S-1 Ash Monofill Closure in Place

Cell 1 is currently overlain by a 2-ft thick earthen cover with a vegetated soil cover (AECOM, 2019a) and ceased operation in 2007. Final closure is currently being reviewed by the CDPHE. Cell 1 was not designed with a composite liner since disposal operation began in 1980. At that time, landfill design practices did not call for composite liner systems. Visual observations during recent drilling in Cell 1 indicate that the coal ash below the soil cover has hydrated and formed an approximately 6-inch thick concrete-like layer that likely limits precipitation infiltration into the underlying unconsolidated coal ash as discussed in Section 2.4.2. This is supported by moisture characteristics determination discussed in Section 2.4.3. The coal ash moisture contents measured during this investigation indicate that the ash is dry to extremely dry and that little moisture movement, i.e., percolation, occurs at these moisture contents. This also suggests that the existing vegetated soil cover appears effective at limiting moisture influx and that the potential for leaching of CCR constituents at these moisture contents is likely minimal. Based on the above discussion and considering that selenium only exceeds the GWPS at SSL at monitoring wells ASH-05 and ASH-07, which may not be sourced from the Ash Monofill (based on the low selenium concentrations in ASH-03), the existing cover at Cell 1 is considered adequate to limit infiltration and leaching of CCR constituents.

Cap designs for closure of Cell 2A can range from a prescriptive cover (utilizing a geomembrane liner, geocomposite drainage layer, infiltration layer and a vegetated soil cover to minimize erosion) to an alternative cap meeting the performance standard as specified under 40 CFR 257.102 (d). Alternative caps such as as evapotranspiration cover, exposed geomembrane liners or synthetic turf have recently emerged in the CCR industry and may provide cost-effective options that meet the performance standards. The cap type for Cell 2A closure would be finalized during closure phase.

The evaluation of Alternative S-1 is presented in **Table 4**.

Table 4. Evaluation of Alternative S-1 (Ash Monofill CIP)

Effectiveness	
Protective of Human Health and the Environment	<p>Existing soil cover at Cell 1 appears to be effectively controlling infiltration of liquids into the ash material and releases of CCR to groundwater or to the atmosphere. This is supported by SPLP data for selenium in the coal ash leachate with an average concentration of 0.0035 mg/L which is an order of magnitude lower than the GWPS of 0.05 mg/L.</p> <p>The Cell 2A cap would be designed to meet the performance standards specified in 40 CFR 257.102(d) and CAOs . Potential risks associated with Ash Monofill wastes would be reduced by eliminating exposure pathways such as dermal contact, ingestion and inhalation of contaminated soil. Capping would also prevent infiltration of precipitation and surface water run-off into the wastes and therefore, limit downward migration of constituents into the aquifer. Capping would prevent ecological receptors such as birds and mammals from penetrating the contaminated soil/debris. The Ash Monofill is located within an industrial facility and not accessible to public. No digging or construction activities would occur at this site.</p> <p>Standard health and safety procedures would protect workers during Cell 2A cap installation. Risks to community are minimal.</p> <p>Alternative S-1 would provide adequate protection of human health and the environment.</p>
Attain GWPS	Capping limits precipitation infiltration and leaching of coal ash and protects underlying groundwater from future constituent releases, thereby minimizing the time to achieve GWPS.
Control the Source of Release	Capping is a well-developed technology and is typically implemented for landfill closure to meet regulatory requirements. Capping would minimize infiltration of precipitation and surface run-off and achieve adequate source control, since coal ash has not been placed below or into the groundwater at Cells 1 and 2A.
Comply with Standards for Management of Wastes	No wastes would be generated under this alternative.
Long-Term Effectiveness and Permanence	The integrity of the cap would be preserved by long-term maintenance and repairs, as necessary. Long-Term Monitoring (LTM) data would be used to review and confirm remedy effectiveness over time, otherwise appropriate corrective action would be triggered.
Reduction of Toxicity, Mobility or Volume through Treatment	Capping utilizes “containment” and not “treatment” to reduce the risks associated with the CCR constituents. Capping would reduce the mobility but not the toxicity or volume of the constituents.

Table 4. Evaluation of Alternative S-1 (Ash Monofill CIP)

Effectiveness	
Short-Term Effectiveness	Construction of a cap would be completed with standard equipment and would entail no additional risks to workers beyond those inherent in construction projects. Short-term risks to the public, workers, or the environment during cap installation are expected to be minimal. Engineering controls and personal protective equipment (PPE) would be used to ensure workers' health and safety. Dust suppressants would be used to minimize the possibility of windblown emissions of contaminated dust. All construction activities would be performed in accordance with the Site-Specific Health and Safety Plan (HASP).
Implementability	
Technical Feasibility	The Ash Monofill is generally accessible to equipment such as grader, roller and vibrating compactors that would be used for construction of the cap. Materials such as soil, asphalt, gravel or crushed stones are readily locally available.
Administrative Feasibility	The closure of Ash Monofill Cells 1 and 2A would require CDPHE approval.
Availability of Services and Materials	The construction of a cap is a well-established technology and materials are offered by several vendors.
Cost	
Capital Cost	\$ 3,424,000
O&M Cost	\$ 1,279,000
Total Cost	\$ 4,703,000

Notes:

CAOs = Corrective Action Objectives

CCR = Coal Combustion Residuals

CDPHE = Colorado Department of Public Health and Environment

CFR = Code of Federal Regulations

GWPS = Groundwater Protection Standard

LTM = Long-term Monitoring

mg/L = milligram per liter

O&M = Operation and Maintenance

SPLP = Synthetic Precipitation Leaching Procedure

For the purposes of cost-estimating, the following assumptions were made:

- Cell 2A would consist of a 6-inch vegetative cover underlain by a 24-inch compacted soil layer.
- Groundwater monitoring of six existing wells for Appendix IV constituents for a 30-year period;
- Post-closure care maintenance of Cells 1 and 2A for a 30-year period.

6.2 Alternative S-2 Ash Monofill Closure by Removal

This alternative consists of excavating all of the coal ash in Ash Monofill Cell 1 (approximately 47 acres) and Cell 2A (approximately 11 acres), and contaminated native soils, to achieve clean closure.

Excavation would be performed using equipment such as a hydraulic excavator, scrapers or backhoes, as applicable. Following coal ash and contaminated soil removal, confirmation samples would be collected from the soils in the sidewalls and bottom of the excavated area of each cell to verify that the coal ash was successfully removed. Depending on the depths of the required excavation, benching and/or sloping would likely be required. If the need arises, shoring and bracing will be installed or suitable sides will be constructed to prevent cave-ins or slope failure. Dewatering would not be necessary as excavation does not extend below the water table.

A berm would be constructed around the excavation to prevent surfacewater runoff from entering the excavation prior to backfilling. The excavated areas would be backfilled with soil that may be obtained from on-site or off-site. All activities would be performed in accordance with the Site-Specific HASP.

The excavated coal ash could be transported to appropriate vendors (cement industry, structural fill) for the beneficial use, or placed in an approved on- or off-site landfill. Haul routes and temporary staging areas, including dust control measures, would be planned to ensure transportation of coal ash in a safe manner without adverse impacts to the community.

The evaluation of Alternative S-2 is presented in **Table 5**.

