2019 Annual Groundwater Summary

Brickhaven No. 2 Mine Tract “A” Structural Fill

Charah Solutions, Inc.

Moncure, Chatham County, North Carolina

January 31, 2020

HDR Engineering, Inc. of the Carolinas
440 S Church Street, Suite 1000, Charlotte, NC 28202-2075
704.338.6700
NC License F0116

2019 Annual Groundwater Summary

Brickhaven No.2 Mine Tract "A" Structural Fill Permit 19-10

The Brickhaven No.2 Mine Tract "A" Structural Fill groundwater monitoring system is designed to meet the requirements of the North Carolina Coal Ash Management Act of 2014 (CAMA) and North Carolina Department of Environmental Quality Rule 15A NCAC 13B Section .1631.

HDR conducted the required 2019 semi-annual sampling events on January 21-25 and July 8-12, 2019. Groundwater monitoring and sampling at the site is governed by the following:

- North Carolina - Coal Ash Management Act (CAMA) of 2014 (Senate Bill 729)
- Water Quality Monitoring Plan Brickhaven No.2 Mine Tract "A" Structural Fill, approved March 2015
- North Carolina Department of Environmental Quality (NCDEQ) Permit No. 1910-STRUC-2015, issued June 5, 2015
- NCDEQ Solid Waste Section Guidelines for Groundwater, Soil, and Surface Water Sampling, April 2008
- NCDEQ Division of Water Management memorandum concerning electronic document submittal for routine groundwater and surface water monitoring, November 5, 2014
- U.S. Environmental Protection Agency (EPA) Region I, *Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells*, January 19, 2010
- EPA 2009, Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance and CFR 40 257.93 (f)(3)

The spring and fall summary reports with an EPA method of statistical analysis were submitted to the NCDEQ Division of Waste Management on June 7 and December 9, 2019 respectively. The reports are attached for reference and can be found on the NCDEQ website at this location https://deq.nc.gov/about/divisions/waste-management/laserfiche. The following information has been provided in those reports:

- Status of the groundwater monitoring for the structural fill
- A summary of site conditions and key actions completed during the routine reporting period
- Description of conditions encountered and actions employed to define the conditions
- Key activities proposed for the upcoming year
- A map showing the background (or upgradient) and downgradient monitoring wells
- Monitoring data obtained from sampling of wells, including information on the samples collected

The findings of the groundwater sampling and laboratory testing conducted in 2019 indicate the presence of naturally occurring constituents that were detected at various levels both prior to and after placement of coal combustion products.

On June 21, 2019, the NCDEQ issued a letter to Charah to begin assessment monitoring, citing exceedances of groundwater standards established in 15A NCAC 2L .0202 (2L Standards) and surface water standards established in 15A NCAC 2B .0211 and .0216 (2B Standards) at the Brickhaven No. 2 Mine Structural Fill. Charah submitted a Groundwater and Surface Water Assessment Work Plan (Work Plan) to NCDEQ on August 16, 2019. Collection and analysis of the following samples were proposed in the Work Plan:

- Soil samples from areas within the former General Shale mine, but beyond the area of CCP placement by Charah;
- Groundwater samples from proposed and existing monitoring wells;
- Surface water samples from proposed and existing locations; and,
- Leachate samples from the designated leachate sampling location.

In addition, Charah proposed to perform geochemical analyses of soil and ash quality data to groundwater quality data to confirm or deny the Structural Fill as a potential source of elevated concentrations of inorganic constituents reported in groundwater and surface water in the vicinity of the Site. Further, these data will be used to construct a three-dimensional groundwater flow and transport model to demonstrate groundwater movement patterns in the subsurface near the Structural Fill and to simulate the fate and transport of the constituents detected during groundwater monitoring. Based on the schedule proposed by Charah in correspondence dated September 30, 2019 and approved by NCDEQ on October 4, 2019, the results of assessment monitoring activities will be summarized in an Assessment Monitoring Report to be submitted to NCDEQ on July 27, 2020. Copies of the Work Plan and schedule submitted to NCDEQ are attached.

As HDR's authorized representative, I have prepared or supervised the preparation of the referenced documents above; which have been prepared in general accordance with industry standards and practices; and the information contained therein is truthful and accurate to the best of my knowledge.

Mark P. Filardi, LG
Sr. Geologist

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A

Attachment A – 2019 First Semi-Annual Detection Monitoring Report

DENR USE ONLY: ☐ Paper Report ☐ Electronic Data - Email CD (data loaded: Yes / No) Doc/Event #:

NC DENR
Division of Waste Management - Solid Waste

Environmental Monitoring Reporting Form

Notice: This form and any information attached to it are "Public Records" as defined in NC General Statute 132-1. As such, these documents are available for inspection and examination by any person upon request (NC General Statute 132-6).

Instructions:

- **Prepare one form for each individually monitored unit.**
- **Please type or print legibly.**
- Attach a notification table with values that attain or exceed NC 2L groundwater standards or NC 2B surface water standards. The notification must include a preliminary analysis of the cause and significance of each value. (e.g. naturally occurring, off-site source, pre-existing condition, etc.).
- Attach a notification table of any groundwater or surface water values that equal or exceed the reporting limits.
- Attach a notification table of any methane gas values that attain or exceed explosive gas levels. This includes any structures on or nearby the facility (NCAC 13B .1629 (4)(a)(i).
- Send the original signed and sealed form, any tables, and Electronic Data Deliverable to: Compliance Unit, NCDENR-DWM, Solid Waste Section, 1646 Mail Service Center, Raleigh, NC 27699-1646.

Solid Waste Monitoring Data Submittal Information

Name of entity submitting data (laboratory, consultant, facility owner):

Green Meadow - Charah Solutions, Inc.

Contact for questions about data formatting. Include data preparer's name, telephone number and E-mail address:

Name: Michael Plummer, PE Phone: 704-338-6700

E-mail: michael.plummer@hdrinc.com

Facility name:	Facility Address:	Facility Permit #	NC Landfill Rule: (.0500 or .1600)	Actual sampling dates (e.g., October 20-24, 2006)
Charah, LLC Brickhaven No.2 Mine Tract 'A'	1271 Moncure-Flatwook Rd Chatham County Moncure, NC	1910-Struc-2015	CAMA	January 21-25, 2019

Environmental Status: (Check all that apply)

☐ Initial/Background Monitoring ☐ Detection Monitoring ☐ Assessment Monitoring ☐ Corrective Action

Type of data submitted: (Check all that apply)

☒ Groundwater monitoring data from monitoring wells
☐ Groundwater monitoring data from private water supply wells
☒ Leachate monitoring data
☒ Surface water monitoring data
☐ Methane gas monitoring data
☐ Corrective action data (specify) _____
☐ Other(specify) _____

Notification attached?

☐ No. No groundwater or surface water standards were exceeded.
☒ Yes, a notification of values exceeding a groundwater or surface water standard is attached. It includes a list of groundwater and surface water monitoring points, dates, analytical values, NC 2L groundwater standard, NC 2B surface water standard or NC Solid Waste GWPS and preliminary analysis of the cause and significance of any concentration.
☐ Yes, a notification of values exceeding an explosive methane gas limit is attached. It includes the methane monitoring points, dates, sample values and explosive methane gas limits.

Certification

To the best of my knowledge, the information reported and statements made on this data submittal and attachments are true and correct. Furthermore, I have attached complete notification of any sampling values meeting or exceeding groundwater standards or explosive gas levels, and a preliminary analysis of the cause and significance of concentrations exceeding groundwater standards. I am aware that there are significant penalties for making any false statement, representation, or certification including the possibility of a fine and imprisonment.

Michael Plummer, PE — Facility Representative Name (Print)

Project Manager — Title

704-338-6700 — (Area Code) Telephone Number

Signature

6/7/2019 — Date

Affix NC Licensed Professional Geologist Seal

HDR Engineering, INC. of the Carolinas, 440 S. Church St. Ste. 1000, Charlotte, NC 28202

Facility Representative Address

F0116

NC PE Firm License Number (if applicable effective May 1, 2009)

2019 First Semi-Annual Detection Monitoring Report

Brickhaven No.2 Mine Tract "A" Structural Fill

Charah Solutions, Inc.

Moncure, Chatham County, North Carolina

June 7, 2019

HDR Engineering, Inc. of the Carolinas
440 S Church Street, Suite 1000, Charlotte, NC 28202-2075
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List of Select Acronyms

µg/L	micrograms per liter
bMDL	below Method Detection Limit
CAMA	North Carolina Coal Ash Management Act of 2014
CCP	Coal Combustion Products
DEC	Duke Energy Carolinas
DEP	Duke Energy Progress
DO	Dissolved Oxygen
EDD	Electronic Data Deliverable
EPA	United States Environmental Protection Agency
ft./ft.	feet / foot
ID	Inner Diameter
KM	Kaplan-Meier Method
NCDENR	North Carolina Department of Environment and Natural Resources
NCDEQ	North Carolina Department of Environmental Quality
NCGPS	North Carolina groundwater protection standard
N	Standard Penetration Resistance
ND	Non-detects
NPPL	Non-parametric Prediction Limit
NTU	Nephelometric turbidity units
MCL	Maximum Contaminant Levels
MDL	Method Detection Limit
MLE	Maximum Likelihood Estimate
msl	mean sea level
OD	Outer Diameter
ORP	Oxidation-Reduction Potential
PL	Predictive Limit
PPL	Parametric Prediction Limit
RCRA	Resource Conservation and Recovery Act
ROS	Regression on Order Statistics
SSI	Statistically Significant Increase
UPL	Upper Prediction Limit
USCS	Unified Soil Classification System

1 Introduction

1.1 Purpose

The purpose of this *2019 First Semi-Annual Detection Monitoring Report* is to summarize semi-annual detection monitoring at the Brickhaven No.2 Mine Tract "A" Structural Fill site in Moncure, Chatham County, North Carolina. The report includes results from the January 21-25, 2019 semi-annual detection monitoring event, as well as the statistical results calculated for this monitoring event.

The next semi-annual monitoring event will take place in July 2019.

1.2 Regulatory Compliance

Operating under Facility Permit #1910-STRUT-2015, Charah is required to monitor groundwater and surface water quality at designated locations. Per the Water Quality Monitoring Plan (Buxton, 2015a), groundwater samples are collected from 11 monitoring wells (MW-1 through MW-8, BG-1, and BG-2) and two surface water locations (SW-1 and SW-2). Groundwater samples are analyzed for constituents listed in NCDEQ Solid Waste Appendix I and II, 40 CFR 257 Appendix III, and 40 CFR 257 Appendix IV. If sampling results indicate impacts to groundwater or surface water, Charah must notify NCDEQ within 14 days. If no impacts are observed, Charah must submit a report of the sampling results to NCDEQ with 120 days of the sampling event.

Groundwater monitoring and sampling at the site is governed by the following:

- North Carolina - Coal Ash Management Act (CAMA) of 2014 (Senate Bill 729).
- Water Quality Monitoring Plan, Brickhaven No.2 Mine Tract "A" Structural Fill, approved March 2015 (Buxton, 2015a).
- North Carolina Department of Environment and Natural Resources (NCDENR)[1] Permit No. 1910-STRUC-2015, issued June 5, 2015.
- NCDENR Solid Waste Section Guidelines for Groundwater, Soil, and Surface Water Sampling, April 2008 including Groundwater Rules .1600.
- NCDENR Division of Water Management memorandum concerning electronic document submittal for routine groundwater and surface water monitoring, November 5, 2014.
- U.S. Environmental Protection Agency (EPA) Region I, *Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells*, January 19, 2010.

Groundwater monitoring and sampling at the site is also conducted in general accordance with the U.S. EPA's "Disposal of Coal Combustion Residuals from Electric Utilities" rule (CCR Rule).

[1] On September 18, 2015, the North Carolina Department of Environment and Natural Resources (NCDENR) became the North Carolina Department of Environmental Quality (NCDEQ). Both naming conventions are used in this report, as appropriate.

1.3 Site Location and Operation

The site is located in Chatham County, approximately four miles southeast of Moncure, North Carolina (**Figure 1**). The owner of the site is Green Meadow, LLC (Green Meadow). Charah Solutions, Inc. (Charah) is responsible for the operation and maintenance of the site. The mine property is approximately 301 acres in total; of which 145 acres is permitted for structural fill placement of coal combustion products (CCP).

The property located within the structural fill area was previously owned by General Shale Brick, Inc., which operated the site and an adjacent property as a clay mine beginning in 1985 for their off-site brick manufacturing facility. Mined clay was stockpiled and then transported approximately 3.5 miles south to Brickhaven, North Carolina for brick manufacturing.

The area immediately surrounding the site primarily consists of rural residential (approximately 2,500 feet east, 1,000 feet southeast, and 1,000 feet southwest), commercial, industrial, wooded and agricultural property. According to information obtained from the Chatham County GIS website (October 2015), municipal water is available to the surrounding area.

Charah began CCP placement in the first composite liner containment system (Cell 1, Sub Cell 1A) on October 23, 2015. CCP placement has occurred in Cell 1, Cell 2, Cell 6A and Cell 6B. Charah has placed just over 7.3 million tons of CCP material in the structural fill at the time of this report. CCP materials (including fly ash, bottom ash, boiler slag, and/or flue gas desulfurization materials) were initially brought to the site by truck through October 2015 until transportation was changed to rail in January 2016. The CCP originated at the Duke Energy Carolinas (DEC) Riverbend Steam Station and Duke Energy Progress (DEP) L.V. Sutton Energy Complex (Sutton Plant) sites.

Leachate (i.e., product generated from the liquids present in the fill at the time of placement and/or stormwater that infiltrates the fill) is managed on-site through the collection, storage, and disposal of the resultant liquid. Green Meadow has approved pump and haul permits to dispose of leachate at the City of Sanford's Big Buffalo Creek Wastewater Treatment Plant and the Town of Spring Lake's South Harnett Regional Wastewater Treatment Plant.

1.4 Groundwater Monitoring System

The groundwater monitoring system was designed to provide background groundwater quality data prior to the placement of CCP in the structural fill and early detection of potential CCP constituents subsequent to CCP placement to be protective of human health and the environment. The groundwater monitoring system is comprised of ten (10) wells: eight wells are located downgradient/side-gradient (MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-7R and MW-8) and two wells are considered to represent background groundwater quality (BG-1 and BG-2). Well construction details are presented in **Table 1**.

Background monitoring well BG-1 was installed in July of 2015 near the entrance of the site along Moncure-Flatwood Road. This location was selected to provide groundwater quality data in an area of the site presumed to not be impacted by historic or current usage of the site. Upon statistical analysis of groundwater quality data collected pre- and post-CCP placement,

concentrations of target analytes from well BG-1 appear to be anonymously low when compared to pre-CCP conditions elsewhere on-site. With approval from NCDEQ, Charah installed a second background well (BG-2) southwest of the structural fill in December 2018 to evaluate spatial variability of inorganic concentrations across the site. This 2019 first semi-annual sampling event constitutes the first time well BG-2 was sampled. A boring log and survey data for BG-2 are included in **Appendix A**.

MW-7R was installed in April of 2017 as a replacement for monitoring well MW-7 as documented and approved in the May 25, 2017 memorandum to NCDEQ - Solid Waste Section. MW-7 will temporarily remain onsite for water level gauging purposes only.

Table 1: Well Construction, Survey, and Groundwater Elevations

Well ID	Northing	Easting	Pad Elev.	TOC Elev.	TD (ft. BGS)	TD (ft. BTOC)	Screen Length (ft.)	Screened Interval (ft. BGS)	DTW (ft. BTOC)	GW Elevation	Lithologic Unit
BG-1	670898.50	1996348.25	225.64	228.19	40.50	43.05	15	26-41	9.69	218.50	Layered Rock/PWR*
BG-2	669278.99	1990476.10	191.41	194.23	23.29	26.11	10	13-23	10.95	183.28	Layered Rock/PWR*
MW-1	674737.98	1993417.69	277.28	280.08	72.50	75.30	15	57-72	59.56	220.52	Layered Rock/PWR*
MW-2	673677.07	1994537.54	229.27	231.76	47.66	50.15	15	30-45	36.15	195.61	Layered Rock/PWR*
MW-3	672474.63	1994834.76	220.00	222.56	40.80	43.36	15	25-40	23.53	199.03	PWR
MW-4	671326.48	1994974.40	214.49	217.13	22.70	25.34	10	13-23	12.97	204.16	Residuum/PWR
MW-5	671081.19	1993779.03	242.72	244.86	44.00	46.14	10	34-44	21.00	223.86	PWR
MW-6	671267.60	1992793.34	228.63	231.10	27.00	29.47	15	12-27	6.21	224.89	Residuum/PWR
MW-7	672306.28	1992642.35	229.53	231.71	15.00	17.18	10	5-15	16.31	215.40	Residuum/PWR
MW-7R	672221.96	1992702.98	239.99	242.22	36.00	39.94	10	26-36	22.40	219.82	Residuum/PWR
MW-8	673304.83	1992200.37	233.41	236.47	46.00	49.06	15	31-46	34.62	201.85	PWR

Notes:

1. Top-of-casing, ground surface elevations and horizontal locations at MW-4 (PZM-1), MW-5 (PZM-22) and MW-7 (PZM-27) surveyed by Lawrence Surveying of Monroe, NC.
2. Top-of-casing, ground surface elevations and horizontal locations at BG-1, MW-1, MW-3, MW-6, MW-8 and MW-7R surveyed by McAdams of Durham, NC.
3. Top-of-casing, ground surface elevations and horizontal location at monitoring well MW-2 surveyed by McAdams of Durham, NC.
4. Top-of-casing, ground surface elevations and horizontal location at monitoring well BG-2 surveyed by McAdams of Durham, NC.
5. TD=total depth; BGS=below ground surface; TOC=top of casing; DTW = Depth-to-Water; BTOC = below top-of-casing; GW = groundwater.
6. Depth to water measurements obtained on January 21, 2019, to the nearest 0.01 foot with a water level meter.
7. Well locations and elevations based on NAD 83 horizontal datum and NGVD88 vertical datum.
8. * = interpreted lithologic unit based on relative drilling hardness and geologic judgment during well installation.

1.5 Site Topography and Geographical Setting

Based on review of the 1993 USGS topographic quadrangle (**Figure 2**) and GIS mapping, the topography of the site and immediately surrounding area can be characterized by moderately rolling hills, which are dissected by dendritic creeks. Prior to mining by General Shale, a topographic ridge was present within the site, extending from the northwestern corner of the present-day structural fill toward the southeast. Thus, historic drainage was to the north/northwest/west and to the northeast/east/southeast away from the ridge, as shown on **Figure 3**.

1.6 Geologic and Hydrogeologic Setting

1.6.1 Regional Geology

The site is located within the Piedmont physiographical province of North Carolina, which is a northeast-southwest trending region extending from New York to Alabama.

According to the 1985 North Carolina Geologic Map prepared by the North Carolina Geological Survey, the site is located in the Triassic Basin Belt of the Piedmont physiographic province. The basement rocks of the Triassic Basin Belt include conglomerate, sandstone, mudstone, limestone, coal, and shale. The majority of the subject property is located within the Sanford Formation which contains conglomerate, fanglomerate, sandstone, and mudstone. The far western portion of the site is located in the Cummock Formation which contains sandstone, mudstone, gray and black coal, and carbonaceous shale. The Triassic Basin is bounded by felsic metavolcanic rock within the Carolina Slate Belt approximately 6.5 miles to the northwest; and is contacted by metamorphosed granite and biotite gneiss and schist of the Raleigh Belt along a normal fault approximately 2.5 miles to the southeast. The Triassic Basin formations have been intruded by north northwest-south southeast trending igneous diabase dikes during the Jurassic Period (~144 to 208 Ma), and contain northeast-southwest trending normal faults. However, none of these faults were indicated to exist at the subject site on the 1985 geologic map (NCDENR, 1985).

In the Piedmont, the bedrock is typically overlain by a mantle of weathered rock (residuum/saprolite), which has an average thickness of approximately 25 feet. The residuum/saprolite consists of varying amounts of unconsolidated clays, silts, and sands, with lesser amounts of rock fragments. Due to the range of the parent rock composition and the variable susceptibility to weathering of each rock type, the residuum/saprolite range widely in color, texture, and thickness. Generally, the residuum/saprolite is thickest near inter-stream divides (ridges) and thins toward stream beds. In profile, the residuum/saprolite normally grades from clayey soils near the land surface to sandier, partially weathered rock above competent bedrock (Buxton, 2014).

1.6.2 Site Geology

The geology of the site can be subdivided into six units which include fill, flood plain, soil horizon, residuum, partially weathered rock, and layered rock. These units generally grade downward from a soil horizon, to residuum, to partially weathered rock and finally layered rock. Fill materials were limited to the road bed and berm located around the east and west sides of

MW-4. Flood plain sediments were only identified at MW-4 on the southeast corner of the site. The following summary of site-specific units is based on boring logs originally included in the *Design Hydrogeologic Report* (Buxton, March 2016).

FILL

Fill materials were primarily identified in the road bed and berm located around the east and west sides near MW-4 and generally consisted of mottled reddish yellow, orange, brown, and light gray sandy silty clay with quartz and brick gravel.

FLOOD PLAIN

Flood plain sediments were only located adjacent to MW-4 on the southeast corner of the site. Sediments were associated with a former adjacent intermittent tributary creek and can be generally characterized as mottled light gray fine sandy silty clay. The flood plain sediments were approximately 5 feet thick in this area and had been deposited above residuum. Based on geotechnical laboratory data, the flood plain sediments were identified as lean clay (CL) under the Unified Soil Classification System (USCS).

SOIL HORIZON

The soil horizon is characterized as mottled yellowish, brown, orange, and red silty clay and clayey silt. Root structures were common. The soil horizon at the site is formed from the continued weathering and biologic reworking of residuum, and ranges from 2 to 15 feet in thickness, when present. Based on geotechnical laboratory data, the soil horizon consisted of clayey sand (SC), elastic silt (MH), and lean clay (CL) and had a hydraulic conductivity of 2.86 x 10^{-7} cm/sec.

RESIDUUM

Residuum is characterized as mottled (black and gray) red and reddish brown sandy silty clay with infrequent quartz gravel and cobbles. Residuum is characteristically fissile, often breaking in horizontal sheets. Residuum generally retains the remnant texture, structure and mineral content of the rock from which it was formed, and ranges from 5 to 15 feet in thickness. Residuum has a Standard Penetration Resistance (N) of less than 100 blows per foot. Based on geotechnical laboratory data, the residuum consisted of lean clay (CL) with hydraulic conductivity ranging from 7.69 x 10^{-8} cm/sec to 3.69 x 10^{-9} cm/sec.

PARTIALLY WEATHERED ROCK

Partially weathered rock is characterized as mottled (light green and purple) brown, reddish gray, and weak red silty clay and weathered mudstone, which are often fissile. Partially weathered rock generally retains the remnant texture, structure, and mineral content of the rock from which it was formed, and ranges from 5 to 40 feet in thickness. Partially weathered rock has an N-value of 100 blows per foot or greater and can generally be drilled with standard hollow-stem auger drilling technology. Based on geotechnical laboratory data, partially weathered rock consisted of lean clay (CL). Hydraulic conductivity ranged from 2.433 x 10^{-4} cm/sec to 7.154 x 10^{-8} cm/sec, according to slug or recovery test data (for wells screened solely in partially weathered rock).

LAYERED ROCK

Based on rock coring activities conducted near MW-7/MW-7R and visual inspection of the layered rock exposed on the north side of the MW-4 area, layered rock at the site is primarily composed of reddish to light tan gray mudstone, cross-bedded muddy sandstone, and muddy sandy conglomerate (rounded quartz gravel and cobbles). Layered rock generally occurs as horizontally oriented and relatively thin intermittent layers (especially within the upper 15 feet of contacting layered rock) across the site, based on rock coring and the horizontal fissile nature of residuum and partially weathered rock. Layered rock contained horizontal to near vertical fracturing. Large fractures, oriented approximately N 40º to 60º E at 70 º northwest, were observed in weathered mudstone to the immediate northeast near MW-8. Rock Quality Designation (RQD) values for the MW-8 area rock core (21-inch recovery) were poor (47.6%). The occurrence of layered rock at the site was generally defined by auger refusal.

1.6.3 Regional Hydrogeology

The occurrence and movement of groundwater in the Piedmont physiographic province are within two separate but interconnected water-bearing zones that typically comprise one aquifer. A shallow water-bearing zone typically occurs within the residuum/saprolite and a deeper zone within the underlying bedrock.

Groundwater in the residuum/saprolite zone occurs in the interstitial pore spaces between the individual sediment grains. Groundwater in this zone generally flows from topographic highs to topographic lows. The occurrence and movement of groundwater in the underlying bedrock zone are controlled by joints and fractures within the bedrock. Groundwater within this deeper zone may occur under confined or semi-confined conditions, depending on the extent of fracturing at the saprolite/bedrock interface. Deeper groundwater movement is typically controlled by the distribution of openings in the bedrock and can be variable.

2 Groundwater Flow Characteristics

On January 21, 2019, groundwater depth was measured in each well. Depths-to-water ranged from 6.21 feet (MW-6) to 59.56 feet below top of casing (MW-1). Groundwater elevations ranged from 183.28 feet in well BG-2 to 224.89 feet in well MW-6 (**Table 1**). Historic groundwater elevations are shown in **Table 2**. Monitoring well locations are shown on **Figure 3**.

Table 2: Historic Groundwater Elevations

Well ID	TOC Elev.	Groundwater Elevation													
		Aug-15	*Oct-15*	*Nov-15*	*Jan-16*	*Feb-16*	*Apr-16*	*Jun-16*	*Jul-16*	*Jan-17*	*Apr-17*	*Jul-17*	*Jan-18*	*Jul-18*	*Jan-19*
BG-1	228.19	216.31	215.70	216.83	218.14	218.94	218.46	218.46	218.74	217.08	216.61	216.76	211.96	215.37	218.50
BG-2	194.23	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	183.28
MW-1	280.08	220.04	220.18	220.55	222.03	222.76	221.83	221.83	221.51	220.58	219.72	219.19	217.61	218.03	220.52
MW-2	229.97	191.78	190.20	192.90	197.19	198.82	201.17	201.17	204.62	205.42	201.63	201.58	186.33	195.65	195.61
MW-3	222.56	207.62	208.46	210.29	210.64	212.31	212.36	212.36	204.81	202.35	202.36	203.91	199.53	194.38	199.03
MW-4	217.13	205.53	206.37	206.83	206.98	211.36	208.34	208.34	205.66	203.67	203.30	204.10	202.16	203.43	204.16
MW-5	244.86	232.01	229.66	230.11	230.16	228.69	220.06	220.06	222.96	203.32	221.53	222.60	218.86	221.93	223.86
MW-6	231.1	223.31	223.99	223.97	224.53	224.75	224.13	224.13	224.07	224.54	223.31	223.58	222.14	222.21	224.89
MW-7	231.71	223.45	222.36	222.53	216.11	215.31	215.66	215.65	216.21	215.42	215.59	216.09	215.03	215.97	215.40
MW-7R	242.22	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	220.92	217.54	220.30	219.82
MW-8	236.47	199.98	200.58	201.35	200.60	200.55	199.49	199.49	199.82	199.31	199.11	198.98	198.75	198.45	201.85

Notes:
1. NG – Not Gauged; MW-7R installed April 2017 and BG-2 installed December 2018.

2.1.1 Groundwater Flow Direction

Groundwater at the site flows away from the historic northwest to southeast trending topographic ridge that was present prior to mine development by General Shale (**Figure 4**). Groundwater elevations and general flow directions remain consistent with previous background and detection monitoring events.

2.1.2 Hydraulic Conductivity

Horizontal hydraulic conductivity of aquifer materials adjacent to the well screen were estimated through in-situ slug testing during the *Design Hydrogeologic Report* (Buxton, 2016). Results are provided in **Table 3**.

Table 3: Hydraulic Conductivity

Well ID	Screen Length (ft)	Screened Interval (ft)	Estimated Effective Porosity (%)	Hydraulic Conductivity (K, cm/sec)	Lithologic Unit
BG-1	15	26-41	0.075	7.76E-05	Layered Rock/PWR*
BG-2	10	13-23	NA	NA	Layered Rock/PWR*
MW-1	15	57-72	0.075	4.11E-04	Layered Rock/PWR*
MW-2	15	30-45	0.05	3.41E-06	Layered Rock/PWR*
MW-3	15	25-40	0.05	4.08E-07	PWR
MW-4	10	13-23	0.14	1.41E-04	Residuum/PWR
MW-5	10	34-44	0.075	8.01E-06	PWR
MW-6	15	12-27	0.15	1.10E-04	Residuum/PWR
MW-7	10	5-15	0.15	1.26E-06	Residuum/PWR
MW-8	15	26-36	0.075	1.29E-04	PWR

Notes:
1. Hydraulic conductivity values determined by Buxton Environmental, Inc. on September 10, 2015, by conducting rising head slug tests; and solved utilizing the Bouwer-Rice (unconfined slug test) solution with AQTESOLV for Windows Version 4.50 software by Hydrosolv, Inc. (1996-2007).
2. Effective porosity values from geotechnical testing and the literature (McWhorter and Sunada, 1977; Sinhal and Gupta, 2010) where geotechnical data was not available.
3. MW-7R and BG-2 were installed after the Hydrogeologic Report was submitted; MW-7 was utilized for evaluation in lieu of data from MW-7R.
4. * = interpreted lithologic unit based on relative drilling hardness during well installation.

2.1.3 Horizontal Hydraulic Gradients

Horizontal hydraulic gradient is calculated by taking the difference in hydraulic head over the length of the flow path between two wells of similar construction. Hydraulic gradients at the site during this sampling event are depicted in **Table 4.**

Table 4: Horizontal Hydraulic Gradients (i, dh/dl)

Upgradient Well	Downgradient Well	Upgradient Groundwater Elevation (ft)	Downgradient Groundwater Elevation (ft)	Linear Flow Distance (ft)	Hydraulic Gradient
MW-1	MW-2	220.52	195.61	1,543	0.016
MW-5	MW-4	223.86	204.16	1,220	0.002

Notes:
1. Horizontal hydraulic gradients calculated by dividing the difference in hydraulic head between a well pair by the length of the flow path between the well pair. (*i*= dh/dl)
2. All well pairs assumed to be screened in same surficial aquifer unit
3. Horizontal flow path distance calculated by

$$\sqrt{(Easting_1 - Easting_2)^2 + (Northing_1 - Northing_2)^2}$$

4. Top-of-casing elevation and horizontal location for well MW-5 surveyed by Lawrence Surveying of Monroe, NC.
5. Top-of-casing elevations and horizontal locations for wells MW-1 and MW-3 surveyed by McAdams of Durham, NC.
6. Top-of-casing elevation and horizontal location for well MW-2 surveyed by Gregory C. Bewley.
7. Groundwater elevations calculated for depth-to-water measurements recorded on January 21, 2019.

2.1.4 Groundwater Flow Velocity

The average linear velocity, or seepage velocity, of groundwater between wells at the site was calculated using Darcy's Law, as follows:

$$V_S = \frac{Ki}{P_e}$$

Where:

V_s = seepage velocity
K = horizontal hydraulic conductivity
i = horizontal hydraulic gradient
P_e = effective porosity

Seepage velocities for groundwater were calculated using horizontal hydraulic gradients, as referenced above, average horizontal hydraulic conductivity and estimated effective porosity values from geotechnical testing and from the literature where geotechnical data was not available (Buxton, 2014; Sinhal and Gupta, 2010).

Seepage velocity varies on a well-by-well basis and was calculated between the MW-1/MW-2 and MW-5/MW-4 well pairs, representing the two well pairs that are roughly perpendicular to the direction of groundwater flow. Seepage velocity was calculated at 10.0 feet per year (between MW-1 and MW-2) and 5.2 feet per year (between MW-5 and MW-4) for this sampling event.

3 Sampling Procedures

3.1 Groundwater Sampling Procedures

HDR collected groundwater samples from the monitoring well network between January 21 and 25, 2019. Purging was conducted via low-flow methods and was considered complete when the water table and field parameters had stabilized in accordance with the targets specified below.

- Turbidity (10% for values greater than 5 NTU (if three turbidity values are less than 5 NTU, the values are considered stabilized)
- DO (10% for values greater than 0.5 mg/L, if three DO values are less than 0.5 mg/L, the values are considered stabilized)
- Specific conductance (3%)
- Temperature (3%)
- pH (± 0.1 unit)
- ORP (± 10 millivolts)

In cases where water level in the well would not stabilize, the well was pumped dry and groundwater samples were collected with disposable bailers upon achieving 80% recharge. Field data sheets are provided in **Appendix A**.

All non-disposable equipment was decontaminated after each use by washing in an Alconox® detergent solution followed by a tap-water rinse. Purge water was discharged to the ground surface adjacent to each well.

Samples were shipped under Chain of Custody (COC) procedures to Pace Analytical Services, LLC (Pace) for analysis. Sample handling and custody were performed according to the EPA Guidance for Field Samplers.

3.2 Surface Water Sampling Procedures

Surface water samples were collected from two locations outside of the structural fill boundary to evaluate potential groundwater to surface water interaction. Surface water sample SW-1 was collected approximately 3,000 feet south of the structural fill boundary along an unnamed tributary of Gulf Creek. Surface water sample SW-2 was collected approximately 3,100 feet west of the structural fill boundary along Shaddox Creek. Prior to sample collection, field parameters (temperature, specific conductance, DO, pH, turbidity, and ORP) were measured with a water quality meter and recorded on field data sheets (**Appendix A**). Approximate surface water sampling locations are shown on **Figure 3**.

3.3 Leachate Sampling Procedures

One leachate sample (Leachate) was collected from the on-site storage holding tanks. The leachate sample is used to evaluate potential on-site leachate impacts. The leachate sample location is shown on **Figures 3** and **5**.

4 Water Quality

Groundwater samples are collected from 11 monitoring wells (MW-1 through MW-8, BG-1, and BG-2) and two surface water locations (SW-1 and SW-2). Groundwater samples are analyzed for constituents listed in NCDEQ Solid Waste Appendix I and II, 40 CFR 257 Appendix III, and 40 CFR 257 Appendix IV.

4.1 Background Site Conditions

Two groundwater sampling events were conducted prior to CCP placement (August and October 2015). The background sampling events consisted of sample collection and analysis from nine monitoring wells (MW-1 through MW-8 and BG-1) and two surface water sample locations (SW-1 and SW-2).

During these initial background monitoring events, chloride, pH, TDS, and vanadium were detected at concentrations that exceeded their North Carolina 2L Groundwater Protection Standards (2L Standard) or Interim Maximum Allowable Concentration (IMAC) in groundwater samples collected from background monitoring well BG-1. Antimony, barium, chloride, chromium, cobalt, pH, TDS, and vanadium were detected at concentrations that exceeded their respective 2L Standards or IMACs in other monitoring wells prior to ash placement. Additional target analytes were detected in the samples from well BG-1 and other wells; however, these concentrations did not exceed applicable standards.

Copper and cobalt concentrations that exceeded their respective NC Surface Water & Wetland Standards (2B Standards) were reported in surface water samples collected during the initial background monitoring events, prior to CCP placement. Additionally, all EPA Appendix III constituents were detected in the surface water samples collected prior to CCP material placement, but at concentrations below their respective 2B Standards (if applicable).

During the first monitoring event (August 2015), bromodichloromethane and dibromochloromethane were detected at concentrations above their respective 2L Standards in groundwater samples collected from MW-2, MW-3, and MW-7. Volatile organic compounds (VOCs), including trihalomethanes, are not present naturally at the site. These detections are attributed to the use of municipal water during previous well development activities. VOCs were not detected above laboratory method detection limits (MDLs) in any subsequent (2nd through 8th) background sampling events.

A detailed discussion of background groundwater conditions can be found in the *2016 Background Sampling Report* (HDR, 2016b). Additional discussion of the statistical results can be found in **Section 4.0** of this report for a better understanding of predictive limits for the background well location (BG-1), as well as interwell interactions.

4.2 Groundwater Analytical Results

Concentrations of the following constituents have exceeded 2L Standards or IMACs in one or more wells: chloride, pH, TDS, barium, chromium, cobalt, and vanadium. EPA Appendix I VOCs were not detected above laboratory method detection limits. Analytical results are presented in

Table 5. Concentration versus time plots generated for three constituents (barium, chloride, and TDS) with the most frequent detections and/or exceedances are included in **Appendix B**.

In general, constituent concentrations varied through the first four to five sampling events (October 2015 through April 2016) before stabilizing for the remainder of the monitoring period. Early variation in concentrations is typical and may reflect seasonal variation because wells were sampled monthly. Once the sampling schedule was revised to a semi-annual basis, constituent concentrations gained consistency and continue as such through the most recent sampling event.

The presence of naturally occurring inorganic constituents above regulatory criteria is common in North Carolina due to various geologic conditions. The presence of naturally occurring metals (i.e., weathering of crystalline parent material) is discussed in more detail in the *Initial Background Groundwater & Surface Water Monitoring Event* (Buxton, 2015c). The laboratory report for the current sampling event is provided in **Appendix C**. Electronic data deliverables (EDDs) are provided in **Appendix D**.

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Table 6: Analytical Detections and Exceedances