Table 5. Evaluation of Alternative S-2 (Ash Monofill Cells CBR)

Effectiveness	
Protective of Human Health and the Environment	<p>With removal of coal ash from Cells 1 and 2A, any Appendix IV constituents that could pose risks to the environment to human health upon exposure or become a source of groundwater contamination would be removed. Therefore, this alternative would provide maximum protection for human health and the environment. Any short-term risks such as fugitive dust emissions during excavation and transportation would be addressed through the use of engineering controls and PPE.</p> <p>Standard health and safety procedures would protect workers during excavation. Off-site traffic planning and dust control measures would be incorporated during transportation to minimize risks to community.</p> <p>Alternative S-2 would provide adequate protection of human health and the environment.</p>
Attain GWPS	Removal of the coal ash eliminates future leaching of coal ash and constituent releases to underlying groundwater, thereby minimizing the time to achieve GWPS.
Control the Source of Release	With removal of coal ash and associated contaminated soil, if any, this alternative would provide maximum source control.
Comply with Standards for Management of Wastes	Excavation of the 58-acre Ash Monofill would generate more than 2,000,000 cubic yards of coal ash. Waste would be managed to comply with applicable standards, although there would be logistical challenges in managing such high volume of waste.
Long-Term Effectiveness and Permanence	This alternative would provide maximum long-term effectiveness and permanence because the coal ash would be completely and permanently removed from Cells 1 and 2A. Upon completion of this alternative, no LTM or maintenance of the specified cells would be required.
Reduction of Toxicity, Mobility or Volume through Treatment	The toxicity, mobility and volume of coal ash would be completely eliminated from Cells 1 and 2A. However, the toxicity, mobility and volume

Table 5. Evaluation of Alternative S-2 (Ash Monofill Cells CBR)

Effectiveness	
	of CCR constituents in the excavated material itself would remain unchanged unless it is subsequently treated through beneficial use or at an approved waste disposal facility.
Short-Term Effectiveness	The excavation and transportation activities associated with this alternative could generate fugitive dust. This alternative involves the greatest potential impact to the community during transportation since all coal ash would be removed from Cells 1 and 2A. The potential worker and community exposures would be minimized through the use of PPE and dust control measures.
Implementability	
Technical Feasibility	Excavation can be accomplished using standard construction equipment. There are no buildings or other infrastructure that could pose accessibility concerns at the Ash Monofill. There are no wetlands, historic areas or wildlife refuge that could preclude implementation of this alternative. However, the terrain and significantly high volume of excavated coal ash and soil may pose technical constraints.
Administrative Feasibility	The engineering design and operations plans for this alternative would require CDPHE approval.
Availability of Services and Materials	Excavation is a well-established technology and offered by several vendors.
Cost	
Capital Cost	\$283,816,000
O&M Cost	\$0
Total Cost	\$ 283,816,000

Notes:

CBR = Closure by Removal

CCR = Coal Combustion Residuals

GWPS = Groundwater Protection Standard

O&M = Operation and Maintenance

PPE = personal protective equipment

For the purpose of cost-estimating, the following assumptions were made:

- Approximately 2,600,000 cubic yards of coal ash and underlying contaminated soil from Cells 1 and 2A based on a disposal rate of 71,600 cubic yard per year.

Alternative S-2 is cost-prohibitive and not an economically viable option. In addition, implementation of this alternative poses safety concerns, and logistical constraints in transportation and disposal of such large volumes of ash wastes.

7. Groundwater Technology Identification and Corrective Action Alternatives

The purpose of this section is to identify potentially applicable groundwater treatment technologies that can be used to remediate selenium-contaminated groundwater downgradient of the Ash Monofill. The selected treatment technologies were assembled into corrective action alternatives and evaluated to determine whether they are capable of achieving the CAOs presented in **Section 4.0** considering screening criteria of effectiveness, implementability, and cost.

7.1 Technology Screening and Identification

Potentially applicable groundwater remediation technologies were identified based on selenium characteristics and site-specific hydrogeologic and geochemical conditions determined to be present downgradient of Ash Monofill. The technology identification process focused only on those technologies that have proven to be effective at other CCR or metal-impacted sites. Potentially applicable groundwater technologies for selenium remediation in groundwater were identified from a multitude of sources based on literature research (Goldermund and Ahrens, 2017; Kleinmann, 2017; Geosyntec, 2018).

The following remedial technologies, as standalone or in combination, were identified for consideration to achieve the groundwater CAOs:

- Monitored Natural Attenuation (MNA);
- Permeable Reactive Barrier (PRB);
- Groundwater Collection (via Extraction Wells);
- Off-Site Groundwater Discharge;
- On-Site Groundwater Discharge; and
- Long-Term Monitoring (LTM)

The above selected groundwater remediation technologies were screened based on effectiveness, technical implementability, and relative life-cycle cost. Those technologies that passed screening were used to develop corrective action alternatives, and these alternatives are subjected to detailed analysis and comparison in Sections 8 and 9. Those technologies that were not effective, had implementation concerns, and/or were excessively expensive in comparison to other technologies were rejected from further consideration.

7.2 Description of Applicable Technologies

Groundwater technologies identified in Section 7.1 are described in the following subsection.

7.2.1 Monitored Natural Attenuation (MNA)

MNA relies on a combination of physical, chemical and biological processes including dilution, dispersion, adsorption, intrinsic biodegradation, volatilization, and stabilization to reduce toxicity, mobility, or volume of contaminants. At CCR sites, the natural attenuation processes for inorganic contaminants such as selenium include a variety of physical and chemical processes that, under favorable conditions, act without human intervention to reduce a constituents' mass, toxicity, mobility, volume, or concentration in groundwater. Physical attenuation includes dispersion and dilution. Chemical attenuation includes constituent adsorption, ion exchange, and precipitation of minerals. Adsorption of metals to iron and manganese oxides, clay particles, or organic matter in soils is typically the most common sequestration mechanism naturally active at CCR disposal sites (Kleinmann, 2017).

MNA requires LTM to track constituent concentrations over time and to determine whether site-specific CAOs are achieved. Monitoring trends in a carefully designed monitoring network typically is a key part of informed decision making for both (1) selecting MNA as an appropriate response action for a site, and (2) assessing the effectiveness of MNA over time. Initial assessments of constituent extent, aquifer pH, whether the aquifer is generally oxidizing or reducing, and whether it is influenced by external hydrologic forces (for example, interactions between groundwater and surface water, recharge from precipitation or episodic regional withdrawals from an aquifer) should be considered in designing the dimensions of the monitoring network and the frequency of data collected to characterize site geochemistry and hydrology (EPA, 2008).

MNA is a viable option for this site considering that selenium, the sole COC that exceeds the GWPS at a SSLs only at monitoring wells ASH-05 and ASH-07. Natural processes such as sorption, biogeochemical reactions, and dilution/dispersion are expected to decrease selenium concentrations in the downgradient groundwater once Ash Monofill Cells 1 and 2A achieve final closure and construction of lined Cell 2B is completed.

7.2.2 Permeable Reactive Barrier (PRB)

PRBs are a feasible alternative for in-situ treatment of various inorganic constituents that may be present in groundwater at CCR sites. PRBs must be engineered with appropriate reactive media, effective residence time of impacted groundwater in the reactive media, and strategic location to passively capture the entire extent of the plume. Various design configurations have been constructed, including continuous barriers, funnel-and-gate systems, in situ deep slurry injections, and in situ reactive vessels (ITRC, 2005). Remediation is achieved as contaminated groundwater passes through a reactive subsurface zone that either removes the COC from groundwater or facilitates its transformation into a less toxic form. Some potential reactive media, such as zero valent iron (ZVI), promote both adsorption and precipitation of a broad range of constituents, while others, such as hybrid ion exchange resins, specifically promote one reaction to target a single or narrow range of constituents. Media such as ZVI, organic matter, ion-exchange resins, surfactant-modified zeolites, ferrous sulfate, red muds, and Granular Ferric Hydroxide™ show promise for remediation of CCR leachate. Overall, performance and cost data are needed for a wide range of constituents, and for varying mixtures of these constituents (EPRI, 2006). A wide range of PRB reactive media including ZVI, organic matter and limestone is available for selenium remediation.