January 2019

Analyte	CAS Number	Pre-ash concentration range	2L Standard / IMAC	BTV (1Q2019)	Groundwater Analysis										Quality Control			Surface Water Analysis			Leachate Analysis
					BG-1	BG-2	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7R	MW-8	Equip. Blank	Trip Blank	DUP (MW-6)	SW-1	SW-2	*2B Standard*	LEACHATE
EPA APPENDIX III																					
Boron (µg/l)	7440-42-8	*6.01 - 53.10*	*700*	*9.26*	<2.60	<2.60	<2.60	**39.1**	<2.60	<2.60	<2.60	<2.60	<2.60	<2.60	<2.60	NT	<2.60	<2.60	<2.60	*NE*	1,760
Calcium (µg/l)	7440-70-2	*16,900 - 185,000*	*NE*	*89,600*	23,900	89,600	**205,000**	**207,000**	**194,000**	64,300	13,700	34,400	89,100	**110,000**	<50.00	NT	35,200	2,970	5,230	*NE*	227,000
Chloride (µg/l)	16887-00-6	*2,220, - 1,166,000*	*250,000*	*355,000*	213,000	218,000	**756,000**	**1,200,000**	**1,120,000**	**485,000**	22,200	229,000	289,000	**377,000**	<1.00	NT	228,000	6,900	23,200	*250,000*	12,500
Fluoride (µg/l)	16984-48-8	*<20 - 590*	*2,000*	*189*	170	160	160	**260**	**420**	**290**	**570**	**400**	110	<100	<100	NT	390	<100	<100	*1,800*	170
pH (standard units)	pH	*6.17 - 7.70*	*6.5-8.5*	*6.05 - 7.07*	6.21	6.83	6.41	**7.53**	**7.13**	6.10	**7.26**	6.23	**7.27**	6.94	NT	NT	NT	7.39	7.40	*6.0-9.0*	7.64
Sulfate (µg/l)	14808-79-8	*3,700 - 199,000*	*250,000*	*64,700*	23,200	64,700	8,000	**130,000**	**80,200**	12,200	2,900	48,700	18,300	7,900	<0.50	NT	49,300	3,800	7,900	*250,000*	483,000
Total Dissolved Solids (µg/l)	TDS	*296,000 - 2,770,000*	*500,000*	*2,630,000*	546,000	810,000	1,510,000	2,590,000	2,360,000	1,170,000	261,000	649,000	820,000	814,000	<25.00	NT	649,000	182,000	229,000	*500,000*	1,110,000
EPA APPENDIX IV																					
Antimony (µg/l)	7440-36-0	*<3.80 - 12.00*	*1*	*3.90*	<3.90	<3.90	<3.90	<3.90	<3.90	<3.90	<3.90	<3.90	<3.90	<3.90	<3.90	NT	<3.90	<3.90	<3.90	*5.6*	<3.90
Arsenic (µg/l)	7440-38-2	*<2.50*	*10*	*5.00*	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	NT	<5.00	<5.00	<5.00	*10*	18.8
Barium (µg/l)	7440-39-3	*117 - 1,240*	*700*	*433*	278	123	242	360	**715**	268	123	89.7	255	**1,170**	<2.50	NT	90.4	85.2	94.2	*1,000*	73.4
Beryllium (µg/l)	7440-41-7	*<0.50*	*4*	*0.500*	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	NT	<0.50	<0.50	<0.50	*6.5*	<0.50
Cadmium (µg/l)	7440-43-9	*<0.50*	*2*	*0.500*	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	NT	<0.50	<0.50	<0.50	*2*	<0.50
Chromium (µg/l)	7440-47-3	*<2.50 - 33.90*	*10*	*2.50*	<2.50	<2.50	<2.50	**14†**	**179†**	<2.50	<2.50	**5.3†**	**6.5†**	<2.50	<2.50	NT	5.2	<2.50	5.0	*50*	<2.50
Cobalt (µg/l)	7440-48-4	*<2.50 - 7.00*	*1*	*2.50*	<2.50	<2.50	<2.50	<2.50	**6.2†**	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	NT	<2.50	<2.50	<2.50	*3*	5.1
Fluoride (µg/l)	16984-48-8	*<20 - 590*	*2,000*	*189*	170	160	160	260	**420**	**290**	**570**	**400**	110	<0.10	<0.10	NT	390	<0.10	<0.10	*1,800*	170
Lead (µg/l)	7439-92-1	*<2.50 - 6.30*	*15*	*2.50*	<2.50	<2.50	<2.50	<2.50	**7.3†**	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	NT	<2.50	<2.50	5.4	*25*	<2.50
Lithium (µg/l)	7439-93-2	*7.50 - 70.40*	*NE*	*42.7*	16	12.1	30.9	**94.1**	**72.6**	25.4	8	27.9	25.4	21.7	<0.42	NT	28.6	<0.42	<0.42	*NE*	26.5
Mercury (µg/l)	7439-97-6	*<0.10*	*1*	*0.100*	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	NT	<0.10	<0.10	<0.10	*0.012*	<0.10
Molybdenum (µg/l)	7439-98-7	*<2.50 - 20.60*	*NE*	*6.80*	<2.50	<2.50	<2.50	**7.9**	**12**	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	NT	<2.50	<2.50	<2.50	*160*	147
Selenium (µg/l)	7782-49-2	*<5.00*	*20*	*5.00*	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	NT	<5.00	<5.00	<5.00	*5*	<5.00
Thallium (µg/l)	7440-28-0	*<5.00*	*0.28*	*13.7*	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	0.12	<0.06	<0.06	NT	<0.06	<0.06	<0.06	*0.24*	0.47
Radium 226 (pCi/l)	13982-63-3	*0.0774 - 0.820*	*NE*	*0.800*	0	0.236	0.607	**1.21**	**1.92**	**0.913**	0.108	0	**0.987**	0.743	0.303	NT	0.51	0.458	0.289	*NE*	0
Radium 228 (pCi/l)	15262-20-1	*0.0230 - 1.56*	*NE*	*1.29*	1.08	1.06	0.737	**1.49**	**2.00**	**1.35**	0.695	0.628	1.01	1.2	0.676	NT	0.757	0.602	0.22	*NE*	1.06
Combined Radium (pCi/l)	7440-14-4	*0.304 - 2.93*	*NE**	*2.09*	1.08	1.30	1.34	**2.70**	**3.92**	**2.26**	0.803	0.63	2.00	1.94	0.979	NT	1.27	1.06	0.509	*NE*	1.06
EPA APPENDIX I METALS																					
Copper (µg/l)	7440-50-8	*<2.50 - 16.40*	*1,000*	*2.50*	<2.50	<2.50	<2.50	**17.2†**	**36†**	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	NT	<2.50	<2.50	<2.50	*7*	<2.50
Nickel (µg/l)	7440-02-0	*<2.50 - 18.20*	*100*	*2.50*	<2.50	<2.50	<2.50	**9.7†**	**86†**	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	NT	<2.50	<2.50	<2.50	*88*	5.4
Silver (µg/l)	7440-22-4	*<2.50*	*20*	*2.50*	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	NT	<2.50	<2.50	<2.50	*0.06*	<2.50
Vanadium (µg/l)	7440-62-2	*<2.50 - 9.90*	*0.3*	*5.50*	<2.50	<2.50	<2.50	**7.6**	**13.9**	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	NT	<2.50	9.4	13.1	*NE*	6.5
Zinc (µg/l)	7440-66-6	*<5.00 -106*	*1,000*	*10.0*	<5.00	<5.00	**14.7**	**31.1**	**42.7**	**29.4**	<5.00	**17.7**	**10.7**	**13.6**	<5.00	NT	17.5	11.5	14.3	*50*	<5.00
EPA APPENDIX I VOCs																					
Acetone (µg/l)	67-64-1	*<10.00*	*6,000*	*10.0*	<6.20	<6.20	<6.20	<6.20	<6.20	<6.20	<6.20	<6.20	<6.20	<6.20	<6.20	<25.0	<6.20	<6.20	<6.20	*2,000*	<6.20
Bromodichloromethane (µg/l)	75-27-4	*<0.18*	*0.6*	*0.260*	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<0.34	<1.0	<0.34	<0.34	<0.34	*NE*	<0.34
Bromoform (µg/l)	75-25-2	*<0.26*	*4*	*0.620*	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	<1.0	<0.62	<0.62	<0.62	*4.3*	<0.62
Chloroform (µg/l)	67-66-3	*<0.14 - 1.80*	*70*	*2.30*	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30	<5.0	<2.30	<2.30	<2.30	*5.6*	<2.30
Dibromochloromethane (µg/l)	124-48-1	*<0.21*	*0.4*	*0.41*	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<1.0	<0.41	<0.41	<0.41	*NE*	<0.41
Carbon Disulfide (µg/l)	75-15-0	*<1.20*	*700*	*1.20*	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<2.0	<0.40	<0.40	<0.40	*NE*	<0.40
Dibromomethane (µg/l)	74-95-3	*<0.21*	*70*	*0.460*	<0.46	<0.46	<0.46	<0.46	<0.46	<0.46	<0.46	<0.46	<0.46	<0.46	<0.46	<1.0	<0.46	<0.46	<0.46	*47*	<0.46
1,4-Dichlorobenzene (µg/l)	106-46-7	*<0.33*	*6*	*0.330*	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<1.0	<0.26	<0.26	<0.26	*63*	<0.26

Notes:

* = no established 2L Standard. 5 (pCi/l) is the Federal Standard

†= potential SSIs as they are non-detected constituents that had detected values

BTV = background threshold value calculated for January 2019

NE = not established

NT = not tested

VOCs = volatile organic compounds

µg/l = micrograms per liter

pCi/l - picocuries per liter

Shaded = concentration reported above established 2L Standard, IMAC, or 2B Standard

Bold/Underlined = concentration exceeded BTV

2L Standard = North Carolina Groundwater Protection Standard (T15A NCAC 02L .0202)

IMAC = Interim Allowable Maximum Concentration

2B Standard = North Carolina Surface Water and Wetland Standards (15A NCAC 02B) for Gulf Creek (SW-1) a Shaddox Creek (SW-2) which are both Class WS-IV Waters or are National Criteria per EPA

pH was field tested

Groundwater, surface water, and leachate samples collected from January 21-25, 2019 and analyzed for above parameters by Pace Analytical Services, LLC

Pre-ash concentration range = range of concentrations taken from MW-1 thru MW-8 and BG-1 during the October 2015 sampling event

4.3 Surface Water Analytical Results

Surface water samples were compared to the North Carolina Water Quality Standards for Surface Waters established under T15A NCAC 02B (2B Standards) or the EPA National Criteria Standard (utilized by the North Carolina Division of Water Quality as default standards for parameters not listed in 15A NCAC 02B). No exceedances of regulatory criteria were reported during the current sampling event.

Note that standards have not been established under T15A NCAC 02B for the following constituents detected: boron, calcium, cobalt, lithium, radium 226, radium 228, vanadium, bromodichloromethane, dibromochloromethane, and carbon disulfide. Laboratory results are presented in **Table 5**.

4.4 Leachate Analytical Results

One sample of leachate generated on-site was collected and analyzed this event. In general, results show a declining trend for EPA Appendix III, Appendix IV, and Appendix I Metal analytes when compared to results from previous events. Leachate sampling is required by the Permit to Operate and is disposed of in compliance with the Clean Water Act at either the City of Sanford's Big Buffalo Creek Wastewater Treatment Plant or the Town of Spring Lake's South Harnett Regional Wastewater Treatment Plant.

5 Statistics

5.1 Methodology

Background groundwater quality was evaluated to establish statistically-derived background concentrations for the site. Groundwater quality in downgradient wells were then compared to background concentrations to determine if a statistically significant increase (SSI) over background has occurred, as required by Section .1600 rules of the North Carolina Solid Waste Management Rules 15A NCAC 13B.

Sampling results used to establish background threshold values (BTVs) were obtained during sixteen monitoring events performed between October 2015 and January 2019. Downgradient sampling results from the detection monitoring round in January 2019 were used to evaluate for SSIs. Software packages ProUCL, NCSS, R and SPSS were used in the production of the statistics (ProUCL is offered by the USEPA; R is a free software environment; NCSS and SPSS are licensed software packages).

Groundwater samples collected as part of the monitoring program were analyzed for EPA Appendix III and Appendix IV constituents, Appendix I Metals, and Appendix I Volatile Organic Compounds (VOCs). Only non-filtered sample results were utilized for the statistical analysis of monitored constituents.

5.1.1 Statistical Analysis

The background sample size (i.e., quantity of qualifying samples) was evaluated per constituent. Descriptive statistics were calculated for the background data set including non-detect (ND) values and excluding ND values. When NDs were included in the data set, the method detection limit (MDL) was substituted as the ND value for simple descriptive statistics. The analysis was performed with NDs removed to better understand the central tendency and range of the detected values. Note that for the trend analyses in **Section 5.1.4** and for the establishment of statistically-derived background concentration levels in Section 5.2, imputation methods using the maximum likelihood method (MLE) for NDs, regression on order statistics (ROS) or Kaplan-Meier (KM) methods, where appropriate, were used.

Following the calculation of descriptive statistics, the statistical analysis for the background data set was performed to evaluate for outliers, data distributions, and trends for Appendix III and IV constituents, Appendix I Metals, and Appendix I VOCs, where data quantity and quality permit. A total of seventeen samples (sixteen monitoring events from BG-1 and one monitoring event from BG-2) were included for the descriptive analysis of the background monitoring well results for the monitored constituents. The first sampling event conducted in August 2015 was not included in the analysis as data obtained during this event were not consistent with data from subsequent rounds; sample analyses for the August 2015 event were performed by a different laboratory, possibly accounting for the disparity in results.

For downgradient monitoring results, the data analysis included the calculation of descriptive statistics for Appendix III and IV constituents, Appendix I Metals, and Appendix I VOCs (for the data sets including and excluding ND values), followed by an evaluation of outliers and trends.

A total of sixteen monitoring events performed between October 2015 and January 2019 were included for the descriptive analysis of the downgradient monitoring well results for the monitored constituents.

5.1.2 Outliers

Outliers are values that are not representative of the population from which they are sampled. The background and downgradient data sets were screened for outliers using the Dixon's outlier test, which is suitable for data sets containing less than 25 samples. The outlier test was conducted using a significance of one percent. For constituents that had NDs, the NDs were removed prior to testing for outliers.

Statistical outliers were identified in the background data set evaluated for three Appendix III constituents (calcium, sulfate, and total dissolved solids) and one Appendix IV constituent (barium). The constituent concentrations identified as statistical outliers were sampled from the newly installed background well BG-2, except for total dissolved solids.

Statistical outliers were identified intermittently for numerous Appendix III and Appendix IV constituents and Appendix I Metals, in the data sets evaluated for downgradient monitoring wells throughout the monitoring period.

The statistical outliers were investigated as possible data entry or measurement errors. The values were all within one order of magnitude of other observations and deemed correct. Given the variable nature of groundwater samples, the small sample sizes and that it is common for groundwater quality samples to have very low or very high concentrations over time, statistical outliers are expected but do not necessarily signify that the outliers are from different distributions. As additional background samples are collected over time, outlier test results may change and earlier observations thought to be outliers may no longer be outliers.

5.1.3 Data Distribution

Groundwater data was fitted to known distribution models using Goodness-of-Fit (GOF) tests incorporated into ProUCL. For data sets comprised of 50 or fewer samples, ProUCL's GOF module incorporates the Shapiro-Wilk GOF test to determine normal or lognormal distribution and Anderson-Darling to determine gamma distribution. Normal, lognormal and gamma distributions are parametric distributions. If a data set could not be fit with any of these three parametric distributions, it was considered to follow a nonparametric distribution.

Note that ProUCL does not provide GOF results for data sets with less than three detected values due to insufficient data. For purposes of estimating background concentrations, these data sets were treated under non-parametric distribution assumptions with the maximum detected value chosen to represent the background concentrations.

5.1.4 Trends

Background constituent concentrations in groundwater should demonstrate stationary conditions through time, free of trends. Constituents were analyzed for trends within the data set using a maximum likelihood estimate (MLE) regression for constituents which followed parametric distributions and Mann-Kendall tests for those that were treated under

nonparametric distributional assumptions. The MLE regression can be applied to data sets that can be fitted to a specific distribution model, and that contain NDs with multiple MDLs. The Mann-Kendall test is suitable for data series with no discernable distributions and only one MDL value for NDs.

Constituents treated under nonparametric data assumptions (either tested as nonparametric or having more than 50 percent NDs) and with multiple MDLs or with less than three detected values were not assessed for trends.

The background well regression analysis showed a potential increasing trend for one Appendix III constituent (fluoride) and a potential decreasing trend for two Appendix III constituents (boron and chloride) and one Appendix IV constituent (barium). There were no increasing or decreasing trends identified for other constituents with sufficient data quantity and quality for testing with the MLE analysis or Mann-Kendall test. Although statistical trends were identified for boron, barium, chloride, and fluoride, the results can be misleading due to the short duration of the sampling program.

Trends were also evaluated for constituents in each downgradient well using the same methods as described above for the background data set. Trends were identified for select constituents at select monitoring well locations and should be monitored as additional downgradient groundwater data are collected at the site (**Section 4.2**).

5.1.5 Spatial Variability

Spatial variability refers to identifying whether or not there are statistically identifiable differences in mean concentrations or variance levels across the well field (i.e., the pooled background data). The results from background wells BG-1 and BG-2 were assessed to determine if it is appropriate to pool the data to calculate background concentrations. Results of sampling from well BG-2 were compared to the BTVs established in 2018 with the BG-1 well concentrations. The majority of the concentrations in BG-2 were below the former BTVs, therefore no evidence of spatial variability was identified. The constituents in BG-2 will be monitored as additional background groundwater data are collected at the site.

5.2 Evaluation for SSIs over Background

Based on the statistical evaluations performed, BTVs were calculated for the detection monitoring program at the site for Appendix III and IV constituents and Appendix I metals. Note that UPLs were not calculated for Appendix I VOCs as all of these constituents were 100 percent non-detects. For constituents that have all ND background values, the maximum MDL is chosen to represent background and the double quantification rule (DQR) is used to evaluate whether or not there is an SSI. The BTV provided for detection monitoring constituents is the statistically-derived background concentration (i.e., upper prediction limit [UPL]), the maximum detected value or the maximum MDL depending on the level of censorship in each of the background samples.

Downgradient sampling results from the detection monitoring round in January 2019 were used to test for SSIs. Downgradient concentrations were compared to BTVs. For constituents that have all ND background values, the DQR is applied; that is, an SSI is registered for the well-

constituent pair if the downgradient concentrations exhibit detects in two consecutive sampling events.

5.3 Statistical Summary

BTVs were calculated using wells BG-1 and BG-2 as the background monitoring wells. However, eight monitoring wells (MW-1 through MW-8) were installed and sampled (October 2015) prior to ash placement, thus representing pre-ash conditions at the site. SSIs were found for six Appendix III constituents (boron, calcium, chloride, fluoride, pH (field), and sulfate), seven Appendix IV constituents (barium, fluoride, lithium, molybdenum, radium-226, radium-228, and total radium), and two Appendix I metals (vanadium and zinc). Three Appendix IV constituents (chromium, cobalt, and lithium) and two Appendix I metals (copper and nickel) were flagged as potential SSIs as they are non-detected constituents that had detected values. If the downgradient concentrations for these constituents exhibit detects in the consecutive sampling event, then an SSI would be registered. When results of the January 2019 sampling event are compared to the pre-ash sampling results from those eight wells, current downgradient groundwater constituent concentrations are generally similar to concentrations reported prior to ash placement. Of the fourteen constituents with observed SSIs, eight are within the range of pre-ash conditions. Depending on the data distribution of the constituent, the BTVs have been computed to allow for one to three verification samples. With verification sampling, the validity of the SSIs can be confirmed. Additional details regarding statistical methodology and results is provided in **Appendix E**.

6 Conclusions

The 2019 First Semi-Annual Detection Monitoring Event was conducted at the Brickhaven No. 2 Mine Tract "A" Structural Fill site from January 21-25, 2019. A summary of the findings from is provided below**.**

6.1 Groundwater

- Concentrations of chloride, pH, TDS, barium, chromium, and vanadium in groundwater samples exceeded the 2L Standards or IMACs during the current sampling event.
- No exceedances were reported for EPA Appendix I VOCs.
- Concentrations of calcium, lithium, molybdenum, and radium 226/radium 228 were detected above the laboratory MDLs; however, standards have not been established by NCDEQ for these constituents.
- Chromium and TDS concentrations in MW-3 have increased over the past two sampling events. Vanadium concentrations in MW-3 increased during this sampling event. Increasing concentrations of chromium and vanadium may be associated with increased TDS.
- Vanadium concentrations in MW-2 have increased during this sampling event.
- Concentrations of chloride and barium, as well as pH measurements, have generally remained consistent with previous sampling events.

6.2 Surface Water

- Vanadium exceeded the 2B Standard in the sample collected from sampling location SW-2.
- No exceedances were reported for EPA Appendix I metals, EPA Appendix III, and EPA Appendix IV constituents.
- Concentrations of calcium, radium 226/radium 228, and vanadium (SW-1 only) were detected above the laboratory MDLs; however, standards have not been established by NCDEQ for these constituents.

6.3 Leachate

- Leachate samples collected during this sampling event generally show a declining trend in concentrations of EPA Appendix III, Appendix IV, and Appendix I Metals.

6.4 Statistical Analysis

- The analysis is based on an interwell analysis consisting of sixteen monitoring events of the background well BG-1 and one monitoring event of the background well BG-2 (nine more than the required eight). Subsequent sampling events could provide greater refinement and confidence of statistical significance.
- Statistical outlier was identified in the background data set evaluated for barium, calcium, sulfate, and TDS. Intermittent statistical outliers for Appendix III and Appendix IV constituents and Appendix I Metals, in the data sets evaluated for downgradient monitoring wells, were noted throughout the monitoring period. As the sample size is

very small from a statistical perspective, the variability in the concentrations of these constituents will change as additional samples are obtained.

- SSIs were found for six Appendix III constituents (boron, calcium, chloride, fluoride, pH (field), and sulfate), seven Appendix IV constituents (barium, fluoride, lithium, molybdenum, radium-226, radium-228, and total radium), and two Appendix I metals (vanadium and zinc). When results of the January 2019 sampling event are compared to the pre-ash sampling results, current groundwater constituent concentrations are generally similar to concentrations reported prior to ash placement. Of the fourteen constituents with observed SSIs, eight of them are within the range of pre-ash conditions.
- Three Appendix IV constituents (chromium, cobalt, and lithium) and two Appendix I metals (copper and nickel) were flagged as potential SSIs as they are non-detected constituents that had detected values.
- HDR believes that the presence of SSIs is the result of low background concentrations that may not represent data collected prior to CCP placement (August and October 2015 sampling events) and is influenced by natural and seasonal variations at the site. In general, the SSIs reported during this sampling event are either consistent with those evaluated in the Alternate Source Demonstration (ASD) dated March 29, 2019 or are potential SSIs to be verified during the next sampling event.

7 Recommendations

Based on the findings, HDR makes the following recommendations:

- Continue to sample semi-annually, as well as incorporating Chatham County quarterly split sampling data, to improve the dataset for greater statistical confidence and refinement.
- Discontinue sampling for EPA Appendix I VOCs. VOCs have only been detected in MW-2 (October 2015), an ambient blank (July 2016), and an equipment blank (July 2016). VOCs are not typically associated with CCP and continued analysis of VOCs is unlikely to provided new information.
- Evaluate the validity of SSIs by further assessing sampling protocols/performance, spatial variability, and seasonality of constituent concentrations as additional sampling rounds are conducted.
- HDR recommends that the site remain in the Detection Monitoring Program.

8 References

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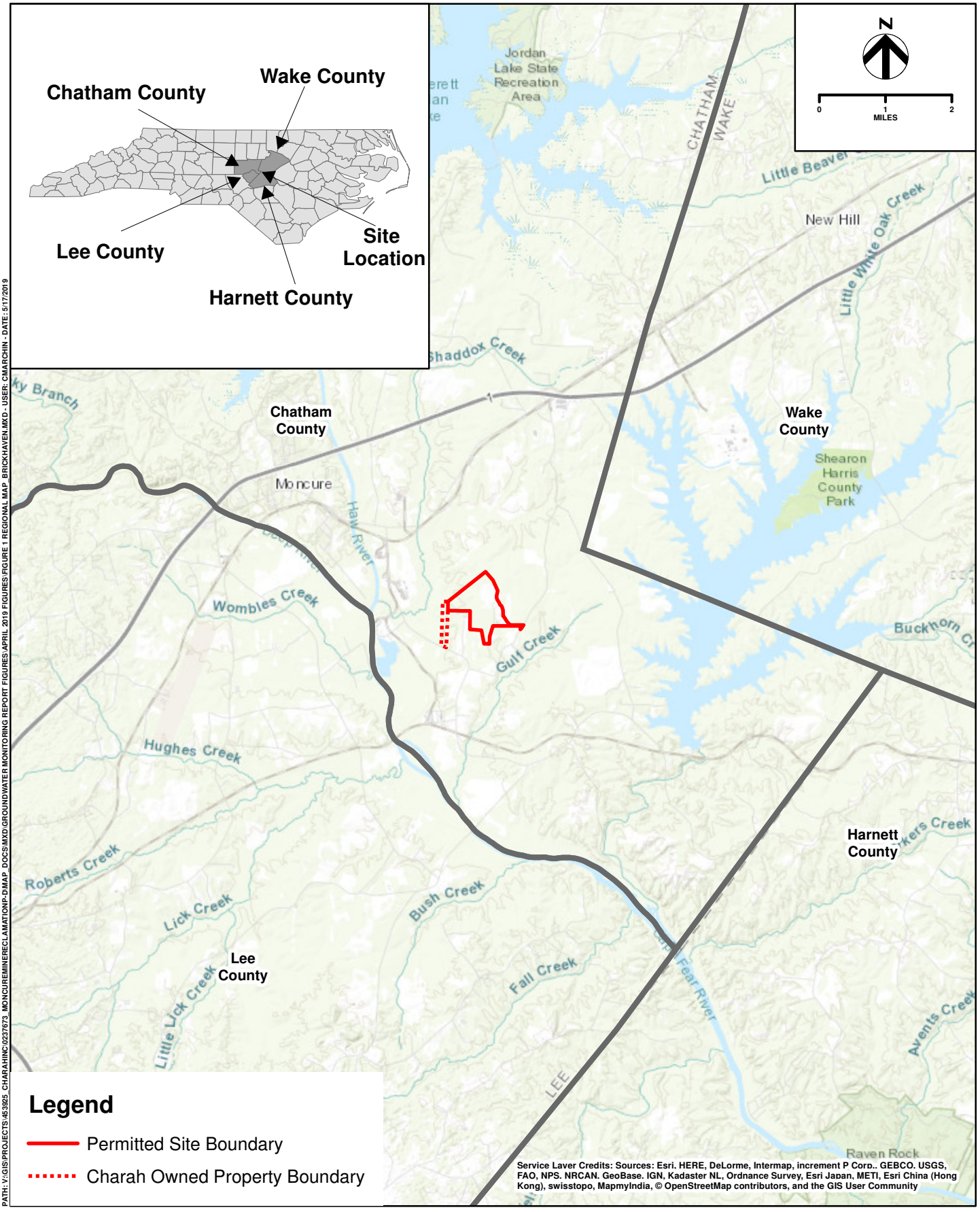
Singhal, B. B.S. and R. P. Gupta. 2010. *Applied Hydrogeology of Fractured Rocks: Springer, 2nd Edition*, 408p. (Table 8-1, p. 140)United States Geological Survey. 2004. *Arsenic, Nitrate, and Chloride in Groundwater, Oakland County, Michigan.*

Figures



PATH: V:\GIS\PROJECTS\463925_CHARAHINC\0237673_MONCUREMINERECLAMATIONP-D\MAP_DOCS\MXD\GROUNDWATER MONITORING REPORT FIGURES\APRIL 2019 FIGURES\FIGURE 1 REGIONAL MAP_BRICKHAVEN.MXD - USER: CMARCHIN - DATE: 5/17/2019

REGIONAL SITE LOCATION MAP
CHARAH SOLUTIONS, INC
MONCURE, NORTH CAROLINA

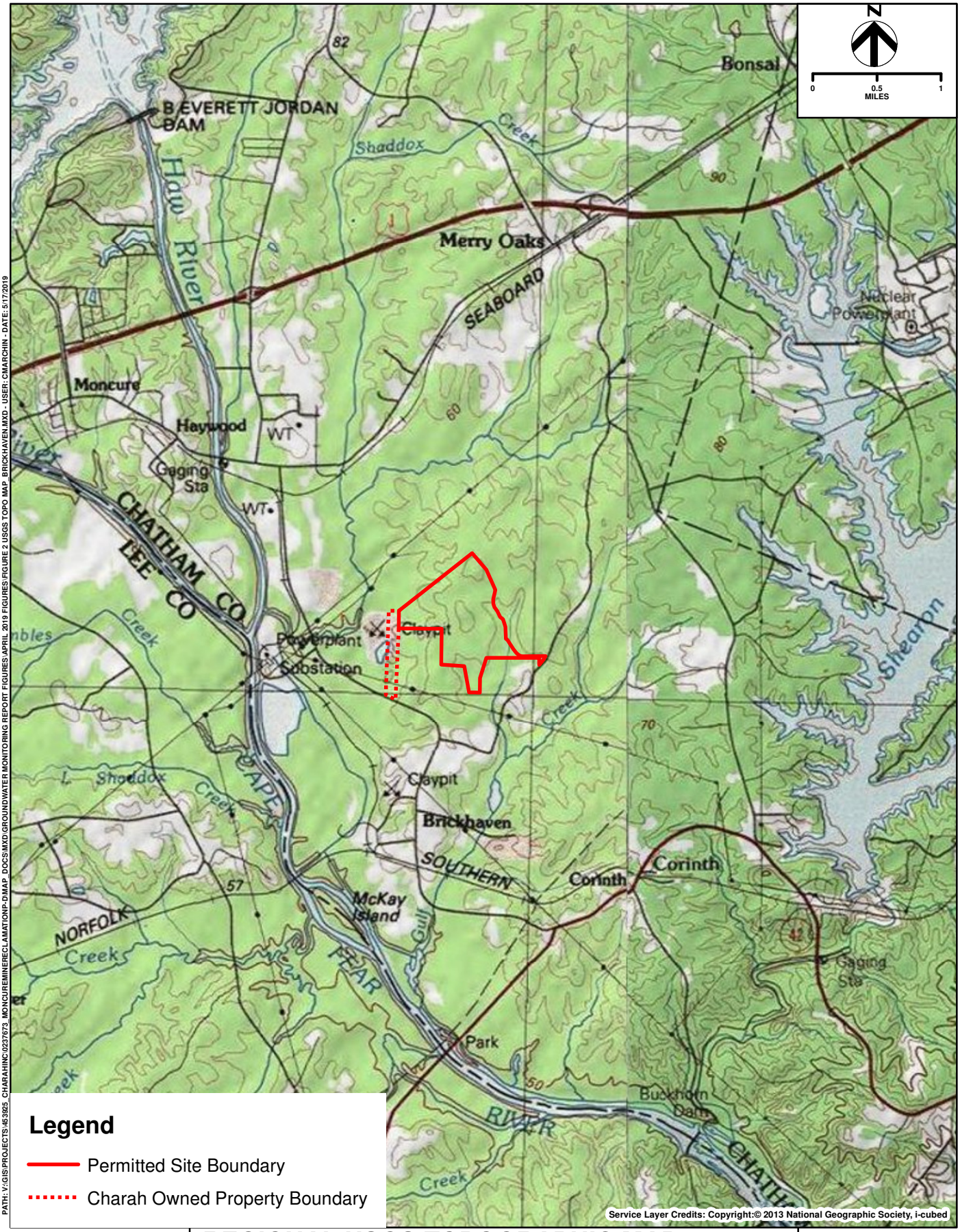
BRICKHAVEN NO. 2 MINE TRACT "A"

DATE

MAY 2019

FIGURE

1



PATH: V:\GIS\PROJECTS\463925_CHARAHINC\0237673_MONCUREMINERECLAMATIONP-D\MAP_DOCS\MXD\GROUNDWATER MONITORING REPORT FIGURES\APRIL 2019 FIGURES\FIGURE 2 USGS TOPO MAP_BRICKHAVEN.MXD - USER: CMARCHIN - DATE: 5/17/2019

REGIONAL USGS TOPOGRAPHIC MAP
CHARAH SOLUTIONS, INC
MONCURE, NORTH CAROLINA

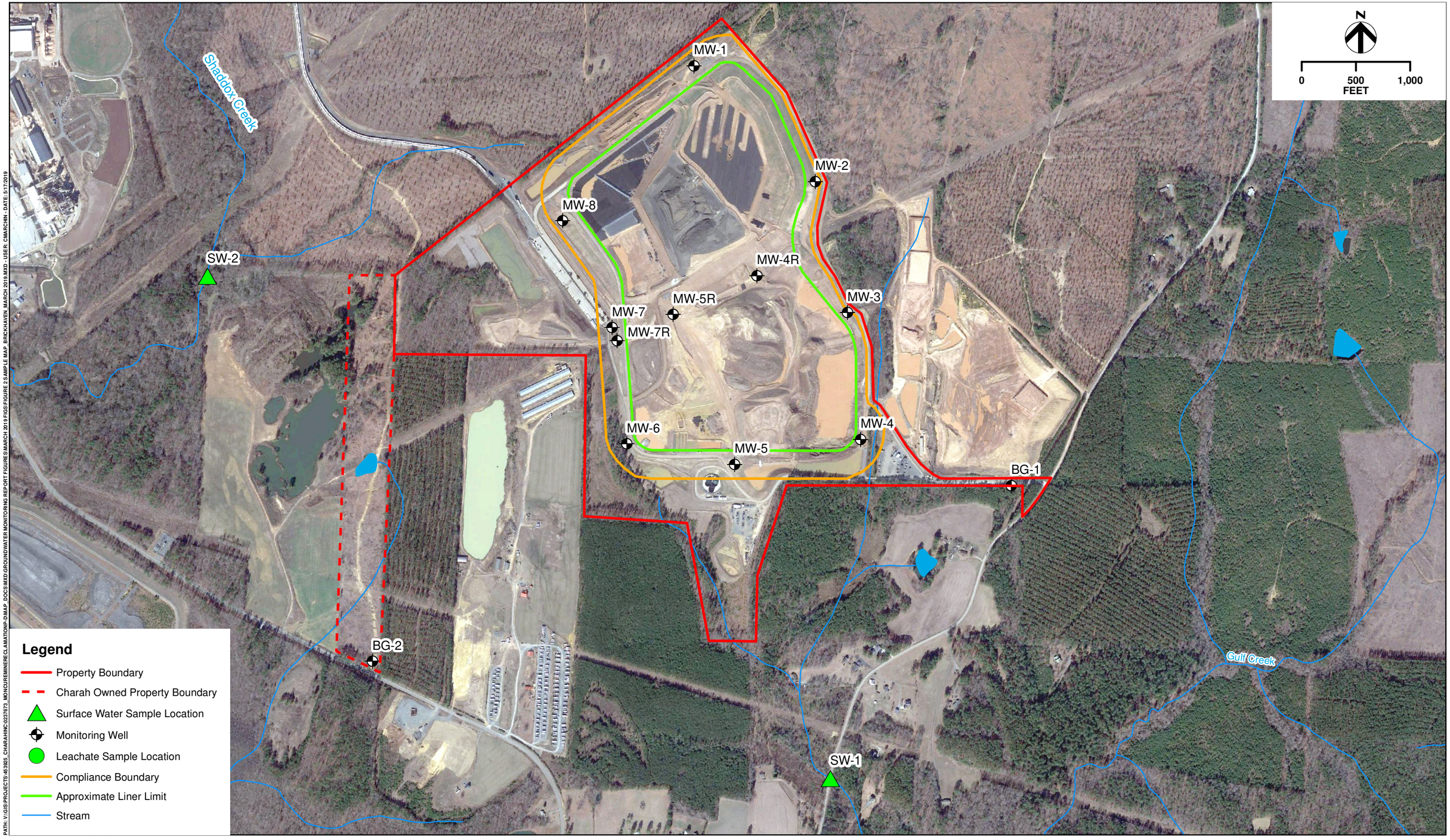
BRICKHAVEN NO. 2 MINE TRACT "A"

DATE

MAY 2019

FIGURE

2



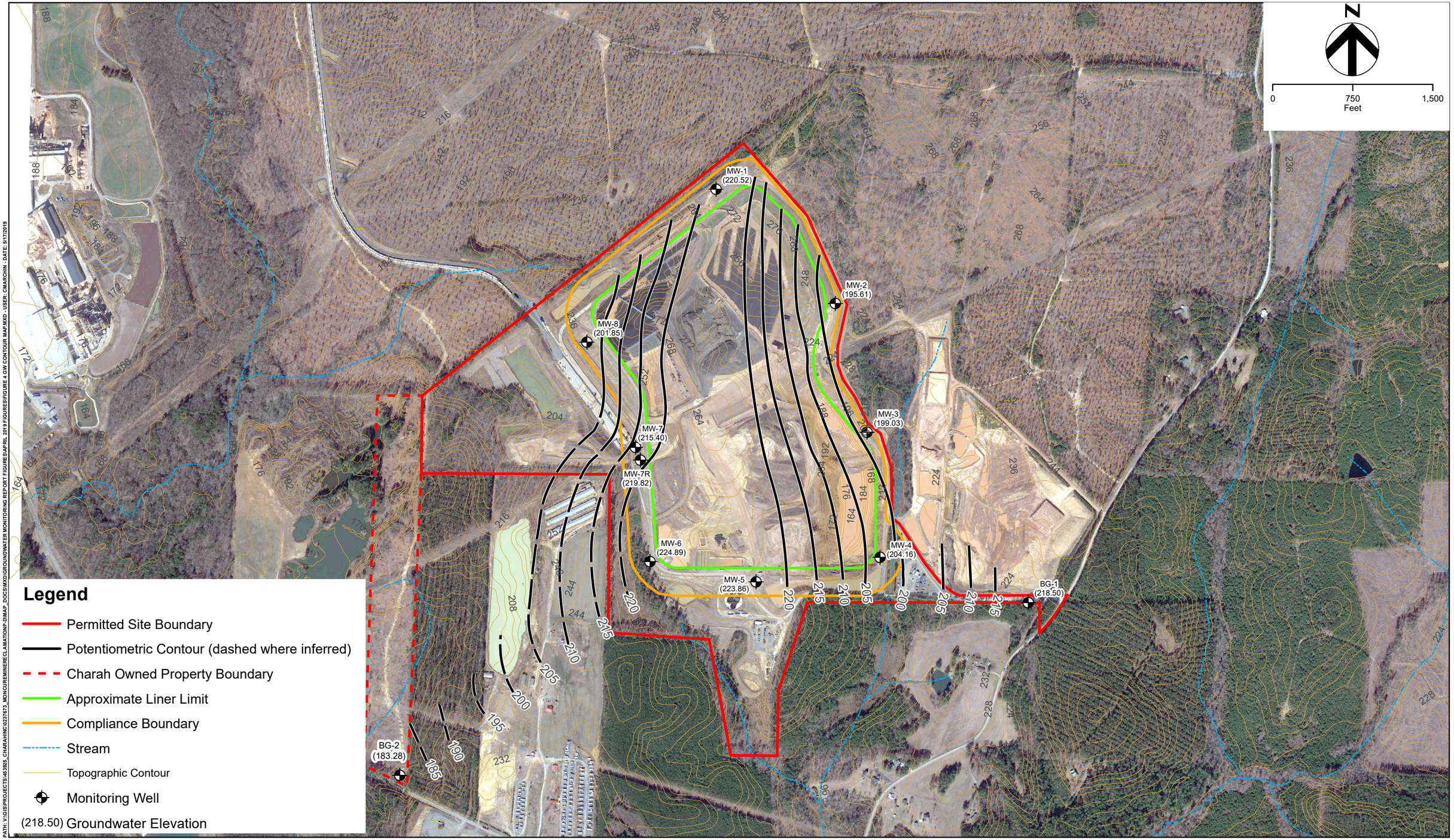
PATH: V:\GIS\PROJECTS\453925_CHARAHINC\2037673_MONCURE\MXD\GROUNDWATER MONITORING REPORT FIGURES\MARCH 2019 FIGS\FIGURE 2 SAMPLE MAP_BRICKHAVEN_MARCH 2019.MXD - USER: CMARCHIN - DATE: 5/17/2019

SAMPLE LOCATION MAP
CHARAH SOLUTIONS, INC.
MONCURE, NORTH CAROLINA

BRICKHAVEN NO. 2 MINE TRACT "A"

DATE
MAY 2019

FIGURE
3



PATH: V:\GIS\PROJECTS\463925_CHARAHINC\0237673_MONCURERINEERECLAMATIONP-DIMAP_DOCS\MXD\GROUNDWATER MONITORING REPORT FIGURES\APRIL 2019 FIGURES\FIGURE 4 GW CONTOUR MAP.MXD - USER: CMARCHIN - DATE: 5/17/2019

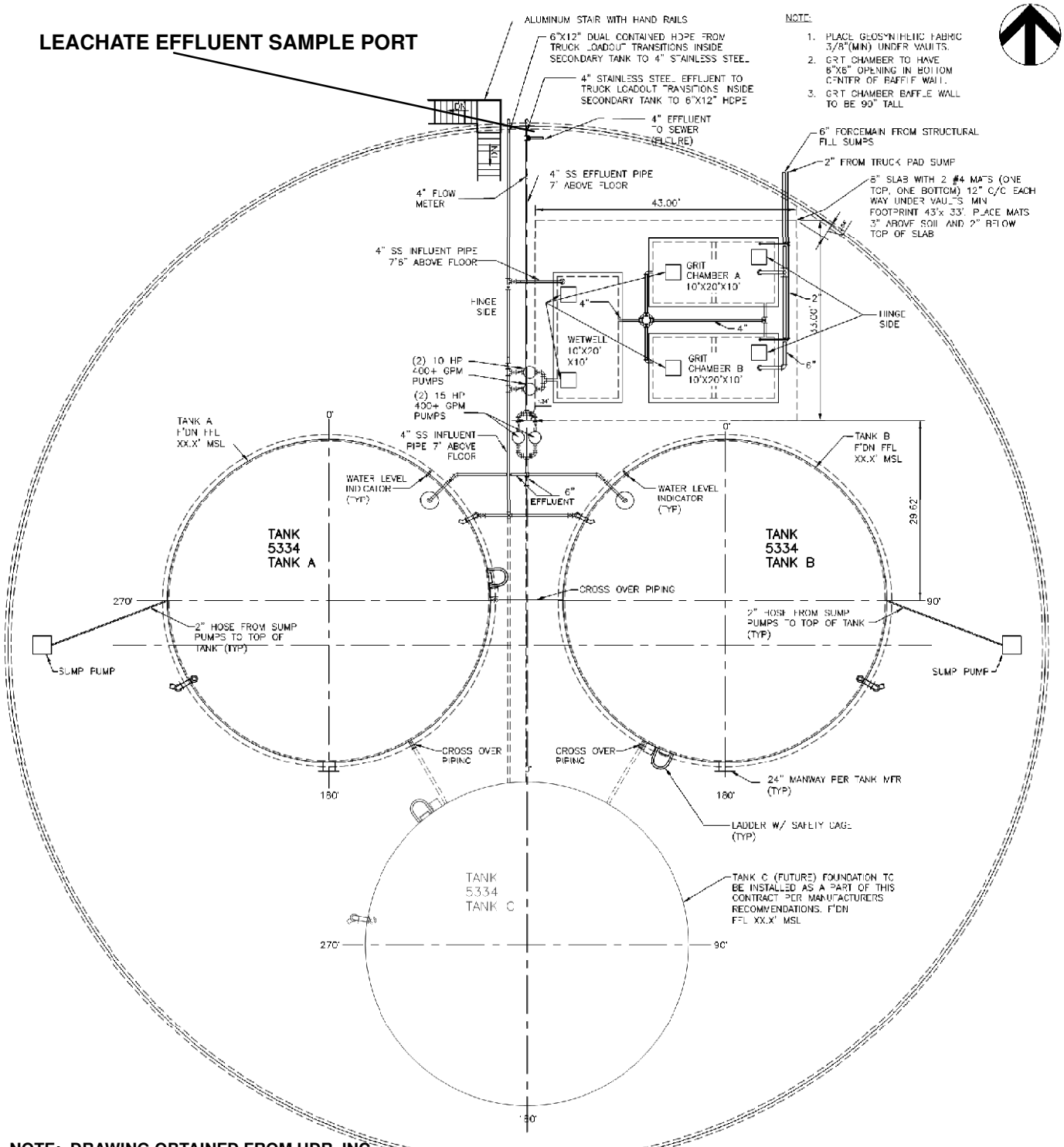
Note:
1. Groundwater elevations derived from depth to water measurements collected on January 21, 2019.
2. Topography data for the site was obtained from NCDOT Geographic Information System (GIS) website (Dated 2007).
3. Aerial photography was obtained from Google Earth dated 2018.