7.2.3 Hydraulic Containment Using Extraction Wells

Groundwater collection using extraction wells is suitable for removing impacted groundwater from an aquifer for subsequent treatment and/or discharge. An extraction well is a component of a groundwater pump and treatment system. An extraction network is designed to capture impacted groundwater, preventing it from migrating further downgradient, and/or to provide hydraulic containment. The extraction well flowrates and spacing are based on aquifer hydraulic characteristics. Groundwater is then pumped through subsurface piping to an aboveground storage tank for disposal or to a centralized treatment system.

7.2.4 Ex-Situ Groundwater Treatment Technologies

Ex-situ groundwater treatment technologies are used to remove metal constituents from groundwater to meet regulatory discharge requirements. Treatment options for metal constituents may include pH adjustment, coagulation/chemical precipitation, or constructed treatment wetlands. Groundwater treatment technologies have not been considered for the impacted groundwater downgradient of the Ash Monofill because the low selenium concentrations cannot be treated ex-situ cost effectively.

7.2.5 On-Site/Off-Site Discharge of Groundwater

Groundwater discharge technologies involve the disposal of untreated groundwater at an approved on-site or off-site treatment facility, a publicly owned treatment works (POTW), discharge to surface water, or re-injection into an aquifer. The discharge of treated groundwater must satisfy effluent limitations and typically requires regulatory approval.

7.2.6 Long-Term Monitoring (LTM)

LTM of groundwater is an effective tool in evaluating remedial progress and attainment of CAOs. During remedy implementation, groundwater is typically monitored and evaluated periodically to assess constituent migration and track the progress of constituent concentration reduction, as well as provide an early indication of unforeseen environmental or human health exposures. LTM allows assessment of the remedy protectiveness over time, including an early indication of any changed site conditions if they occur.

7.3 Assembly of Corrective Measure Alternatives

Based on the results of the identification and screening of remedial technologies/process options, the following corrective measure alternatives were developed and retained for detailed evaluation:

- Alternative G-1: MNA and LTM
- Alternative G-2: PRB and LTM
- Alternative G-3: Hydraulic Containment (via Extraction Wells) and LTM

8. Detailed Evaluation of Corrective Measure Alternatives

A detailed evaluation of the three alternatives developed in Section 7.0 is presented in the following subsections. Each alternative is evaluated against the requirements specified in 40 CFR 257.96 and 257.97. The cost for each alternative is estimated using RACER Version 11.4.

8.1 Alternative G-1 MNA and LTM

This alternative consists of MNA and LTM. Once the Ash Monofills Cells 1 and 2A are closed, selenium concentrations in groundwater downgradient of the Ash Monofill is expected to decrease by naturally occurring processes such as sorption, biogeochemical reactions, and advection/ dispersion. As part of MNA, LTM would be conducted downgradient of Ash Monofill to document that MNA is reducing selenium concentrations over time. LTM would be performed using existing wells which may be supplemented by newly installed wells, as necessary. Groundwater would be monitored over the 20 to 40 ft bgs depth interval because selenium are currently found at this depth. At a minimum, the LTM network would include an upgradient well (ASH-01) and a hydraulically connected existing downgradient well(s), such as ASH-03, ASH-04, ASH-05, ASH-07, ASH-02 and/or ASH-08). Groundwater samples will be collected semi-annually and analyzed for Appendix IV constituents consistent with the assessment monitoring program. The LTM network would be finalized during design and optimized periodically based on LTM data review. The remediation timeframe for MNA to attain the GWPS and background concentration for selenium would be determined by statistically-based trend analyses or modeling during design.

If during LTM, data review indicates selenium concentrations in groundwater at downgradient wells are not declining over time or that selenium is migrating further downgradient towards Hamilton Reservoir at concentrations exceeding the GWPS, a contingency remedy such as hydraulic containment would be considered. Appropriate corrective action would be implemented until the selenium GWPS is met.

An evaluation of Alternative G-1 is presented in **Table 6**.

Table 6. Evaluation of Alternative G-1: MNA and LTM

Effectiveness	
Protective of Human Health and the Environment	<p>Following closure of the Ash Monofill Cells 1 and 2A, the relatively low selenium concentrations in the downgradient groundwater are expected to attenuate over time through naturally occurring processes such as sorption and/or precipitation combined with dilution/dispersion. Source control would prevent precipitation infiltration and mitigate further releases of selenium from the coal ash to the underlying groundwater. Although Cell 2B is expected to remain active until 2046, the disposal area would be constructed with a composite liner and a leachate collection system that would prevent release of CCR constituents from the active portion of the Ash Monofill. However, the low selenium concentrations that had been historically released to the underlying groundwater from the Ash Monofill, would continue to migrate further downgradient. It would likely take MNA less than 10 years to achieve the selenium GWPS.</p> <p>Furthermore, groundwater in the Pierre Shale is of limited quality and quantity and there are no current or planned future domestic or agricultural uses of the groundwater at the facility. Therefore, exposure of selenium in groundwater through ingestion, inhalation, dermal contact or agricultural use is unlikely to occur at the site. There are no potential off-site groundwater pathways, human receptors, or known sensitive environmental habitat or species that would be adversely impacted by selenium in groundwater at the site.</p> <p>Alternative G-1 is protective of human health and the environment.</p>
Attain GWPS	<p>Once the Ash Monofill Cells 1 and 2A achieve final closure, MNA is expected to meet the GWPS of 0.05 mg/L (40 CFR Part 257(h) for selenium within a reasonable timeframe. As part of MNA, LTM would be conducted to periodically assess selenium trends. This would ensure that the remedy continues to be protective of human health and the environment or determine if additional review/corrective action is warranted.</p>
Control the Source of Release	<p>Source control would be achieved with the closure of Ash Monofill Cells 1 and 2A.</p>
Comply with Standards for Management of Wastes	<p>No wastes would be generated under this alternative.</p>
Long-Term Effectiveness and Permanence	<p>Given that source control would be achieved through the closure of Ash Monofill Cells 1 and 2A, dissolved selenium in groundwater is expected to be attenuated by natural effects such as sorption, precipitation onto the soil minerals of the aquifer matrix combined with dilution/dispersion. LTM data would be used to demonstrate that natural attenuation is occurring, and that selenium is being attenuated over time.</p>
Reduction of Toxicity, Mobility or Volume through Treatment	<p>This alternative would not employ any active treatment technologies; therefore, no reduction in the toxicity, mobility, or volume of selenium would occur through treatment.</p>

Table 6. Evaluation of Alternative G-1: MNA and LTM

Effectiveness	
Short-Term Effectiveness	Implementation of Alternative G-1 would not include on-site activities other than periodic groundwater sampling to monitor MNA progress. Proper use of PPE and following a Site-Specific HASP would minimize or eliminate impacts to workers during groundwater sampling. No construction activities would be involved that could adversely impact the ambient water or air quality at the site.
Implementability	
Technical Feasibility	This alternative includes no active remediation components. Periodic groundwater sampling and reporting are easily implemented.
Administrative Feasibility	No additional approvals and permits would be required to implement this alternative.
Availability of Services and Materials	This alternative would include standard sampling methods and equipment. No special equipment or technical specialists would be required during implementation.
Cost	
Capital Cost	\$0
O&M Cost	\$464,500
Total Cost	\$464,500

Notes:

CCR = Coal Combustion Residuals

GWPS = Groundwater Protection Standard

LTM = Long-term Monitoring

MNA = Monitored Natural Attenuation

PPE = personal protective equipment

For cost estimating purposes, the following assumptions were made:

- LTM network consists of 6 existing wells (ASH-01, ASH-03, ASH-04, ASH-05, ASH-07, and ASH-08).
- Collection of twelve groundwater samples per year for analyses of Appendix IV constituents and specified MNA parameters (pH, oxidation-reduction potential (ORP), dissolved oxygen (DO), sulfate), for an anticipated MNA period of 10 years. This would be followed by post-remedy, semiannual monitoring period of 3 years for Appendix IV constituents.

8.2 Alternative G-2 PRB and LTM

Alternative G-2 involves the application of a PRB for the remediation of selenium in groundwater downgradient of the Ash Monofill. As groundwater passes through the PRB under natural gradients, dissolved constituents such as selenium would be immobilized through precipitation and/or adsorption to remove them from groundwater. Since selenium is an inorganic constituent and is not subject to degradation, the remediation strategy is to remove it from solution or cause it to become immobile in the subsurface. Once groundwater passes through the PRB, the concentrations of selenium would be attenuated to meet the GWPS. The PRB would be installed downgradient of monitoring wells ASH-03, ASH-04, ASH-05, and ASH-07 to intercept and treat selenium in groundwater. There are no site

constraints in this area such as buildings and major overhead and underground utilities that would affect PRB positioning and construction methods.

The PRB would be installed either using continuous trenching equipment or through the use of a series of injection points. The PRB would be designed with appropriate reactive media and an effective residence time in the reactive media to meet CAOs for groundwater remediation. Some potential reactive media, such as ZVI, promote both adsorption and precipitation of a broad range of constituents, while others, such as hybrid ion exchange resins, can specifically promote one reaction to target a single or narrow range of constituents. A variety of PRB media such as ZVI, limestone and organic carbon is available to remediate selenium contamination in groundwater. A treatability study would be required to determine site-specific effectiveness, appropriate reactive media for the PRB, and operational parameters such as the projected longevity of the PRB. Treatability study is an important consideration in the design process because environmental factors such as pH, ORP and competing ions in the groundwater would affect the ability of various media which may degrade due to clogging and due to reactions with constituents that are not identified as COCs.

Performance monitoring would be conducted using wells located immediately upgradient, cross-gradient and downgradient of the PRB. This monitoring would be used to assess remediation effectiveness, short-circuiting, if any of impacted groundwater flowed around the PRB, changes in media reactivity, and decreases in PRB permeability, etc.

Performance monitoring would be conducted on semi-annual basis for Appendix IV constituents and geochemical parameters (pH, ORP, DO, sulfate, sulfide, total and ferrous iron, total and dissolved organic carbon, and alkalinity) followed by LTM. Monitoring would be performed by sampling groundwater at six existing wells (ASH-01, ASH-03, ASH-04, ASH-05, ASH-07 and ASH-08) and newly installed monitoring wells as required.

An evaluation of Alternative G-2 is presented in **Table 7**.

Table 7. Evaluation of Alternative G-2: PRB and LTM

Effectiveness	
Protective of Human Health and the Environment	<p>Following final closure of Cells 1 and 2A, this alternative involves the installation of a PRB to facilitate precipitation/adsorption to reduce dissolved selenium concentrations in groundwater. Source control would be achieved by closure of Cells 1 and 2A. Source control would prevent further releases of selenium, if any from Cells 1 and 2A to downgradient groundwater. Although Cell 2B is expected to remain active until 2046, the disposal area would be constructed with a composite liner and a leachate collection system that would prevent leaching of CCR constituents from the active portion of the Ash Monofill. Source control combined with a PRB would likely achieve the GWPS for selenium in groundwater within 5 to 10 years. Performance monitoring would be implemented to determine whether the selenium concentrations in groundwater are being reduced at a reasonable rate to meet their respective GWPS within a specified remediation timeframe.</p> <p>There are no short-term human health or environmental concerns during remedy implementation since groundwater is not currently used at the site. Exposure to selenium-impacted in groundwater through ingestion, inhalation, dermal contact or agricultural use is unlikely to occur at the site. There are no potential off-site groundwater exposure pathways, human receptors, or known sensitive environmental habitat or species that would</p>

Table 7. Evaluation of Alternative G-2: PRB and LTM

	<p>be adversely impacted by the selenium-impacted groundwater downgradient of the Ash Monofill.</p> <p>Alternative G-2 is protective of human health and the environment.</p>
Effectiveness	
Attain GWPS	This alternative is likely to meet the selenium GWPS of 0.05 mg/L (40 CFR Part 257(h)) within a timeframe of 7 years. LTM would be implemented to evaluate whether the PRB is reducing concentrations at a rate to meet the GWPS within a reasonable timeframe, or if remedy optimization or an alternative remedy is warranted.
Control the Source of Release	Source control would be achieved with the final closure of Cells 1 and 2A. In addition, the operation of Cell 2B would include safe disposal practice by employing a composite liner and a leachate collection system to control release of CCR constituents to the underlying groundwater.
Comply with Standards for Management of Wastes	This alternative would include trenching for the PRB installation. This would generate excavated material that would be disposed of at an approved on-site location or off-site facility. Management including disposal of the excavated material would comply with standards specified under 40 CFR 257.98(d).
Long-Term Effectiveness and Permanence	PRB is expected to result in significant reduction of selenium concentrations in groundwater. The PRB would be designed to intercept the entire width of the contaminated groundwater zone. Upon contact with the PRB, selenium in the groundwater would precipitate and/or sorb onto the reactive media of the PRB. The thickness of the PRB would be designed to provide sufficient residence time for precipitation/adsorption processes to occur. The longevity of a typical PRB with ZVI is estimated to be 10 to 20 years. Less information is available for the longevity of other media, which may still be from 5 to 10 years (EPRI 2006). Performance monitoring would be performed to demonstrate the effectiveness of the PRB process over time. Alternative G-2 would provide long-term effectiveness and permanence.
Reduction of Toxicity, Mobility or Volume through Treatment	PRB is expected to reduce the toxicity, mobility, and volume of selenium in the groundwater downgradient of the Ash Monofill.
Short-Term Effectiveness	<p>Implementation of this alternative would include trenching and backfilling with reactive media and routine groundwater sampling. Reactive media such as ZVI, organic matter or other media are relatively safe products to handle in the field. The use of proper PPE and following the Site-Specific HASP is expected to provide adequate protection of workers during implementation of the PRB treatment and long-term groundwater monitoring.</p> <p>Any potential adverse air quality impacts as a result of fugitive dust emissions during PRB installation and transportation of excavated materials that could adversely impact air quality would be addressed by engineering controls, PPE, and following the Site-Specific HASP.</p>

Table 7. Evaluation of Alternative G-2: PRB and LTM

Implementability	
Technical Feasibility	This alternative is implementable. Site conditions and hydrogeology are amenable to PRB construction. PRB technology has been used to successfully remediate metals-impacted sites and significant research and research is ongoing related to the use of reactive media to treat CCR constituents in groundwater. A treatability study would be required to determine site-specific effectiveness and appropriate PRB media for the Ash Monofill. The construction activities required to install a PRB are routine remediation activities and would be implemented easily.
Administrative Feasibility	Implementation of this alternative would require coordination with construction contractors.
Availability of Services and Materials	Vendors and contractors are available to provide reactive media and install a PRB. Availability and scheduling of equipment and supplies is not expected to be an issue.
Cost	
Capital Cost	\$2,372,000
O&M Cost	\$393,300
Total Cost	\$2,765,300

Notes:

CCR = Coal Combustion Residuals

CFR = Code of Federal Regulations

GWPS = Groundwater Protection Standard

HASP = Health and Safety Plan

LTM = Long-term Monitoring

PPE = personal protective equipment

PRB = permeable reactive barrier

ZVI = zero valent iron

For the purpose of cost-estimating, the following assumptions were made:

- ZVI and crushed limestone are used as reactive media
- Remediation timeframe of 7 years followed by 3 years of LTM. Semi-annual groundwater analysis would be performed during this 9-year period.
- Monitoring network would consist of 6 existing and 2 newly installed wells.