POTENTIOMETRIC SURFACE MAP - JANUARY 2019
CHARAH SOLUTIONS, INC.
MONCURE, NORTH CAROLINA

BRICKHAVEN NO. 2 MINE TRACT "A"

DATE
MAY 2019

FIGURE
4



NOTE: DRAWING OBTAINED FROM HDR, INC.
LANDFILL LEACHATE COLLECTION SYSTEM REPORT

PATH: \\CLTSMAIN\GIS_DATA\GIS\PROJECTS\453925_CHARAHINC\0237673_MONCURE\MINERECLAMATION\P-D\MAP_DOCS\MXD\GROUNDWATER MONITORING REPORT FIGURES\JULY 2018\FIGURE 5 LEACHATE LOCATIONS_BRICKHAVEN.MXD - USER: CMARCHIN - DATE: 4/29/2019

LEACHATE SAMPLE COLLECTION LOCATION
CHARAH SOLUTIONS, INC
MONCURE, NORTH CAROLINA

BRICKHAVEN NO. 2 MINE TRACT "A"

DATE
MAY 2019

FIGURE
5

A

Appendix A – Field Data Sheets

GROUNDWATER DEPTH

Project Name: Charah – Brickhaven Date: 1/21/19

Project Address: Moncure, NC Project No: 237673-019

Time Started: 1000 Time Finished: 1153

Personnel: J. Ruffing Signature:

Well ID	Depth to Water	Total Depth
BG-1	9.69	43.82
BG-2	10.95	26.11
MW-1	59.56	75.60
MW-2	36.15	50.20
MW-3	23.53	43.65
MW-4	12.97	27.75
MW-5	21.00	47.00
MW-6	6.21	27.47
MW-7	16.31	17.66
MW-7R	27.40	40.00
MW-8	34.62	49.76

Well ID	Depth to Water	Total Depth

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 1/22/18 **SAMPLER'S INITIALS:** JR

WELL ID: BG-1 **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** 43.82

SCEENED Length (ft): 15 **DEPTH TO WATER (ft):** 9.85

PURGE METHOD: Low flow **SAMPLING METHOD:** Poly tubing

Sample Time: 1010 **Sample Date:** 1/22/19

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
0900	—	9.85	—	—	—	—	—	—	—
0905		13.76	350	15.0	1066	2.60	6.25	80.2	—
0915		13.40	350	15.0	1084	1.19	6.25	45.2	160.6
0920	7.00	13.15	300	15.3	1090	0.86	6.26	21.5	159.0
0925		13.10	300	15.4	1084	0.73	6.26	18.5	—
0930		13.20	300	15.9	1076	0.65	6.27	20.5	155.9
0940		13.20	300	15.2	1064	0.50	6.20	19.4	159.8
0950	14	13.06	300	15.1	1054	0.39	6.22	13.2	154.2
0955		13.10	300	15.3	1045	0.38	6.22	10.1	152.8
1000		13.08	300	15.5	1035	0.31	6.22	6.23	150.0
1005	23.5	13.08	300	15.3	1030	0.24	6.21	4.76	147.9

Stable

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 1/22/19 **SAMPLER'S INITIALS:** _____

WELL ID: BG-2 **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** 26.11 BTOC

SCEENED Length (ft): 10 **DEPTH TO WATER (ft):** 10.72

PURGE METHOD: Low flow **SAMPLING METHOD:** Poly tubing

Sample Time: ~~1335~~ 1345 **Sample Date:** 1/22/19

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
1115	1	11.53	200	13.5	1849	1.85	6.78	Overrange	38.0
1125	4	11.83	150	15.2	1659	0.46	6.88	"	-19.5
1135		12.10	200	15.1	1463	0.23	6.86	32.4	-67.1
1205		12.40	200	15.3	1423	0.19	6.83	11.0	-76.1
1210		12.55	200	15.4	1424	0.17	6.89	8.34	-79.2
1220		12.55	200	14.1	1441	0.18	6.88	20.1	-80.5
1225		12.55	200	15.0	1437	0.16	6.90	8.49	-86.3
1230		12.55	200	15.1	1412	0.15	6.85	7.79	-87.3
1240		13.05	200	15.9	1445	0.15	6.90	21.1	-91.0
1250		12.90	200	15.6	1401	0.14	6.87	28.3	-91.9
1300		12.97	200	15.9	1436	0.13	6.89	31.3	-94.3
1315		12.75	~~100~~ 200	~~16.7~~ 15.7	1418	0.12	6.89	19.0	-100.6
1320		12.90	100	15.7	1411	0.13	6.56	17.8	-100.2
1325	34	12.75	100	15.1	1411	0.13	6.83	17.4	-100.0
								Sampled	

After sampling - surged & purged well dry twice

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 1/24/19 **SAMPLER'S INITIALS:** JR

WELL ID: MW-1 **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** 72.50

SCEENED Length (ft): 15 **DEPTH TO WATER (ft):** 58.62

PURGE METHOD: Low flow **SAMPLING METHOD:** Poly tubing

Sample Time: 1100 **Sample Date:** 1/24/19

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
0930	1	58.62	150	17.1	911	3.35	6.95	819	25.5
0940		58.71	400	17.9	778	1.58	6.96	607	7.2
0950		58.79	400	18.1	782	0.68	6.90	169	18.3
1000	19	58.91	400	17.8	1450	0.35	6.66	71.5	32.2
1015		58.90	400	17.6	2587	0.41	6.44	22.8	42.7
1025		58.83	400	17.9	2715	0.41	6.42	13.7	34.0
1035		58.85	400	18.0	2733	0.40	6.42	12.3	26.6
1045		58.85	400	18.0	2787	0.39	6.41	12.1	21.3
1050	38	58.87	400	18.0	2810	0.38	6.41	11.7	19.7
							Sample		

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 1/22/19 **SAMPLER'S INITIALS:** JR

WELL ID: MW-2 **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):**

SCEENED Length (ft): **DEPTH TO WATER (ft):** 42.90

PURGE METHOD: ~~Low flow~~ ~~pot purged~~ **SAMPLING METHOD:** ~~Poly tubing~~ poly bailer

Sample Time: 0840 **Sample Date:** 1/23/19

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
1500	Purged well dry								
1/23/19									
0830	—	42.90	—	Well recovered		84% , start sampling			
w/ bailer									
0855	5	42.90	—	15.1	4328	4.43	7.53	634	137.0

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 1/24/19 **SAMPLER'S INITIALS:** JR

WELL ID: MW-3 **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** 43.36

SCEENED Length (ft): 15 **DEPTH TO WATER (ft):** 22.40

PURGE METHOD: Low flow **SAMPLING METHOD:** Poly tubing

Sample Time: 1/25/19 **Sample Date:** 0840

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
1455	2	24.75	200	17.6	4128	5.65	7.37	OR	68.4
1500		25.25	300	18.0	4200	4.66	7.27	310	62.0
1520		32.41	200	18.3	3557	5.58	7.28	18.7	44.3
1530		33.10	100	17.7	3480	5.24	7.24	12.9	44.0
1540		34.00	100	18.1	3690	5.10	7.17	11.3	43.5
1550		34.55	100	17.7	3795	4.62	7.13	9.15	43.1
1640		42.45							
	lost flow - water level would not stabilize. Pumped dry.								
Recharge →		42.18	to	41.18	in ~ 1 hour				
let recharge overnight; sample in morning. Well ran dry after samples taken. Not enough water for final parameters									

OR = overlange

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 1/22/19 **SAMPLER'S INITIALS:** JR

WELL ID: MW-4 **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** 27.75 bTOC

SCEENED Length (ft): 10 **DEPTH TO WATER (ft):** 12.80

PURGE METHOD: Low flow **SAMPLING METHOD:** Poly tubing

Sample Time: 1745 **Sample Date:** 1/22/18

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
1535	1	14.15	400	17.2	2123	2.44	6.43	OR	-40.0
1550		15.87	900	17.6	2216	0.52	6.02	79.5	-33.7
1555	19	16.49	500	17.6	2219	0.82	6.05	143	-33.9
1600		16.53	400	17.7	2206	0.46	6.09	76.5	-35.7
1610		16.43	400	17.8	2204	0.31	6.10	79.6	-31.9
1615		17.13	700	17.9	2224	0.43	6.07	128	-32.3
1620		17.31	500	18.0	2222	0.34	6.09	147	-30.3
1625		17.50	500	17.9	2223	0.27	6.09	136	-28.4
1630	38	17.35	400	18.0	2221	0.17	6.10	104	-24.3
1640		17.35	400	17.9	2226	0.15	6.11	71.7	-20.8
1645		17.30	375	17.9	2224	0.14	6.11	37.6	-16.6
1650		17.30	375	17.8	2227	0.13	6.11	35.3	-16.1
1655		17.02	375	17.5	2224	0.11	6.11	29.4	-16.5
1700		16.90	375	17.8	2219	0.11	6.11	58.4	-7.3
1705		16.70	375	17.8	2224	0.10	6.11	21.8	-4.8
1715		16.43	200	17.5	2227	0.09	6.11	17.2	-2.5
1720		16.23	200	17.9	2222	0.09	6.11	15.8	-1.8
1725		16.31	200	18.0	2226	0.09	6.12	11.2	-2.1
1730		16.32	200	17.5	2222	0.11	6.11	11.6	-3.8
1735		16.20	200	17.5	2226	0.09	6.10	11.8	-1.3
							Sample		

OR = over range

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven

PROJECT #: 237673-019

DATE: 1/23/19

SAMPLER'S INITIALS: JR

WELL ID: MW-5

WELL DIAMETER (in): 2

WELL DEPTH (ft): 46.14

SCEENED Length (ft): 10

DEPTH TO WATER (ft): 19.91

PURGE METHOD: ~~low flow~~ pump dry

SAMPLING METHOD: ~~Poly tubing~~ bailer

Sample Time: 0450

Sample Date: 1/24/19

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
1530	1	—	300	18.1	467.0	3.18	6.63	~~213~~	31.4
1600		26.00	300	18.3	349.0	0.63	6.44	213	12.5
1610		31.28	300	18.4	340.1	0.47	6.44	24.6	10.3
1615		31.75	300	18.4	347.3	0.40	6.32	15.9	16.0
1625		~~35~~ 35.30	100	17.8	342.7	0.31	6.27	18.9	—
1700		40.50	75	17.8	328.8	0.44	6.37	22.2	12.2
1705		41.04	75	17.8	348.5	0.33	6.39	21.1	8.4
1715		41.19	75	18.2	359.5	0.30	6.51	19.6	-1.3
1725	36	42.69	75	could not get water level to					
		stabilize.							
		Purge well dry. Will check tomorrow							
0430		25.41	—	~80% recovery					
0450	65	—	—	17.6	463.7	2.88	7.26	18.6	131.1

Drew down

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 1/23/19 **SAMPLER'S INITIALS:** [illegible]

WELL ID: MW-6 DUP **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** 27.97

SCEENED Length (ft): 15 **DEPTH TO WATER (ft):** 5.68

PURGE METHOD: Low flow **SAMPLING METHOD:** Poly tubing

Sample Time: 1350/DUP 1260 **Sample Date:** 1/23/19

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
1140									
1145	1	7.06	200	16.4	1391	5.42	6.76	417	79.4
1155		6.92	200	15.8	1356	2.13	6.55	143	76.5
1210		6.83	150	15.8	1276	1.43	6.43	91.6	71.1
1220		6.75	100	16.0	1237	1.16	6.37	56.6	66.8
1230		7.00	100	16.3	1224	1.01	6.36	43.1	62.6
1240		7.02	100	16.6	1201	0.80	6.32	28.4	58.4
1250		7.05	100	16.5	1183	0.68	6.29	22.8	54.8
1300		7.00	100	16.5	1175	0.60	6.26	20.3	50.6
1310		6.96	100	16.3	1165	0.55	6.24	16.5	48.6
1320		6.96	100	16.6	1170	0.51	6.25	15.4	45.7
1325		6.89	100	16.5	1162	0.48	6.23	13.0	44.2
1330		6.90	100	16.7	1157	0.45	6.23	11.9	42.3
1335		6.91	100	16.7	1159	0.45	6.23	11.4	40.0
						Sample			

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 1/24/19 **SAMPLER'S INITIALS:** JR

WELL ID: MW-7R **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** 39.94

SCEENED Length (ft): 10 **DEPTH TO WATER (ft):** 21.25

PURGE METHOD: Low flow **SAMPLING METHOD:** Poly tubing

Sample Time: 1350 **Sample Date:** 1/24/19

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
1140	—	21.25	—						
1155	3	24.48	200	17.7	1528	4.61	7.31	OR	52.4
1215		26.80	200	18.4	1522	3.16	7.43	577	39.3
1220		27.70	400	18.5	1515	3.69	7.39	393	37.8
1235		30.95	100	18.2	1512	3.34	7.35	52.0	19.5
1245		31.01	100	18.1	1516	3.11	7.32	38.6	21.1
1250		31.07	100	18.4	1518	2.86	7.31	31.2	20.7
1255		31.09	100	18.7	1517	2.73	7.32	34.2	18.6
1305		31.13	100	18.8	1520	2.52	7.32	38.5	17.9
1310		31.15	100	18.1	1517	2.46	7.28	53.7	17.7
1315		31.16	100	17.6	1514	2.44	7.24	36.3	20.0
1320		31.16	100	17.2	1519	2.33	7.24	30.4	18.5
1325		31.16	100	17.7	1511	2.42	7.24	26.5	17.5
1330		31.17	75	17.7	1513	2.26	7.26	22.1	17.7
1340		31.19	75	17.4	1509	2.16	7.27	19.7	13.1
—	2 hr	time	limit	for	purge	—			
—						Sample			

DRW Down

OR = over range

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 1/23/19 **SAMPLER'S INITIALS:** JR

WELL ID: MW-8 **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** 46

SCEENED Length (ft): 15 **DEPTH TO WATER (ft):** ~~35~~ 34.80

PURGE METHOD: Low flow **SAMPLING METHOD:** Poly tubing

Sample Time: 1100 **Sample Date:** 1/23/19

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
0920	0	34.80	—						
0945	2	35.45	300	16.9	2977	5.73	6.96	266	—
1000		36.01	300	17.5	2520	3.45	6.89	60	88.1
1005		36.84	300	17.5	2206	2.34	6.90	54.5	79.5
1015	19	37.45	500	17.2	1743	1.22	6.94	54.5	63.4
1030		37.04	475	17.5	1442	0.55	6.96	3.62	42.3
1035		37.10	475	17.6	1477	0.53	6.95	3.35	39.5
1040		37.08	475	17.5	1490	0.55	6.94	3.61	38.5
1045		37.08	475	17.6	1494	0.51	6.94	3.81	35.6
—							— Sample		—

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 1/21/19 **SAMPLER'S INITIALS:** JR

WELL ID: Leachate **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** —

SCEENED Length (ft): — **DEPTH TO WATER (ft):** —

PURGE METHOD: ~~Low flow~~ **SAMPLING METHOD:** ~~Poly tubing~~ Grab

Sample Time: 1320 **Sample Date:** 1/21/19

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
1316	1	—	—	12.5	1377	7.66	7.64	14.3	124.6

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #: 237673-019**

DATE: 1/21/19 **SAMPLER'S INITIALS:** SR

WELL ID: SW-1 **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** —

SCEENED Length (ft): — **DEPTH TO WATER (ft):** —

PURGE METHOD: ~~Low flow~~ Grab **SAMPLING METHOD:** ~~Poly tubing~~ Grab

Sample Time: 1440 **Sample Date:** 1/21/19

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
1440	—	—	—	5.8	62.0	9.14	7.39	163	156.7

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 1/21/19 **SAMPLER'S INITIALS:** JR

WELL ID: SW-2 **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** —

SCEENED Length (ft): — **DEPTH TO WATER (ft):** —

PURGE METHOD: ~~Low flow~~ NA **SAMPLING METHOD:** ~~Poly tubing~~ Grab

Sample Time: 1400 **Sample Date:** 1/21/19

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
1400	—	—	—	5.1	1626	12.45	7.40	271	113

Pace Analytical

CHAIN-OF-CUSTODY / Analytical Request Document

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

Page : 1 Of 2

Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:	
Company:	HDR	Report To:	JACOB RUFFING	Attention:	
Address:	440 S CHURCH STREET	Copy To:		Company Name:	
Suite 900, CHARLOTTE, NC 28202				Address:	
Email:		Purchase Order #:		Pace Quote:	
Phone:	Fax:	Project Name:	Charah Brickhaven	Pace Project Manager:	kevin.herring@pacelabs.com,
Requested Due Date:		Project #:		Pace Profile #:	7672-1

Regulatory Agency

State / Location: NC

ITEM #	SAMPLE ID (One Character per box. (A-Z, 0-9 / , -) Sample Ids must be unique)	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test Y/N	8260 Full List	300.0-Cl, SO4, F	2540C TDS	Radium 226/228	6010/7470	6020-B, Li, Tl	Trip BLANK	Residual Chlorine (Y/N)
1	Trip Blank	W	G	1/21/19	1300				2				2												X	
2	Leachate		G	1/21/19	1320				9	2		4	3						X	X	X	X	X	X		
3	SW-2			1/21/19	1400				9	2		4	3						X	X	X	X	X	X		
4	SW-1			1/21/19	1400				9	2		4	3						X	X	X	X	X	X		
5	BG-1			1/22/19	1010				9	2		4	3						X	X	X	X	X	X		
6	BG-2			1/22/19	1345				9	2		4	3						X	X	X	X	X	X		
7	MW-4			1/22/19	1745				9	2		4	3						X	X	X	X	X	X		
8	MW-2			1/23/19	0840				9	2		4	3						X	X	X	X	X	X		
9	MW-8			1/23/19	1100				9	2		4	~~2~~ 3						X	X	X	X	X	X		
10	MW-6			1/23/19	1350				9	2		4	3						X	X	X	X	X	X		
11	DUP			1/23/19	1250				9	2		4	3						X	X	X	X	X	X		
12	MW-5			1/24/19	0850				9	2		4	3						X	X	X	X	X	X		

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
	HDR	1/~~23~~25/19	1200		1-25-19	1200	

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

SIGNATURE of SAMPLER: DATE Signed:

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

Pace Analytical®

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevent fields

MTJL Log-in Number Here

ALL SHADED AREAS are for LAB USE ONLY

Company: HDR	Billing Information:
Address: 440 S Church St	
Report To: Jacob Ruffing	Email To: Jacob.ruffing@hdrinc.com
Copy To:	Site Collection Info/Address:
Customer Project Name/Number: Charah Brickhaven	State: NC / County/City: Moncure / Time Zone Collected: [ ] PT [ ] MT [ ] CT [✓] ET
Phone: / Email:	Site/Facility ID #: / Compliance Monitoring? [ ] Yes [ ] No
Collected By (print):	Purchase Order #: / Quote #: / DW PWS ID #: / DW Location Code:
Collected By (signature):	Turnaround Date Required: / Immediately Packed on Ice: [✓] Yes [ ] No
Sample Disposal: [ ] Dispose as appropriate [ ] Return [ ] Archive: ____ [ ] Hold: ____	Rush: [ ] Same Day [ ] Next Day [ ] 2 Day [ ] 3 Day [ ] 4 Day [ ] 5 Day (Expedite Charges Apply) / Field Filtered (if applicable): [ ] Yes [✓] No / Analysis: ____

Container Preservative Type **

Lab Project Manager:

** Preservative Types: (1) nitric acid, (2) sulfuric acid, (3) hydrochloric acid, (4) sodium hydroxide, (5) zinc acetate, (6) methanol, (7) sodium bisulfate, (8) sodium thiosulfate, (9) hexane, (A) ascorbic acid, (B) ammonium sulfate, (C) ammonium hydroxide, (D) TSP, (U) Unpreserved, (O) Other ____

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)

Customer Sample ID	Matrix *	Comp / Grab	Collected (or Composite Start) Date	Collected (or Composite Start) Time	Composite End Date	Composite End Time	Res Cl	# of Ctns	Analyses: 8260 Full List	300.0 – Cl, SO4, F	2540C-TDS	Radium 226/228	6010/7470	6020 – B, Li, Ti	Lab Profile/Line:
MW-1	GW	Grab	1/24/19	1100	—	—		9	X	X	X	X	X	X	
MW-7R	GW	Grab	1/24/19	1350	—	—		9	X	X	X	X	X	X	
MW-3	GW	Grab	1/25/19	0840	—	—		9	X	X	X	X	X	X	
Equip Blank	GW	Grab	1/25/19	~~0940~~ 1150	—	—		9	X	X	X	X	X	X	

Lab Sample Receipt Checklist:

Custody Seals Present/Intact	Y N NA
Custody Signatures Present	Y N NA
Collector Signature Present	Y N NA
Bottles Intact	Y N NA
Correct Bottles	Y N NA
Sufficient Volume	Y N NA
Samples Received on Ice	Y N NA
VOA - Headspace Acceptable	Y N NA
USDA Regulated Soils	Y N NA
Samples in Holding Time	Y N NA
Residual Chlorine Present	Y N NA
Cl Strips: ____	
Sample pH Acceptable	Y N NA
pH Strips: ____	
Sulfide Present	Y N NA
Lead Acetate Strips: ____	

LAB USE ONLY:
Lab Sample # / Comments:

Customer Remarks / Special Conditions / Possible Hazards:

Type of Ice Used: Wet Blue Dry None

Packing Material Used:

Radchem sample(s) screened (<500 cpm): Y N NA

SHORT HOLDS PRESENT (<72 hours): Y N N/A

Lab Tracking #:

Samples received via: FEDEX UPS Client Courier Pace Courier

Lab Sample Temperature Info:
Temp Blank Received: Y N NA
Therm ID#: ____
Cooler 1 Temp Upon Receipt: ____ oC
Cooler 1 Therm Corr. Factor: ____ oC
Cooler 1 Corrected Temp: ____ oC
Comments:

Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:
[signature] HDR	1/25/19 1200	[signature]	1-25-19 1200
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:

MTJL LAB USE ONLY
Table #:
Acctnum:
Template:
Prelogin:
PM:

Trip Blank Received: Y N NA
HCL MeOH TSP Other

Non Conformance(s): Page:

BORING LOG

PROJECT NAME: **Charah Moncure - Brickhaven**

PROJECT NUMBER: **10021146**

SOIL BORING ☐ MONITORING WELL ☒

BORING NO.: **BG-2**

SHEET 1 OF 1

PROJECT LOCATION: **Hastings, NE**		START DATE: **26 Dec 2018**	COMPLETION DATE: **26 Dec 2018**
		COMPLETED DEPTH: **144'**	GROUNDWATER DEPTH: **NA**
DRILLING CONTRACTOR: **Geologic Exploration**	DRILLER: **Jacob Messik**	WELL CONSTRUCTION	
DRILLING EQUIPMENT: **D50**	BORING DIAMETER: **6.25"**	TYPE AND DIAMETER OF WELL CASING: **2" SCH 40 PVC**	
DRILLING METHOD: Hollow Stem Auger ☒ Hand Auger ☐ Geoprobe ☐		SLOT SIZE: **0.020"**	FILTER MATERIAL: **GP#2 Sand**
LOGGED BY: **J. Ruffing**	BACKFILL MATERIAL: **Portland Cement**	WELL DEPTH: **23'**	PERFORATED INTERVAL: **13 - 23'**

DESCRIPTION	BLOW COUNTS	DEPTH (FEET)	SAMPLE	UCSC SOIL TYPE	LITHOLOGY	WELL	REMARKS
ML, clayey silt, brown (10 YR 5/3), soft, non-plastic, dry, organics - tree roots, grass CL, clay, brownish yellow (10 YR 6/6), stiff, medium to high plasticity, dry CL, clay,very dark grayish brown (10 YR 3/2), very stiff, high plasticity, dry, some organics		5		CL			
CL, clay, brownish yellow (10 YR 6/6), medium stiff, medium plasticity, dry	3,3,4	10					
ML, silt, gray (10 YR 5/1), stiff, non-plastic, dry	2,4,5	15					
some iron staining, hard	14, 50/2	20					
	50/3						Well Construction Grout: 0-9' Bentonite: 9-10.5' Sand: 10.5-25' Screen: 13-23'
Rock/partially weathered rock, very dark greenish gray (gley 1 3/1), very hard, dry	40, 50/3	25		SM			Auger refusal at 25'

Brickhaven No.2 Mine Tract Monitoring Well Location

Description	Northing	Easting	Top Concrete Elev.	Top Well Casing
MW-XX	669278.987	1990476.103	191.405'	194.233'

Notes: -Well observations were taken on 02/26/2019
-Bearings for this survey are based on NAD 83
-Elevations for this survey are based on NAVD 88

NORTH CAROLINA PROFESSIONAL SEAL L-4905 LAND SURVEYOR GREGORY C. BEWLEY

The John R. McAdams Company, Inc.

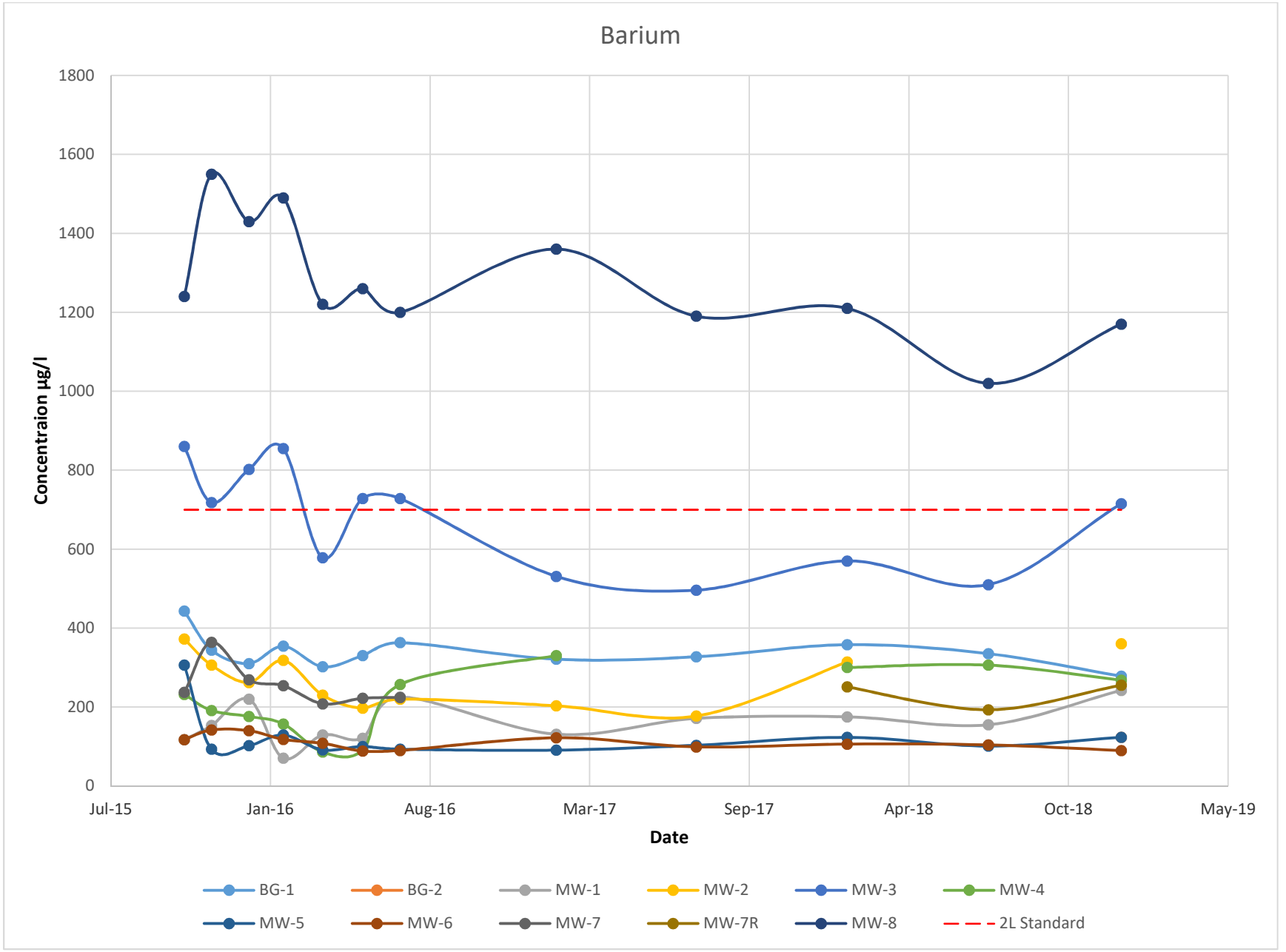
Raleigh / Durham, NC
2905 Meridian Parkway
Durham, North Carolina 27713
(919) 361-5000

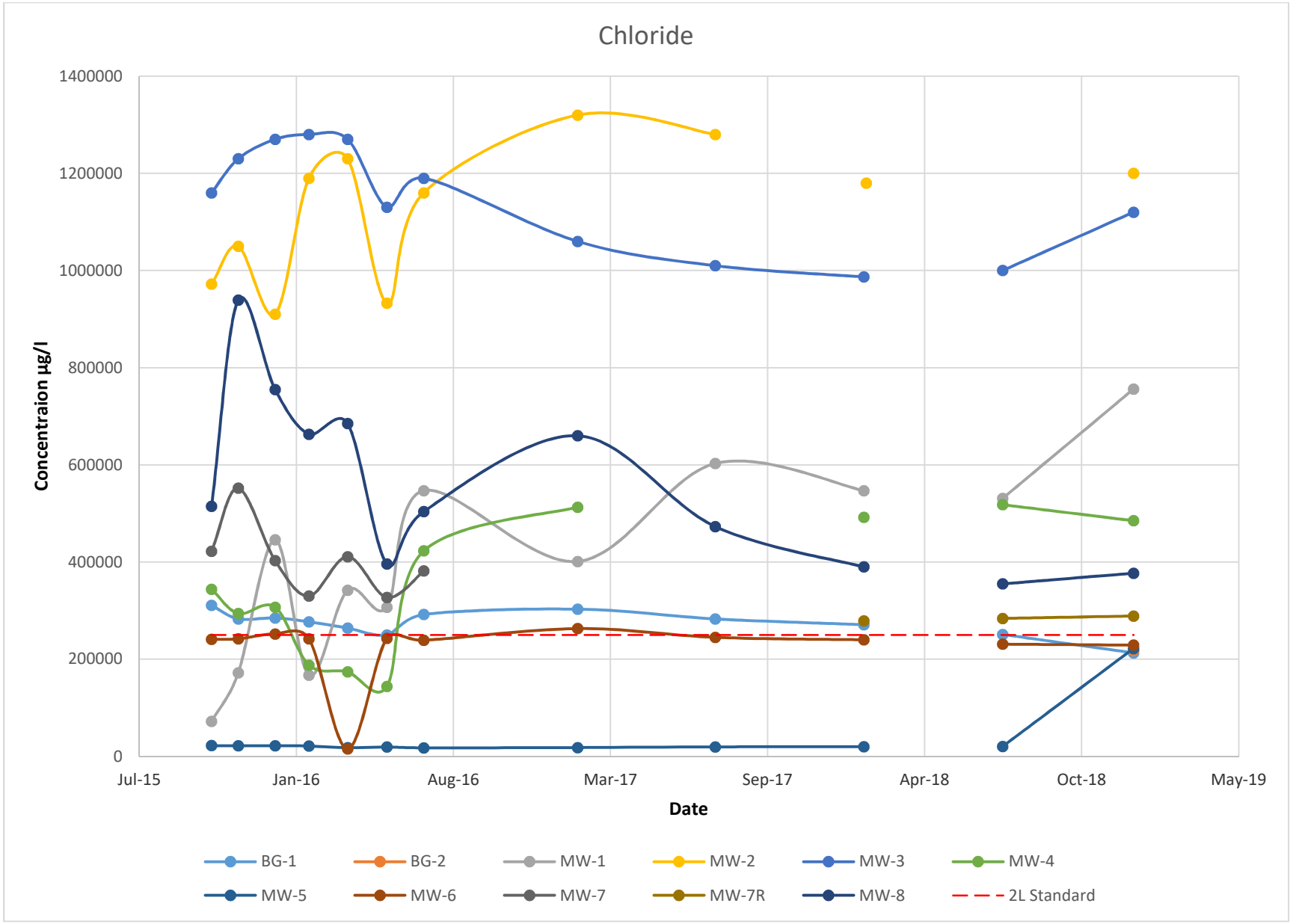
Charlotte, NC
3436 Toringdon Way
Suite 110
Charlotte, North Carolina 28277
(704) 527-0800

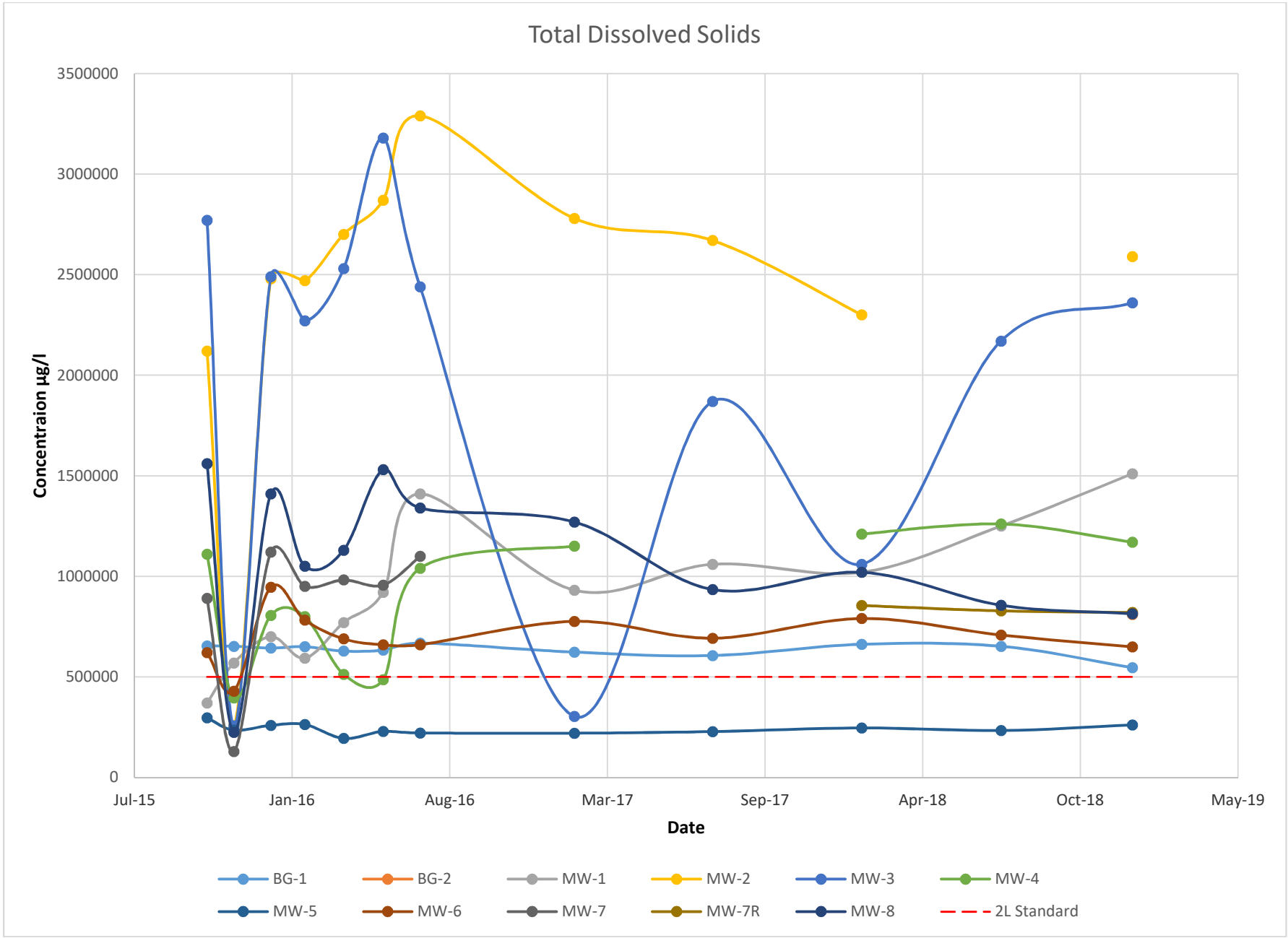
McAdamsCo.com

B

Appendix B – Concentration vs. Time Plots


Barium
1800
1600
1400
1200
1000
800
600
400
200
0
Concentraion µg/l
Jul-15
Jan-16
Aug-16
Mar-17
Sep-17
Apr-18
Oct-18
May-19
Date
BG-1
BG-2
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-7R
MW-8
2L Standard


Chloride
1400000
1200000
1000000
800000
600000
400000
200000
0
Concentraion µg/l
Jul-15
Jan-16
Aug-16
Mar-17
Sep-17
Apr-18
Oct-18
May-19
Date
BG-1
BG-2
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-7R
MW-8
2L Standard


Total Dissolved Solids
3500000
3000000
2500000
2000000
1500000
1000000
500000
0
Concentraion µg/l
Jul-15
Jan-16
Aug-16
Mar-17
Sep-17
Apr-18
Oct-18
May-19
Date
BG-1
BG-2
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-7R
MW-8
2L Standard

C

Appendix C – Laboratory Reports, Chains of Custody, & Quality Control Data

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

February 15, 2019

Mark Filardi
HDR
440 S. Church St
Suite 900
Charlotte, NC 28202

RE: Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Dear Mark Filardi:
Enclosed are the analytical results for sample(s) received by the laboratory on January 25, 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,

Kevin Herring
kevin.herring@pacelabs.com
1(704)875-9092
HORIZON Database Administrator

Enclosures

cc: Mike Plummer, HDR

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

CERTIFICATIONS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

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
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

Charlotte Certification IDs

9800 Kincey Ave. Ste 100, Huntersville, NC 28078
Louisiana/NELAP Certification # LA170028
North Carolina Drinking Water Certification #: 37706
North Carolina Field Services Certification #: 5342
North Carolina Wastewater Certification #: 12
South Carolina Certification #: 99006001
Florida/NELAP Certification #: E87627
Kentucky UST Certification #: 84
Virginia/VELAP Certification #: 460221

Asheville Certification IDs

2225 Riverside Drive, Asheville, NC 28804
Florida/NELAP Certification #: E87648
Massachusetts Certification #: M-NC030
North Carolina Drinking Water Certification #: 37712
North Carolina Wastewater Certification #: 40
South Carolina Certification #: 99030001
Virginia/VELAP Certification #: 460222

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
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SAMPLE SUMMARY

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Lab ID	Sample ID	Matrix	Date Collected	Date Received
92415385001	**TRIP BLANK**	Water	01/21/19 13:00	01/25/19 12:00
92415385002	**LEACHATE**	Water	01/21/19 13:20	01/25/19 12:00
92415385003	**SW-2**	Water	01/21/19 14:00	01/25/19 12:00
92415385004	**SW-1**	Water	01/21/19 14:00	01/25/19 12:00
92415385005	**BG-1**	Water	01/22/19 10:10	01/25/19 12:00
92415385006	**BG-2**	Water	01/22/19 13:45	01/25/19 12:00
92415385007	**MW-4**	Water	01/22/19 17:45	01/25/19 12:00
92415385008	**MW-2**	Water	01/23/19 08:40	01/25/19 12:00
92415385009	**MW-8**	Water	01/23/19 11:00	01/25/19 12:00
92415385010	**MW-6**	Water	01/23/19 13:50	01/25/19 12:00
92415385011	**DUP**	Water	01/23/19 12:50	01/25/19 12:00
92415385012	**MW-5**	Water	01/24/19 08:50	01/25/19 12:00
92415385013	**MW-1**	Water	01/24/19 11:00	01/25/19 12:00
92415385014	**MW-7R**	Water	01/24/19 13:50	01/25/19 12:00
92415385015	**MW-3**	Water	01/25/19 08:40	01/25/19 12:00
92415385016	**EQUIP BLANK**	Water	01/25/19 11:50	01/25/19 12:00

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
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SAMPLE ANALYTE COUNT

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
92415385001	**TRIP BLANK**	EPA 8260B	CL	48	PASI-C
92415385002	**LEACHATE**	EPA 6010D	DS, SH1	16	PASI-A
		EPA 6020B	JMW1	3	PASI-A
		EPA 7470A	RDT	1	PASI-A
		EPA 8260B	CL	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	CEH	1	PASI-A
		EPA 300.0 Rev 2.1 1993	CDC	3	PASI-A
92415385003	**SW-2**	EPA 6010D	DS	16	PASI-A
		EPA 6020B	JMW1	3	PASI-A
		EPA 7470A	RDT	1	PASI-A
		EPA 8260B	CL	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	CEH	1	PASI-A
		EPA 300.0 Rev 2.1 1993	CDC	3	PASI-A
92415385004	**SW-1**	EPA 6010D	DS	16	PASI-A
		EPA 6020B	JMW1	3	PASI-A
		EPA 7470A	RDT	1	PASI-A
		EPA 8260B	CL	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	CEH	1	PASI-A
		EPA 300.0 Rev 2.1 1993	CDC	3	PASI-A
92415385005	**BG-1**	EPA 6010D	DS	16	PASI-A
		EPA 6020B	JMW1	3	PASI-A
		EPA 7470A	RDT	1	PASI-A
		EPA 8260B	CL	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	CEH	1	PASI-A
		EPA 300.0 Rev 2.1 1993	CDC	3	PASI-A

Pace Analytical Services, LLC
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(704)875-9092