8.3 Alternative G-3 Hydraulic Containment (via Extraction Wells) and LTM

This alternative would consist of groundwater extraction wells for hydraulic containment, an above ground storage tank and associated piping in combination with LTM. Treatment is not required because of the relatively low selenium concentrations in groundwater. Groundwater extraction would be performed using multiple vertical extraction wells. These wells would be placed along a line perpendicular to the groundwater flow direction at monitoring wells ASH-03, ASH-04 and ASH-05. The extraction network would be designed to provide hydraulic containment of the impacted groundwater, preventing it from migrating further downgradient. Groundwater would be extracted using a submersible pump in each well to form a cone of depression that contains the contaminated groundwater. The wells would be installed to collect selenium impacted groundwater from a depth interval between 20 and 40 ft within the Pierre

Shale. Depending on the aquifer yield, pumping may be performed in a continuous or pulsed manner. The extraction wells would be monitored to determine the extent of mineral precipitation in the extraction system and take corrective action, as necessary. Following extraction, groundwater would be conveyed to an aboveground storage tank prior to disposal at an approved off-site non-hazardous facility or disposed in an on-site retention pond, such as the PRS Ponds for evaporation. The number of extraction wells, spacing, and storage tank capacity would be determined during the design phase.

Performance monitoring would be required to demonstrate hydraulic containment and constituent concentration reduction. Performance monitoring would include semi-annual groundwater elevation measurements and groundwater sampling and analysis for Appendix IV constituents throughout the hydraulic containment period. When two consecutive groundwater monitoring events indicate that groundwater selenium concentrations are at or below its GWPS, the extraction system would be shut-off. Subsequently, post-remediation monitoring would be performed for a period of 3 years to confirm that selenium concentrations do not rebound over time. Upon completion of groundwater remediation, LTM would be performed to meet the post-closure care requirements per 40 CFR 257.104, assuming Ash Monofill Cells 1 and 2A would be CIP. The LTM network would include six existing wells (ASH-01, ASH-03, ASH-04, ASH-05, ASH-07 and ASH-08).

An evaluation of Alternative G-3 is presented in **Table 8**.

Table 8. Evaluation of Alternative G-3: Hydraulic Containment (via Extraction Wells) and LTM

Effectiveness	
Protective of Human Health and the Environment	<p>Following final closure of the Ash Monofill Cells 1 and 2A, this alternative would consist extraction of selenium-impacted groundwater above the GWPS. With removal of groundwater from the aquifer, selenium concentrations in the affected area would be expected to decrease over time. A field pilot test may be performed to predict the number of wells, well spacing and pumping rate. The extracted groundwater would be stored onsite in an aboveground storage tank and disposed at an approved off-site facility or within the PRS Ponds. Source control combined with hydraulic containment is expected to achieve the GWPS for selenium in groundwater in 5 years. This is based on the assumptions that historically released selenium in the underlying groundwater would continue to migrate downgradient.</p> <p>There are no short-term human health or environmental concerns during the remedy implementation period since Pierre Shale groundwater is naturally of poor quality and quantity and is not currently used for domestic or agricultural purposes at the site. Exposure of selenium-impacted groundwater through ingestion, inhalation, dermal contact or agricultural use is unlikely to occur. There are no potential off-site groundwater pathways, human receptors, or no known sensitive environmental habitat or species that would be adversely impacted by the selenium in groundwater at the site.</p> <p>Alternative G-3 is protective of human health and the environment.</p>
Attain GWPS	<p>This alternative is expected to meet the GWPS of 0.05 mg/L (40 CFR Part 257(h) for selenium within a timeframe of 5 years. LTM would be implemented to evaluate whether groundwater extraction reduces selenium concentrations at a reasonable rate to meet the GWPS, or if extraction well network optimization is warranted.</p>
Control the Source of Release	<p>Source control would be achieved with the final closure of Ash Monofill Cells 1 and 2A.</p>

Table 8. Evaluation of Alternative G-3: Hydraulic Containment (via Extraction Wells) and LTM

Effectiveness	
Comply with Standards for Management of Wastes	This alternative would generate selenium-impacted groundwater that would be disposed at an approved off-site facility or within the PRS Ponds for treatment. A chemical precipitation unit could be employed if the final effluent concentration in the above storage tank equals or exceeds the GWPS; however, this would require disposal of the chemical precipitate on-site or off-site.
Long-term Effectiveness and Permanence	Hydraulic containment would provide an effective long-term solution to groundwater contamination at the Ash Monofill. Groundwater extraction would reduce the mass and concentrations of selenium. The timeframe for this alternative is expected to be shorter than Alternative G-1. LTM data would be used to demonstrate the remedy effectiveness over time. Alternative G-3 would provide long-term effectiveness and permanence.
Reduction of Toxicity, Mobility or Volume through Treatment	This alternative is expected to reduce the toxicity, mobility, and volume of selenium in the groundwater at the Ash Monofill.
Short-term Effectiveness	Construction of a hydraulic containment system consisting of extraction wells and aboveground storage unit would be completed with standard construction equipment and would entail no additional risks to workers beyond those risks inherent in construction projects. The operation of the groundwater pumping system is not expected to increase the risk to human health or the environment. The extracted groundwater would be disposed of as non-hazardous waste at an approved on-site or off-site facility. The use of proper PPE and following the Site-Specific HASP is expected to provide adequate protection of workers during construction and implementation of this alternative. This alternative would not have adverse air quality impacts or fugitive dust emissions, or generation of hazardous wastes that would adversely affect human health or the environment.
Implementability	
Technical Feasibility	Hydraulic containment is a proven technology for containing and removing metals from groundwater. System operation is generally reliable without major disruptions. The system would have to be designed based on site-specific conditions including stratigraphy, hydraulic conductivity, porosity, aquifer thickness, seasonal water-level variations, groundwater recharge/discharge etc. Hydraulic containment has been used effectively at numerous remediation sites. The construction activities required to install extraction wells, piping and aboveground storage tank are routine remediation activities and would be implemented easily.
Administrative Feasibility	Implementation of this alternative would require coordination with construction contractors. Additional coordination and permits would be required for transportation of impacted groundwater to an off-site non-hazardous waste disposal facility.
Availability of Services and Materials	Construction contractors are readily available to install a hydraulic containment system.
Cost	

Table 8. Evaluation of Alternative G-3: Hydraulic Containment (via Extraction Wells) and LTM

Capital Cost	\$ 605,700
O&M Cost	\$ 752,000
Total Cost	\$ 1,357,700

Notes:

CFR = Code of Federal Regulations

GWPS = Groundwater Protection Standard

HASP = Health and Safety Plan

LTM = Long-Term Monitoring

mg/L = milligrams per liter

PPE = personal protective equipment

PRS = phosphorus recovery system

ZVI = zero valent iron

For the purpose of cost-estimating, the following assumptions were made:

- 5 extraction wells downgradient of the Ash Monofill
- Flowrate of 1 gpm per extraction well
- No groundwater treatment is required
- Remediation timeframe of 5 year, followed by semiannual LTM for 3 years
- Semi-annual sampling during the remediation period.

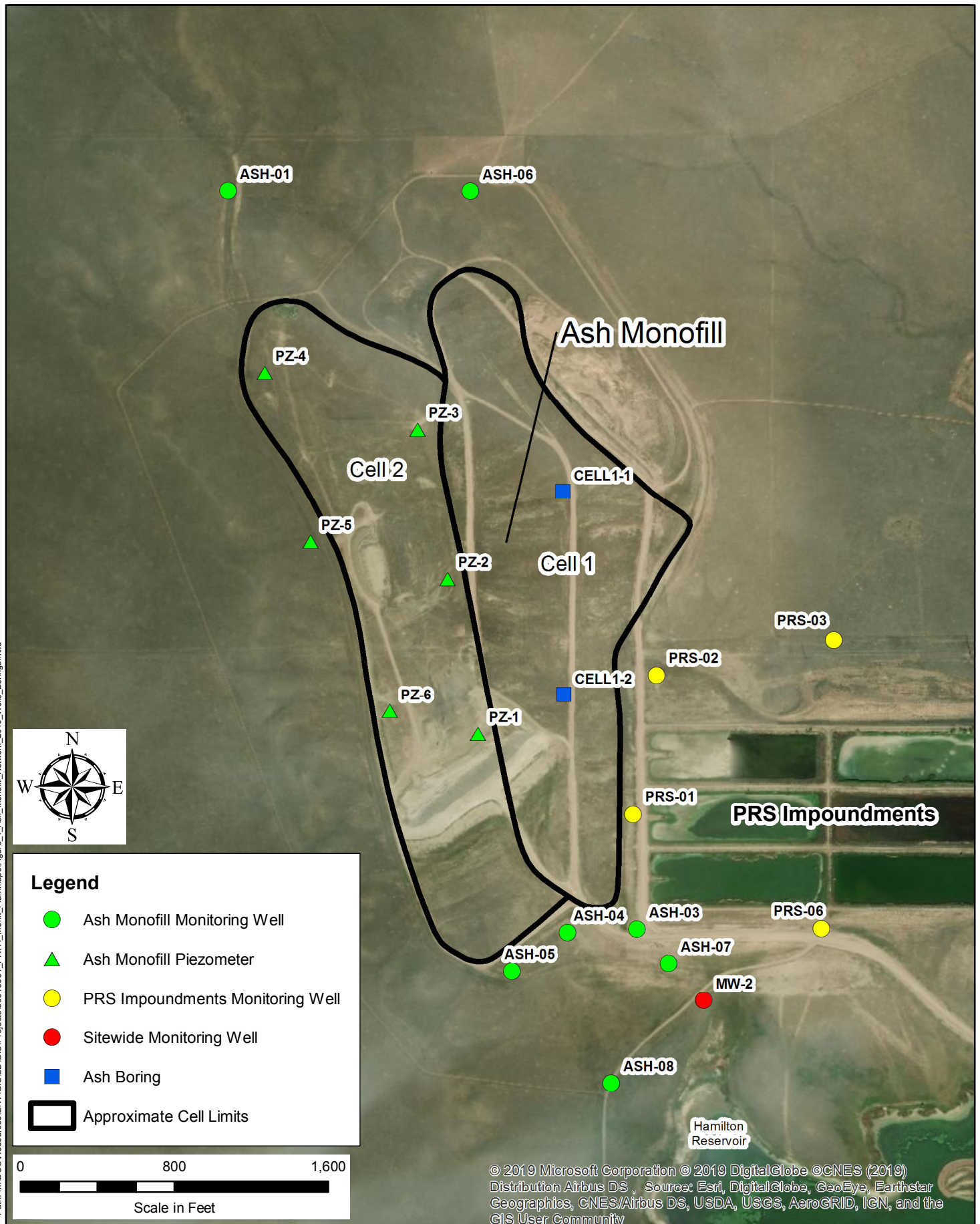
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Figures

Figures

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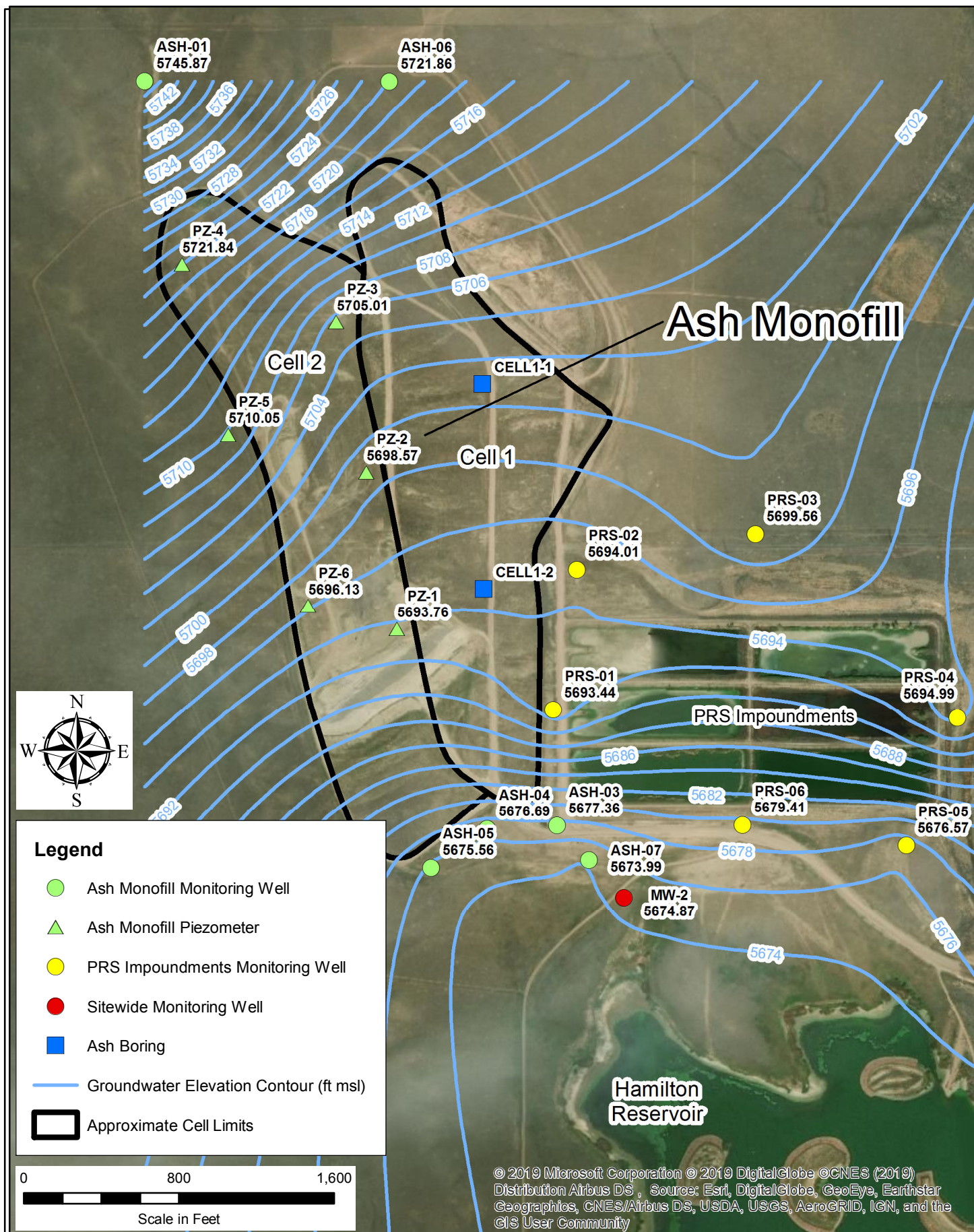