SAMPLE ANALYTE COUNT

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
92415385006	**BG-2**	EPA 6010D	DS	16	PASI-A
		EPA 6020B	JMW1	3	PASI-A
		EPA 7470A	RDT	1	PASI-A
		EPA 8260B	CL	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	CEH	1	PASI-A
		EPA 300.0 Rev 2.1 1993	CDC	3	PASI-A
92415385007	**MW-4**	EPA 6010D	DS	16	PASI-A
		EPA 6020B	JMW1	3	PASI-A
		EPA 7470A	RDT	1	PASI-A
		EPA 8260B	CL	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	CEH	1	PASI-A
		EPA 300.0 Rev 2.1 1993	CDC	3	PASI-A
92415385008	**MW-2**	EPA 6010D	DS, SH1	16	PASI-A
		EPA 6020B	JMW1	3	PASI-A
		EPA 7470A	RDT	1	PASI-A
		EPA 8260B	CL	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	CEH	1	PASI-A
		EPA 300.0 Rev 2.1 1993	CDC	3	PASI-A
92415385009	**MW-8**	EPA 6010D	DS, SH1	16	PASI-A
		EPA 6020B	JMW1	3	PASI-A
		EPA 7470A	RDT	1	PASI-A
		EPA 8260B	CL	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	CEH	1	PASI-A
		EPA 300.0 Rev 2.1 1993	CDC	3	PASI-A
92415385010	**MW-6**	EPA 6010D	DS	16	PASI-A

Pace Analytical Services, LLC
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SAMPLE ANALYTE COUNT

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
		EPA 6020B	JMW1	3	PASI-A
		EPA 7470A	RDT	1	PASI-A
		EPA 8260B	CL	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	CEH	1	PASI-A
		EPA 300.0 Rev 2.1 1993	CDC	3	PASI-A
92415385011	**DUP**	EPA 6010D	DS	16	PASI-A
		EPA 6020B	JMW1	3	PASI-A
		EPA 7470A	RDT	1	PASI-A
		EPA 8260B	CL	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	CEH	1	PASI-A
		EPA 300.0 Rev 2.1 1993	CDC	3	PASI-A
92415385012	**MW-5**	EPA 6010D	DS	16	PASI-A
		EPA 6020B	JMW1	3	PASI-A
		EPA 7470A	RDT	1	PASI-A
		EPA 8260B	CL	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	CRV	1	PASI-A
		EPA 300.0 Rev 2.1 1993	CDC	3	PASI-A
92415385013	**MW-1**	EPA 6010D	DS, SH1	16	PASI-A
		EPA 6020B	JMW1	3	PASI-A
		EPA 7470A	RDT	1	PASI-A
		EPA 8260B	CL	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	CRV	1	PASI-A
		EPA 300.0 Rev 2.1 1993	CDC	3	PASI-A
92415385014	**MW-7R**	EPA 6010D	DS	16	PASI-A
		EPA 6020B	JMW1	3	PASI-A

Pace Analytical Services, LLC
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SAMPLE ANALYTE COUNT

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
		EPA 7470A	RDT	1	PASI-A
		EPA 8260B	CL	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	CRV	1	PASI-A
		EPA 300.0 Rev 2.1 1993	CDC	3	PASI-A
92415385015	**MW-3**	EPA 6010D	DS, SH1	16	PASI-A
		EPA 6020B	JMW1	3	PASI-A
		EPA 7470A	RDT	1	PASI-A
		EPA 8260B	CL	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	MVC	1	PASI-A
		EPA 300.0 Rev 2.1 1993	CDC	3	PASI-A
92415385016	**EQUIP BLANK**	EPA 6010D	DS	16	PASI-A
		EPA 6020B	JMW1	3	PASI-A
		EPA 7470A	RDT	1	PASI-A
		EPA 8260B	CL	48	PASI-C
		EPA 903.1	KAC	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	MVC	1	PASI-A
		EPA 300.0 Rev 2.1 1993	CDC	3	PASI-A

Pace Analytical Services, LLC
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SUMMARY OF DETECTION

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92415385002	**LEACHATE**					
EPA 6010D	Barium	73.4	ug/L	5.0	01/27/19 23:31	
EPA 6010D	Calcium	227000	ug/L	1000	01/28/19 23:12	M6
EPA 6010D	Molybdenum	147	ug/L	5.0	01/27/19 23:31	
EPA 6010D	Nickel	5.4	ug/L	5.0	01/27/19 23:31	
EPA 6010D	Vanadium	6.5	ug/L	5.0	01/27/19 23:31	
EPA 6020B	Boron	1760	ug/L	250	01/29/19 11:58	M6
EPA 6020B	Lithium	26.5	ug/L	2.5	01/28/19 20:57	
EPA 6020B	Thallium	0.47	ug/L	0.10	01/28/19 20:57	
EPA 903.1	Radium-226	0.000 ± 0.359 (0.759) C:NA T:87%	pCi/L		02/07/19 20:27	
EPA 904.0	Radium-228	1.06 ± 0.408 (0.624) C:97% T:83%	pCi/L		02/05/19 16:03	
Total Radium Calculation	Total Radium	1.06 ± 0.767 (1.38)	pCi/L		02/08/19 12:45	
SM 2540C-2011	Total Dissolved Solids	1110	mg/L	50.0	01/25/19 23:32	
EPA 300.0 Rev 2.1 1993	Chloride	12.5	mg/L	1.0	01/30/19 23:35	
EPA 300.0 Rev 2.1 1993	Fluoride	0.17	mg/L	0.10	01/30/19 23:35	
EPA 300.0 Rev 2.1 1993	Sulfate	483	mg/L	10.0	01/31/19 09:59	
92415385003	**SW-2**					
EPA 6010D	Barium	94.2	ug/L	5.0	01/27/19 23:57	
EPA 6010D	Calcium	5230	ug/L	100	01/27/19 23:57	
EPA 6010D	Chromium	5.0	ug/L	5.0	01/27/19 23:57	
EPA 6010D	Copper	5.5	ug/L	5.0	01/27/19 23:57	
EPA 6010D	Lead	5.4	ug/L	5.0	01/27/19 23:57	
EPA 6010D	Vanadium	13.1	ug/L	5.0	01/27/19 23:57	
EPA 6010D	Zinc	14.3	ug/L	10.0	01/27/19 23:57	
EPA 903.1	Radium-226	0.289 ± 0.496 (0.869) C:NA T:86%	pCi/L		02/07/19 20:27	
EPA 904.0	Radium-228	0.220 ± 1.84 (4.24) C:74% T:29%	pCi/L		02/07/19 14:04	
Total Radium Calculation	Total Radium	0.509 ± 2.34 (5.11)	pCi/L		02/08/19 12:45	
SM 2540C-2011	Total Dissolved Solids	229	mg/L	25.0	01/25/19 23:32	
EPA 300.0 Rev 2.1 1993	Chloride	23.2	mg/L	1.0	01/30/19 23:51	
EPA 300.0 Rev 2.1 1993	Sulfate	7.9	mg/L	1.0	01/30/19 23:51	
92415385004	**SW-1**					
EPA 6010D	Barium	85.2	ug/L	5.0	01/28/19 00:00	
EPA 6010D	Calcium	2970	ug/L	100	01/28/19 00:00	
EPA 6010D	Vanadium	9.4	ug/L	5.0	01/28/19 00:00	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

SUMMARY OF DETECTION

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92415385004	**SW-1**					
EPA 6010D	Zinc	11.5	ug/L	10.0	01/28/19 00:00	
EPA 903.1	Radium-226	0.458 ± 0.499 (0.785) C:NA T:86%	pCi/L		02/07/19 20:27	
EPA 904.0	Radium-228	0.602 ± 0.352 (0.652) C:95% T:81%	pCi/L		02/05/19 16:03	
Total Radium Calculation	Total Radium	1.06 ± 0.851 (1.44)	pCi/L		02/08/19 12:45	
SM 2540C-2011	Total Dissolved Solids	182	mg/L	25.0	01/25/19 23:32	
EPA 300.0 Rev 2.1 1993	Chloride	6.9	mg/L	1.0	01/31/19 00:08	
EPA 300.0 Rev 2.1 1993	Sulfate	3.8	mg/L	1.0	01/31/19 00:08	
92415385005	**BG-1**					
EPA 6010D	Barium	278	ug/L	5.0	01/28/19 00:03	
EPA 6010D	Calcium	23900	ug/L	100	01/28/19 00:03	
EPA 6020B	Lithium	16.0	ug/L	2.5	01/28/19 21:20	
EPA 903.1	Radium-226	0.000 ± 0.321 (0.678) C:NA T:92%	pCi/L		02/07/19 20:27	
EPA 904.0	Radium-228	1.08 ± 0.403 (0.608) C:96% T:87%	pCi/L		02/05/19 16:03	
Total Radium Calculation	Total Radium	1.08 ± 0.724 (1.29)	pCi/L		02/08/19 12:45	
SM 2540C-2011	Total Dissolved Solids	546	mg/L	50.0	01/25/19 23:32	
EPA 300.0 Rev 2.1 1993	Chloride	213	mg/L	4.0	01/31/19 10:15	
EPA 300.0 Rev 2.1 1993	Fluoride	0.17	mg/L	0.10	01/31/19 00:24	
EPA 300.0 Rev 2.1 1993	Sulfate	23.2	mg/L	1.0	01/31/19 00:24	
92415385006	**BG-2**					
EPA 6010D	Barium	123	ug/L	5.0	01/28/19 00:06	
EPA 6010D	Calcium	89600	ug/L	100	01/28/19 00:06	
EPA 6020B	Lithium	12.1	ug/L	2.5	01/28/19 21:24	
EPA 903.1	Radium-226	0.236 ± 0.401 (0.708) C:NA T:88%	pCi/L		02/07/19 20:27	
EPA 904.0	Radium-228	1.06 ± 0.418 (0.649) C:94% T:82%	pCi/L		02/05/19 16:04	
Total Radium Calculation	Total Radium	1.30 ± 0.819 (1.36)	pCi/L		02/08/19 12:45	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

SUMMARY OF DETECTION

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92415385006	**BG-2**					
SM 2540C-2011	Total Dissolved Solids	810	mg/L	50.0	01/25/19 23:32	
EPA 300.0 Rev 2.1 1993	Chloride	218	mg/L	5.0	01/31/19 10:31	
EPA 300.0 Rev 2.1 1993	Fluoride	0.16	mg/L	0.10	01/31/19 00:41	
EPA 300.0 Rev 2.1 1993	Sulfate	64.7	mg/L	1.0	01/31/19 00:41	
92415385007	**MW-4**					
EPA 6010D	Barium	268	ug/L	5.0	01/28/19 00:09	
EPA 6010D	Calcium	64300	ug/L	100	01/28/19 00:09	
EPA 6010D	Zinc	29.4	ug/L	10.0	01/28/19 00:09	
EPA 6020B	Lithium	25.4	ug/L	2.5	01/28/19 21:27	
EPA 903.1	Radium-226	0.913 ± 0.558 (0.685) C:NA T:87%	pCi/L		02/07/19 20:42	
EPA 904.0	Radium-228	1.35 ± 0.429 (0.538) C:95% T:85%	pCi/L		02/05/19 16:04	
Total Radium Calculation	Total Radium	2.26 ± 0.987 (1.22)	pCi/L		02/08/19 12:45	
SM 2540C-2011	Total Dissolved Solids	1170	mg/L	50.0	01/25/19 23:32	
EPA 300.0 Rev 2.1 1993	Chloride	485	mg/L	10.0	01/31/19 10:48	
EPA 300.0 Rev 2.1 1993	Fluoride	0.29	mg/L	0.10	01/31/19 00:57	
EPA 300.0 Rev 2.1 1993	Sulfate	12.2	mg/L	1.0	01/31/19 00:57	
92415385008	**MW-2**					
EPA 6010D	Barium	360	ug/L	5.0	01/28/19 00:12	
EPA 6010D	Calcium	207000	ug/L	500	01/28/19 23:31	
EPA 6010D	Chromium	14.0	ug/L	5.0	01/28/19 00:12	
EPA 6010D	Copper	17.2	ug/L	5.0	01/28/19 00:12	
EPA 6010D	Molybdenum	7.9	ug/L	5.0	01/28/19 00:12	
EPA 6010D	Nickel	9.7	ug/L	5.0	01/28/19 00:12	
EPA 6010D	Vanadium	7.6	ug/L	5.0	01/28/19 00:12	
EPA 6010D	Zinc	31.1	ug/L	10.0	01/28/19 00:12	
EPA 6020B	Boron	39.1	ug/L	25.0	01/29/19 12:34	
EPA 6020B	Lithium	94.1	ug/L	2.5	01/29/19 12:34	
EPA 903.1	Radium-226	1.21 ± 0.623 (0.718) C:NA T:86%	pCi/L		02/07/19 20:42	
EPA 904.0	Radium-228	1.49 ± 0.464 (0.590) C:96% T:86%	pCi/L		02/05/19 16:04	
Total Radium Calculation	Total Radium	2.70 ± 1.09 (1.31)	pCi/L		02/08/19 12:45	
SM 2540C-2011	Total Dissolved Solids	2590	mg/L	250	01/25/19 23:32	
EPA 300.0 Rev 2.1 1993	Chloride	1200	mg/L	15.0	01/31/19 11:20	
EPA 300.0 Rev 2.1 1993	Fluoride	0.26	mg/L	0.10	01/31/19 01:13	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
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SUMMARY OF DETECTION

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92415385008	**MW-2**					
EPA 300.0 Rev 2.1 1993	Sulfate	130	mg/L	15.0	01/31/19 11:20	
92415385009	**MW-8**					
EPA 6010D	Barium	1170	ug/L	5.0	01/28/19 00:16	
EPA 6010D	Calcium	110000	ug/L	500	01/28/19 23:34	
EPA 6010D	Zinc	13.6	ug/L	10.0	01/28/19 00:16	
EPA 6020B	Lithium	21.7	ug/L	2.5	01/29/19 12:37	
EPA 903.1	Radium-226	0.743 ± 0.567 (0.806) C:NA T:88%	pCi/L		02/07/19 20:42	
EPA 904.0	Radium-228	1.20 ± 0.439 (0.647) C:94% T:82%	pCi/L		02/05/19 16:04	
Total Radium Calculation	Total Radium	1.94 ± 1.01 (1.45)	pCi/L		02/08/19 12:45	
SM 2540C-2011	Total Dissolved Solids	814	mg/L	50.0	01/25/19 23:32	
EPA 300.0 Rev 2.1 1993	Chloride	377	mg/L	8.0	01/31/19 11:37	M6
EPA 300.0 Rev 2.1 1993	Sulfate	7.9	mg/L	1.0	01/31/19 02:19	
92415385010	**MW-6**					
EPA 6010D	Barium	89.7	ug/L	5.0	01/28/19 00:19	
EPA 6010D	Calcium	34400	ug/L	100	01/28/19 00:19	
EPA 6010D	Chromium	5.3	ug/L	5.0	01/28/19 00:19	
EPA 6010D	Zinc	17.7	ug/L	10.0	01/28/19 00:19	
EPA 6020B	Lithium	27.9	ug/L	2.5	01/29/19 12:40	
EPA 903.1	Radium-226	0.000 ± 0.340 (0.719) C:NA T:90%	pCi/L		02/07/19 20:42	
EPA 904.0	Radium-228	0.628 ± 0.315 (0.538) C:92% T:88%	pCi/L		02/05/19 16:04	
Total Radium Calculation	Total Radium	0.628 ± 0.655 (1.26)	pCi/L		02/08/19 12:45	
SM 2540C-2011	Total Dissolved Solids	649	mg/L	25.0	01/26/19 01:25	
EPA 300.0 Rev 2.1 1993	Chloride	229	mg/L	5.0	01/31/19 13:15	
EPA 300.0 Rev 2.1 1993	Fluoride	0.40	mg/L	0.10	01/31/19 03:09	
EPA 300.0 Rev 2.1 1993	Sulfate	48.7	mg/L	1.0	01/31/19 03:09	
92415385011	**DUP**					
EPA 6010D	Barium	90.4	ug/L	5.0	01/28/19 00:22	
EPA 6010D	Calcium	35200	ug/L	100	01/28/19 00:22	
EPA 6010D	Chromium	5.2	ug/L	5.0	01/28/19 00:22	
EPA 6010D	Zinc	17.5	ug/L	10.0	01/28/19 00:22	
EPA 6020B	Lithium	28.6	ug/L	2.5	01/29/19 12:43	

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SUMMARY OF DETECTION

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92415385011	**DUP**					
EPA 903.1	Radium-226	0.510 ± 0.461 (0.680) C:NA T:89%	pCi/L		02/07/19 20:42	
EPA 904.0	Radium-228	0.757 ± 0.351 (0.585) C:94% T:81%	pCi/L		02/05/19 16:04	
Total Radium Calculation	Total Radium	1.27 ± 0.812 (1.27)	pCi/L		02/08/19 12:45	
SM 2540C-2011	Total Dissolved Solids	649	mg/L	25.0	01/26/19 01:27	
EPA 300.0 Rev 2.1 1993	Chloride	228	mg/L	5.0	01/31/19 13:31	
EPA 300.0 Rev 2.1 1993	Fluoride	0.39	mg/L	0.10	01/31/19 03:26	
EPA 300.0 Rev 2.1 1993	Sulfate	49.3	mg/L	1.0	01/31/19 03:26	
92415385012	**MW-5**					
EPA 6010D	Barium	123	ug/L	5.0	01/28/19 00:31	
EPA 6010D	Calcium	13700	ug/L	100	01/28/19 00:31	
EPA 6020B	Lithium	8.0	ug/L	2.5	01/29/19 12:46	
EPA 903.1	Radium-226	0.108 ± 0.366 (0.706) C:NA T:87%	pCi/L		02/07/19 20:42	
EPA 904.0	Radium-228	0.695 ± 0.324 (0.517) C:93% T:79%	pCi/L		02/05/19 16:04	
Total Radium Calculation	Total Radium	0.803 ± 0.690 (1.22)	pCi/L		02/08/19 12:45	
SM 2540C-2011	Total Dissolved Solids	261	mg/L	25.0	01/29/19 15:06	
EPA 300.0 Rev 2.1 1993	Chloride	22.2	mg/L	1.0	01/31/19 03:42	
EPA 300.0 Rev 2.1 1993	Fluoride	0.57	mg/L	0.10	01/31/19 03:42	
EPA 300.0 Rev 2.1 1993	Sulfate	2.9	mg/L	1.0	01/31/19 03:42	
92415385013	**MW-1**					
EPA 6010D	Barium	242	ug/L	5.0	01/28/19 00:34	
EPA 6010D	Calcium	205000	ug/L	500	01/28/19 23:37	
EPA 6010D	Zinc	14.7	ug/L	10.0	01/28/19 00:34	
EPA 6020B	Lithium	30.9	ug/L	2.5	01/29/19 12:49	
EPA 903.1	Radium-226	0.607 ± 0.425 (0.512) C:NA T:95%	pCi/L		02/07/19 20:57	
EPA 904.0	Radium-228	0.737 ± 0.337 (0.550) C:93% T:85%	pCi/L		02/05/19 16:04	

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SUMMARY OF DETECTION

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92415385013	**MW-1**					
Total Radium Calculation	Total Radium	1.34 ± 0.762 (1.06)	pCi/L		02/08/19 12:45	
SM 2540C-2011	Total Dissolved Solids	1510	mg/L	50.0	01/29/19 15:06	
EPA 300.0 Rev 2.1 1993	Chloride	756	mg/L	16.0	01/31/19 13:47	
EPA 300.0 Rev 2.1 1993	Fluoride	0.16	mg/L	0.10	01/31/19 03:58	
EPA 300.0 Rev 2.1 1993	Sulfate	8.0	mg/L	1.0	01/31/19 03:58	
92415385014	**MW-7R**					
EPA 6010D	Barium	255	ug/L	5.0	01/28/19 00:37	
EPA 6010D	Calcium	89100	ug/L	100	01/28/19 00:37	
EPA 6010D	Chromium	6.5	ug/L	5.0	01/28/19 00:37	
EPA 6010D	Zinc	10.7	ug/L	10.0	01/28/19 00:37	
EPA 6020B	Lithium	25.4	ug/L	2.5	01/29/19 12:52	
EPA 6020B	Thallium	0.12	ug/L	0.10	01/28/19 21:59	
EPA 903.1	Radium-226	0.987 ± 0.578 (0.733) C:NA T:93%	pCi/L		02/07/19 20:57	
EPA 904.0	Radium-228	1.01 ± 0.361 (0.496) C:94% T:88%	pCi/L		02/05/19 16:04	
Total Radium Calculation	Total Radium	2.00 ± 0.939 (1.23)	pCi/L		02/08/19 12:45	
SM 2540C-2011	Total Dissolved Solids	820	mg/L	50.0	01/29/19 15:06	
EPA 300.0 Rev 2.1 1993	Chloride	289	mg/L	6.0	01/31/19 14:03	
EPA 300.0 Rev 2.1 1993	Fluoride	0.11	mg/L	0.10	01/31/19 04:15	
EPA 300.0 Rev 2.1 1993	Sulfate	18.3	mg/L	1.0	01/31/19 04:15	
92415385015	**MW-3**					
EPA 6010D	Barium	715	ug/L	5.0	01/28/19 00:41	
EPA 6010D	Calcium	194000	ug/L	500	01/28/19 23:40	
EPA 6010D	Chromium	179	ug/L	5.0	01/28/19 00:41	
EPA 6010D	Cobalt	6.2	ug/L	5.0	01/28/19 00:41	
EPA 6010D	Copper	36.0	ug/L	5.0	01/28/19 00:41	
EPA 6010D	Lead	7.3	ug/L	5.0	01/28/19 00:41	
EPA 6010D	Molybdenum	12.0	ug/L	5.0	01/28/19 00:41	
EPA 6010D	Nickel	86.0	ug/L	5.0	01/28/19 00:41	
EPA 6010D	Vanadium	13.9	ug/L	5.0	01/28/19 00:41	
EPA 6010D	Zinc	42.7	ug/L	10.0	01/28/19 00:41	
EPA 6020B	Lithium	72.6	ug/L	2.5	01/29/19 12:55	
EPA 903.1	Radium-226	1.92 ± 0.716 (0.622) C:NA T:93%	pCi/L		02/07/19 20:57	