Draft Ash Monofill ACM
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Rawhide Energy Station
Ash Monofill
Wells, Piezometers, and Borings

AECOM
Figure 1

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Ash Monofill ACM

Platte River Power Authority Larimer County, CO
Project No.: 60514657 Date: 08-07-2019

RAWHIDE ENERGY STATION
ASH MONOFILL
POTENTIOMETRIC SURFACE MAP
JANUARY 17, 2019

AECOM

Figure 2

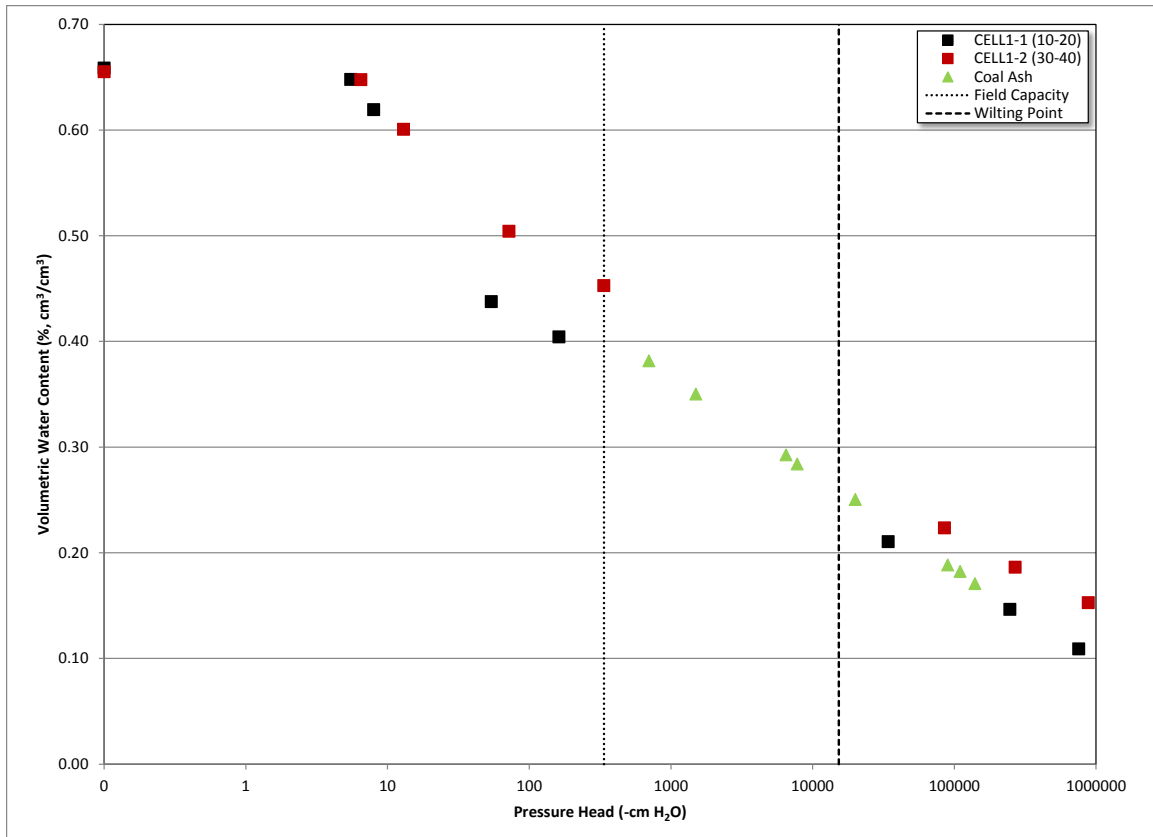


Figure 3. Coal Ash Moisture Characteristic Curves

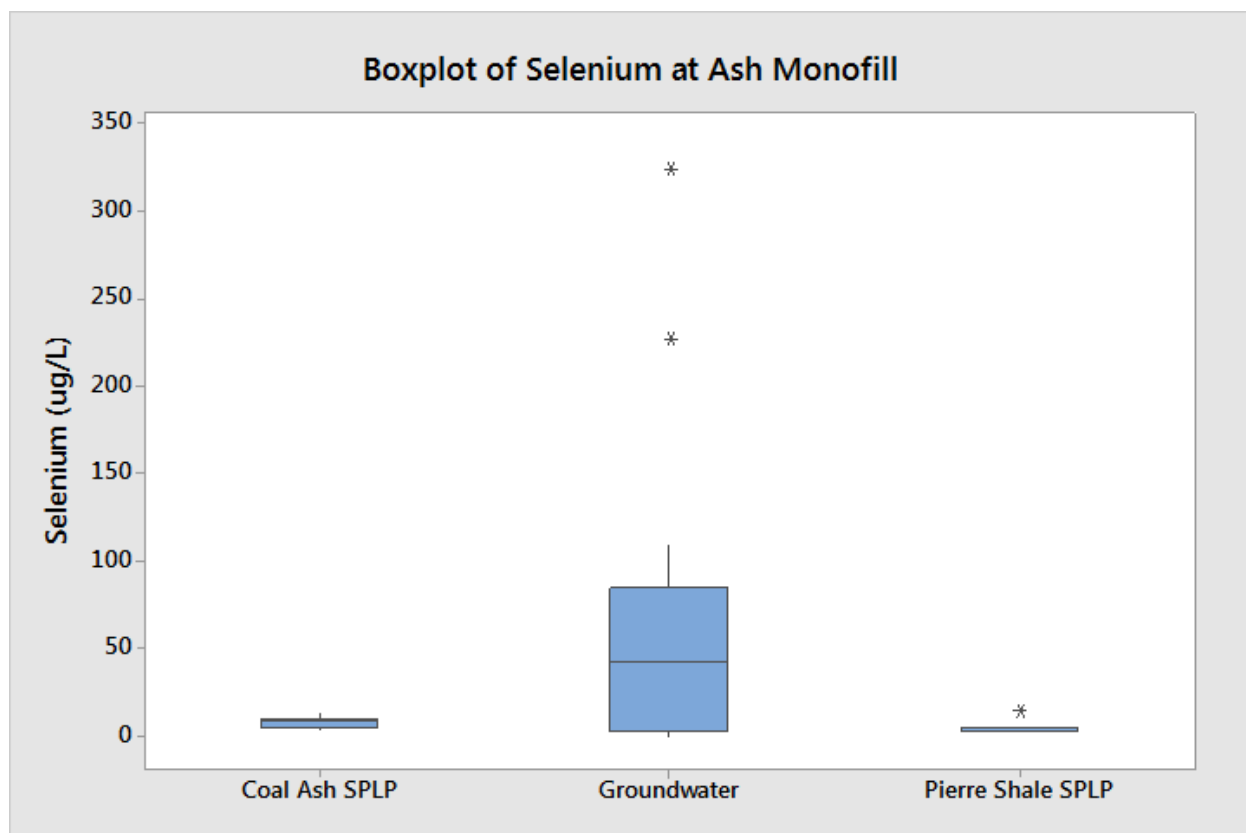


Figure 4. Boxplots of Selenium Concentrations in SPLP Leachates and Groundwater

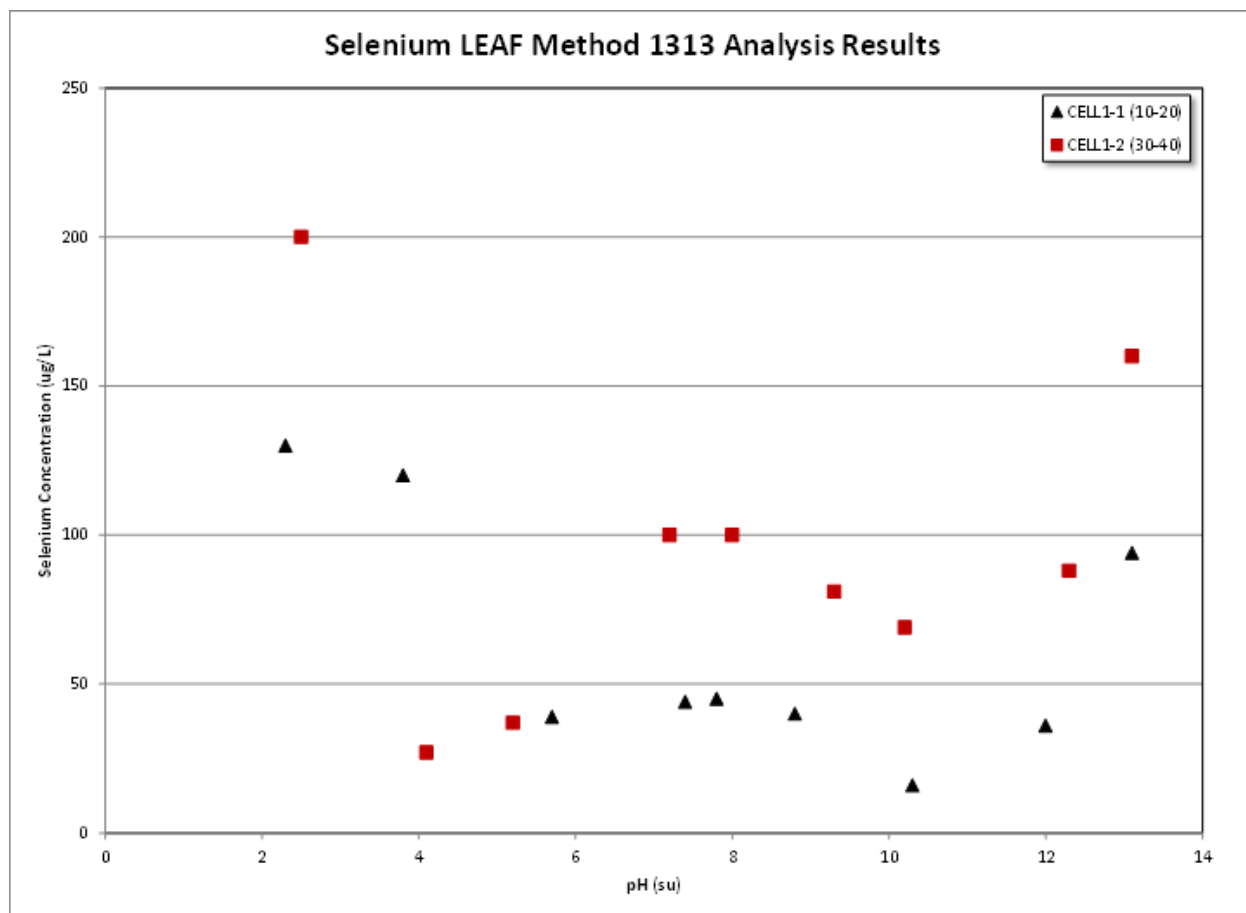


Figure 5. LEAF Method 1313 Results for Selenium in Coal Ash

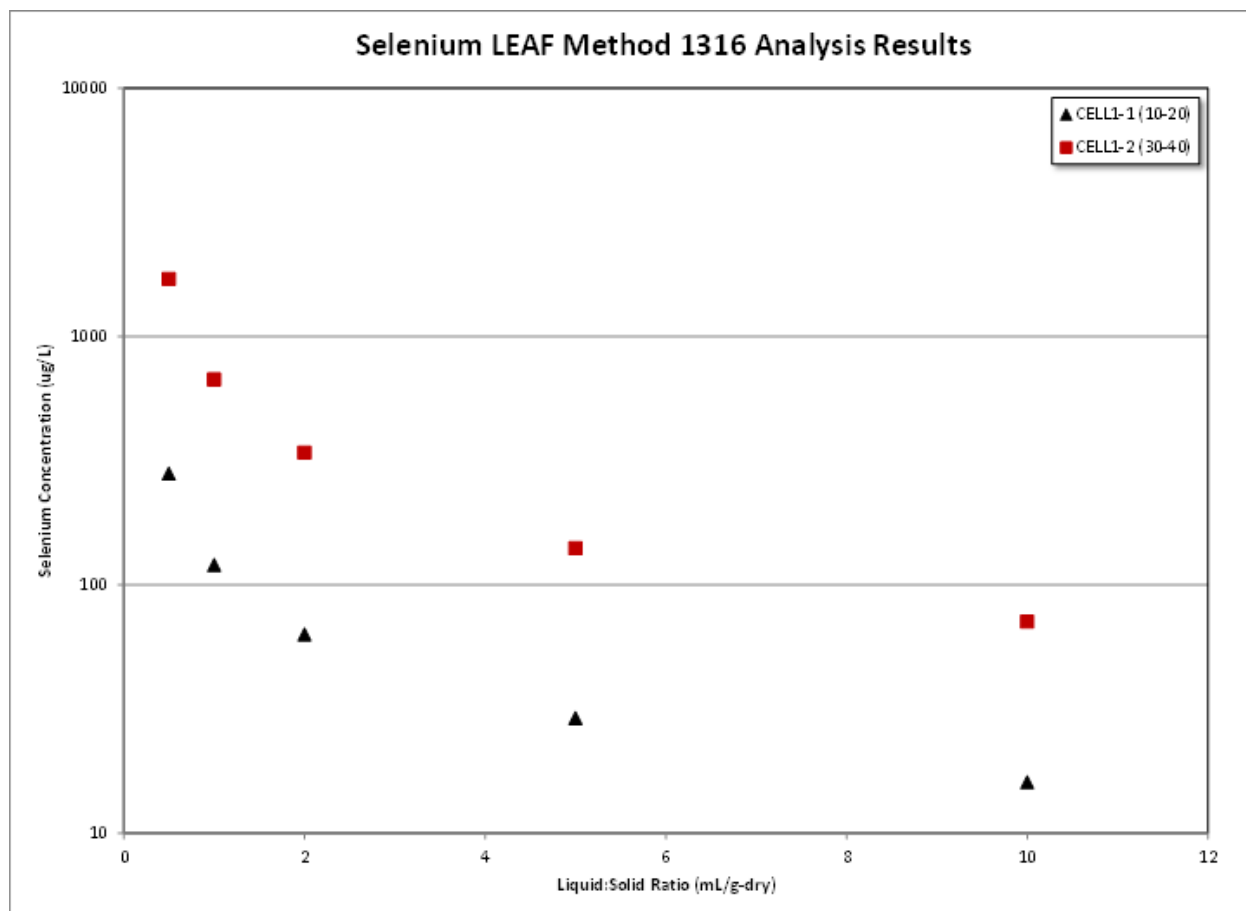


Figure 6. LEAF Method 1316 Results for Selenium in Coal Ash