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SUMMARY OF DETECTION

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92415385015	**MW-3**					
EPA 904.0	Radium-228	2.00 ± 0.570 (0.657) C:94% T:81%	pCi/L		02/05/19 16:05	
Total Radium Calculation	Total Radium	3.92 ± 1.29 (1.28)	pCi/L		02/08/19 12:45	
SM 2540C-2011	Total Dissolved Solids	2360	mg/L	50.0	01/30/19 21:12	
EPA 300.0 Rev 2.1 1993	Chloride	1120	mg/L	20.0	01/31/19 14:20	
EPA 300.0 Rev 2.1 1993	Fluoride	0.42	mg/L	0.10	01/31/19 04:31	
EPA 300.0 Rev 2.1 1993	Sulfate	80.2	mg/L	1.0	01/31/19 04:31	
92415385016	**EQUIP BLANK**					
EPA 903.1	Radium-226	0.303 ± 0.397 (0.661) C:NA T:94%	pCi/L		02/07/19 20:57	
EPA 904.0	Radium-228	0.676 ± 0.315 (0.523) C:91% T:92%	pCi/L		02/05/19 16:05	
Total Radium Calculation	Total Radium	0.979 ± 0.712 (1.18)	pCi/L		02/08/19 12:45	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: TRIP BLANK **Lab ID: 92415385001** Collected: 01/21/19 13:00 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
Acetone	ND	ug/L	25.0	1		01/28/19 13:52	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/28/19 13:52	107-13-1	
Benzene	ND	ug/L	1.0	1		01/28/19 13:52	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/28/19 13:52	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/28/19 13:52	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/28/19 13:52	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/28/19 13:52	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/28/19 13:52	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/28/19 13:52	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/28/19 13:52	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/28/19 13:52	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/28/19 13:52	75-00-3	
Chloroform	ND	ug/L	5.0	1		01/28/19 13:52	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/28/19 13:52	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/28/19 13:52	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		01/28/19 13:52	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 13:52	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 13:52	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/28/19 13:52	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/28/19 13:52	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		01/28/19 13:52	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/28/19 13:52	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 13:52	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 13:52	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/28/19 13:52	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 13:52	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 13:52	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/28/19 13:52	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/28/19 13:52	591-78-6	
Iodomethane	ND	ug/L	20.0	1		01/28/19 13:52	74-88-4	
Methylene Chloride	ND	ug/L	5.0	1		01/28/19 13:52	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/28/19 13:52	108-10-1	
Styrene	ND	ug/L	1.0	1		01/28/19 13:52	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 13:52	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 13:52	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/28/19 13:52	127-18-4	
Toluene	ND	ug/L	1.0	1		01/28/19 13:52	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/28/19 13:52	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/28/19 13:52	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/28/19 13:52	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/28/19 13:52	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/28/19 13:52	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/28/19 13:52	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/28/19 13:52	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/28/19 13:52	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	97	%	70-130	1		01/28/19 13:52	460-00-4	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: TRIP BLANK **Lab ID: 92415385001** Collected: 01/21/19 13:00 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
Surrogates								
1,2-Dichloroethane-d4 (S)	103	%	70-130	1		01/28/19 13:52	17060-07-0	
Toluene-d8 (S)	100	%	70-130	1		01/28/19 13:52	2037-26-5	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: LEACHATE **Lab ID: 92415385002** Collected: 01/21/19 13:20 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/19 07:42	01/27/19 23:31	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/19 07:42	01/27/19 23:31	7440-38-2	
Barium	**73.4**	ug/L	5.0	1	01/26/19 07:42	01/27/19 23:31	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/19 07:42	01/27/19 23:31	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/19 07:42	01/27/19 23:31	7440-43-9	
Calcium	**227000**	ug/L	1000	10	01/26/19 07:42	01/28/19 23:12	7440-70-2	M6
Chromium	ND	ug/L	5.0	1	01/26/19 07:42	01/27/19 23:31	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/19 07:42	01/27/19 23:31	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/19 07:42	01/27/19 23:31	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/19 07:42	01/27/19 23:31	7439-92-1	
Molybdenum	**147**	ug/L	5.0	1	01/26/19 07:42	01/27/19 23:31	7439-98-7	
Nickel	**5.4**	ug/L	5.0	1	01/26/19 07:42	01/27/19 23:31	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/19 07:42	01/27/19 23:31	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/19 07:42	01/27/19 23:31	7440-22-4	
Vanadium	**6.5**	ug/L	5.0	1	01/26/19 07:42	01/27/19 23:31	7440-62-2	
Zinc	ND	ug/L	10.0	1	01/26/19 07:42	01/27/19 23:31	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	**1760**	ug/L	250	10	01/26/19 10:00	01/29/19 11:58	7440-42-8	M6
Lithium	**26.5**	ug/L	2.5	1	01/26/19 10:00	01/28/19 20:57	7439-93-2	
Thallium	**0.47**	ug/L	0.10	1	01/26/19 10:00	01/28/19 20:57	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	01/28/19 21:27	01/29/19 12:37	7439-97-6	M1
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
Acetone	ND	ug/L	25.0	1		01/28/19 14:26	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/28/19 14:26	107-13-1	
Benzene	ND	ug/L	1.0	1		01/28/19 14:26	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/28/19 14:26	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/28/19 14:26	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/28/19 14:26	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/28/19 14:26	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/28/19 14:26	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/28/19 14:26	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/28/19 14:26	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/28/19 14:26	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/28/19 14:26	75-00-3	
Chloroform	ND	ug/L	5.0	1		01/28/19 14:26	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/28/19 14:26	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/28/19 14:26	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		01/28/19 14:26	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 14:26	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 14:26	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/28/19 14:26	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/28/19 14:26	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: LEACHATE **Lab ID: 92415385002** Collected: 01/21/19 13:20 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
1,2-Dichloroethane	ND	ug/L	1.0	1		01/28/19 14:26	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/28/19 14:26	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 14:26	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 14:26	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/28/19 14:26	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 14:26	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 14:26	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/28/19 14:26	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/28/19 14:26	591-78-6	
Iodomethane	ND	ug/L	20.0	1		01/28/19 14:26	74-88-4	
Methylene Chloride	ND	ug/L	5.0	1		01/28/19 14:26	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/28/19 14:26	108-10-1	
Styrene	ND	ug/L	1.0	1		01/28/19 14:26	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 14:26	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 14:26	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/28/19 14:26	127-18-4	
Toluene	ND	ug/L	1.0	1		01/28/19 14:26	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/28/19 14:26	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/28/19 14:26	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/28/19 14:26	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/28/19 14:26	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/28/19 14:26	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/28/19 14:26	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/28/19 14:26	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/28/19 14:26	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	95	%	70-130	1		01/28/19 14:26	460-00-4	
1,2-Dichloroethane-d4 (S)	102	%	70-130	1		01/28/19 14:26	17060-07-0	
Toluene-d8 (S)	99	%	70-130	1		01/28/19 14:26	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**1110**	mg/L	50.0	1		01/25/19 23:32		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**12.5**	mg/L	1.0	1		01/30/19 23:35	16887-00-6	
Fluoride	**0.17**	mg/L	0.10	1		01/30/19 23:35	16984-48-8	
Sulfate	**483**	mg/L	10.0	10		01/31/19 09:59	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: SW-2 **Lab ID: 92415385003** Collected: 01/21/19 14:00 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/19 07:42	01/27/19 23:57	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/19 07:42	01/27/19 23:57	7440-38-2	
Barium	**94.2**	ug/L	5.0	1	01/26/19 07:42	01/27/19 23:57	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/19 07:42	01/27/19 23:57	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/19 07:42	01/27/19 23:57	7440-43-9	
Calcium	**5230**	ug/L	100	1	01/26/19 07:42	01/27/19 23:57	7440-70-2	
Chromium	**5.0**	ug/L	5.0	1	01/26/19 07:42	01/27/19 23:57	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/19 07:42	01/27/19 23:57	7440-48-4	
Copper	**5.5**	ug/L	5.0	1	01/26/19 07:42	01/27/19 23:57	7440-50-8	
Lead	**5.4**	ug/L	5.0	1	01/26/19 07:42	01/27/19 23:57	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/26/19 07:42	01/27/19 23:57	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/26/19 07:42	01/27/19 23:57	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/19 07:42	01/27/19 23:57	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/19 07:42	01/27/19 23:57	7440-22-4	
Vanadium	**13.1**	ug/L	5.0	1	01/26/19 07:42	01/27/19 23:57	7440-62-2	
Zinc	**14.3**	ug/L	10.0	1	01/26/19 07:42	01/27/19 23:57	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/26/19 10:00	01/29/19 12:13	7440-42-8	
Lithium	ND	ug/L	2.5	1	01/26/19 10:00	01/28/19 21:13	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/19 10:00	01/28/19 21:13	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	01/28/19 21:27	01/29/19 12:44	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
Acetone	ND	ug/L	25.0	1		01/28/19 14:43	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/28/19 14:43	107-13-1	
Benzene	ND	ug/L	1.0	1		01/28/19 14:43	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/28/19 14:43	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/28/19 14:43	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/28/19 14:43	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/28/19 14:43	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/28/19 14:43	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/28/19 14:43	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/28/19 14:43	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/28/19 14:43	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/28/19 14:43	75-00-3	
Chloroform	ND	ug/L	5.0	1		01/28/19 14:43	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/28/19 14:43	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/28/19 14:43	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		01/28/19 14:43	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 14:43	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 14:43	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/28/19 14:43	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/28/19 14:43	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: SW-2 **Lab ID: 92415385003** Collected: 01/21/19 14:00 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
1,2-Dichloroethane	ND	ug/L	1.0	1		01/28/19 14:43	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/28/19 14:43	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 14:43	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 14:43	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/28/19 14:43	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 14:43	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 14:43	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/28/19 14:43	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/28/19 14:43	591-78-6	
Iodomethane	ND	ug/L	20.0	1		01/28/19 14:43	74-88-4	
Methylene Chloride	ND	ug/L	5.0	1		01/28/19 14:43	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/28/19 14:43	108-10-1	
Styrene	ND	ug/L	1.0	1		01/28/19 14:43	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 14:43	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 14:43	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/28/19 14:43	127-18-4	
Toluene	ND	ug/L	1.0	1		01/28/19 14:43	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/28/19 14:43	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/28/19 14:43	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/28/19 14:43	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/28/19 14:43	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/28/19 14:43	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/28/19 14:43	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/28/19 14:43	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/28/19 14:43	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	98	%	70-130	1		01/28/19 14:43	460-00-4	
1,2-Dichloroethane-d4 (S)	104	%	70-130	1		01/28/19 14:43	17060-07-0	
Toluene-d8 (S)	101	%	70-130	1		01/28/19 14:43	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**229**	mg/L	25.0	1		01/25/19 23:32		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**23.2**	mg/L	1.0	1		01/30/19 23:51	16887-00-6	
Fluoride	ND	mg/L	0.10	1		01/30/19 23:51	16984-48-8	
Sulfate	**7.9**	mg/L	1.0	1		01/30/19 23:51	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: SW-1 **Lab ID: 92415385004** Collected: 01/21/19 14:00 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:00	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:00	7440-38-2	
Barium	**85.2**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:00	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:00	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:00	7440-43-9	
Calcium	**2970**	ug/L	100	1	01/26/19 07:42	01/28/19 00:00	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:00	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:00	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:00	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:00	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:00	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:00	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:00	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:00	7440-22-4	
Vanadium	**9.4**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:00	7440-62-2	
Zinc	**11.5**	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:00	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/26/19 10:00	01/29/19 12:16	7440-42-8	
Lithium	ND	ug/L	2.5	1	01/26/19 10:00	01/28/19 21:17	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/19 10:00	01/28/19 21:17	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	01/28/19 21:27	01/29/19 12:47	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
Acetone	ND	ug/L	25.0	1		01/28/19 15:00	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/28/19 15:00	107-13-1	
Benzene	ND	ug/L	1.0	1		01/28/19 15:00	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/28/19 15:00	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/28/19 15:00	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/28/19 15:00	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/28/19 15:00	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/28/19 15:00	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/28/19 15:00	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/28/19 15:00	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/28/19 15:00	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/28/19 15:00	75-00-3	
Chloroform	ND	ug/L	5.0	1		01/28/19 15:00	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/28/19 15:00	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/28/19 15:00	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		01/28/19 15:00	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 15:00	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 15:00	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/28/19 15:00	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/28/19 15:00	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: SW-1 **Lab ID: 92415385004** Collected: 01/21/19 14:00 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
1,2-Dichloroethane	ND	ug/L	1.0	1		01/28/19 15:00	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/28/19 15:00	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 15:00	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 15:00	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/28/19 15:00	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 15:00	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 15:00	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/28/19 15:00	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/28/19 15:00	591-78-6	
Iodomethane	ND	ug/L	20.0	1		01/28/19 15:00	74-88-4	
Methylene Chloride	ND	ug/L	5.0	1		01/28/19 15:00	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/28/19 15:00	108-10-1	
Styrene	ND	ug/L	1.0	1		01/28/19 15:00	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 15:00	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 15:00	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/28/19 15:00	127-18-4	
Toluene	ND	ug/L	1.0	1		01/28/19 15:00	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/28/19 15:00	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/28/19 15:00	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/28/19 15:00	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/28/19 15:00	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/28/19 15:00	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/28/19 15:00	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/28/19 15:00	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/28/19 15:00	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	99	%	70-130	1		01/28/19 15:00	460-00-4	
1,2-Dichloroethane-d4 (S)	101	%	70-130	1		01/28/19 15:00	17060-07-0	
Toluene-d8 (S)	101	%	70-130	1		01/28/19 15:00	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**182**	mg/L	25.0	1		01/25/19 23:32		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**6.9**	mg/L	1.0	1		01/31/19 00:08	16887-00-6	
Fluoride	ND	mg/L	0.10	1		01/31/19 00:08	16984-48-8	
Sulfate	**3.8**	mg/L	1.0	1		01/31/19 00:08	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: BG-1 **Lab ID: 92415385005** Collected: 01/22/19 10:10 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:03	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:03	7440-38-2	
Barium	**278**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:03	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:03	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:03	7440-43-9	
Calcium	**23900**	ug/L	100	1	01/26/19 07:42	01/28/19 00:03	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:03	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:03	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:03	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:03	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:03	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:03	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:03	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:03	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:03	7440-62-2	
Zinc	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:03	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/26/19 10:00	01/29/19 12:19	7440-42-8	
Lithium	**16.0**	ug/L	2.5	1	01/26/19 10:00	01/28/19 21:20	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/19 10:00	01/28/19 21:20	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	01/28/19 21:27	01/29/19 12:54	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
Acetone	ND	ug/L	25.0	1		01/28/19 15:17	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/28/19 15:17	107-13-1	
Benzene	ND	ug/L	1.0	1		01/28/19 15:17	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/28/19 15:17	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/28/19 15:17	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/28/19 15:17	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/28/19 15:17	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/28/19 15:17	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/28/19 15:17	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/28/19 15:17	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/28/19 15:17	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/28/19 15:17	75-00-3	
Chloroform	ND	ug/L	5.0	1		01/28/19 15:17	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/28/19 15:17	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/28/19 15:17	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		01/28/19 15:17	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 15:17	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 15:17	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/28/19 15:17	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/28/19 15:17	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: BG-1 **Lab ID: 92415385005** Collected: 01/22/19 10:10 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
1,2-Dichloroethane	ND	ug/L	1.0	1		01/28/19 15:17	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/28/19 15:17	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 15:17	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 15:17	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/28/19 15:17	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 15:17	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 15:17	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/28/19 15:17	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/28/19 15:17	591-78-6	
Iodomethane	ND	ug/L	20.0	1		01/28/19 15:17	74-88-4	
Methylene Chloride	ND	ug/L	5.0	1		01/28/19 15:17	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/28/19 15:17	108-10-1	
Styrene	ND	ug/L	1.0	1		01/28/19 15:17	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 15:17	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 15:17	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/28/19 15:17	127-18-4	
Toluene	ND	ug/L	1.0	1		01/28/19 15:17	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/28/19 15:17	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/28/19 15:17	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/28/19 15:17	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/28/19 15:17	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/28/19 15:17	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/28/19 15:17	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/28/19 15:17	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/28/19 15:17	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	100	%	70-130	1		01/28/19 15:17	460-00-4	
1,2-Dichloroethane-d4 (S)	105	%	70-130	1		01/28/19 15:17	17060-07-0	
Toluene-d8 (S)	100	%	70-130	1		01/28/19 15:17	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**546**	mg/L	50.0	1		01/25/19 23:32		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**213**	mg/L	4.0	4		01/31/19 10:15	16887-00-6	
Fluoride	**0.17**	mg/L	0.10	1		01/31/19 00:24	16984-48-8	
Sulfate	**23.2**	mg/L	1.0	1		01/31/19 00:24	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: BG-2 **Lab ID: 92415385006** Collected: 01/22/19 13:45 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:06	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:06	7440-38-2	
Barium	**123**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:06	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:06	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:06	7440-43-9	
Calcium	**89600**	ug/L	100	1	01/26/19 07:42	01/28/19 00:06	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:06	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:06	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:06	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:06	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:06	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:06	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:06	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:06	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:06	7440-62-2	
Zinc	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:06	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/26/19 10:00	01/29/19 12:22	7440-42-8	
Lithium	**12.1**	ug/L	2.5	1	01/26/19 10:00	01/28/19 21:24	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/19 10:00	01/28/19 21:24	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	01/28/19 21:27	01/29/19 12:56	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
Acetone	ND	ug/L	25.0	1		01/28/19 15:34	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/28/19 15:34	107-13-1	
Benzene	ND	ug/L	1.0	1		01/28/19 15:34	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/28/19 15:34	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/28/19 15:34	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/28/19 15:34	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/28/19 15:34	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/28/19 15:34	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/28/19 15:34	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/28/19 15:34	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/28/19 15:34	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/28/19 15:34	75-00-3	
Chloroform	ND	ug/L	5.0	1		01/28/19 15:34	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/28/19 15:34	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/28/19 15:34	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		01/28/19 15:34	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 15:34	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 15:34	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/28/19 15:34	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/28/19 15:34	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: BG-2 **Lab ID: 92415385006** Collected: 01/22/19 13:45 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
1,2-Dichloroethane	ND	ug/L	1.0	1		01/28/19 15:34	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/28/19 15:34	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 15:34	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 15:34	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/28/19 15:34	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 15:34	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 15:34	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/28/19 15:34	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/28/19 15:34	591-78-6	
Iodomethane	ND	ug/L	20.0	1		01/28/19 15:34	74-88-4	
Methylene Chloride	ND	ug/L	5.0	1		01/28/19 15:34	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/28/19 15:34	108-10-1	
Styrene	ND	ug/L	1.0	1		01/28/19 15:34	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 15:34	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 15:34	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/28/19 15:34	127-18-4	
Toluene	ND	ug/L	1.0	1		01/28/19 15:34	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/28/19 15:34	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/28/19 15:34	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/28/19 15:34	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/28/19 15:34	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/28/19 15:34	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/28/19 15:34	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/28/19 15:34	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/28/19 15:34	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	96	%	70-130	1		01/28/19 15:34	460-00-4	
1,2-Dichloroethane-d4 (S)	104	%	70-130	1		01/28/19 15:34	17060-07-0	
Toluene-d8 (S)	100	%	70-130	1		01/28/19 15:34	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**810**	mg/L	50.0	1		01/25/19 23:32		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**218**	mg/L	5.0	5		01/31/19 10:31	16887-00-6	
Fluoride	**0.16**	mg/L	0.10	1		01/31/19 00:41	16984-48-8	
Sulfate	**64.7**	mg/L	1.0	1		01/31/19 00:41	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-4 **Lab ID: 92415385007** Collected: 01/22/19 17:45 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:09	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:09	7440-38-2	
Barium	**268**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:09	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:09	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:09	7440-43-9	
Calcium	**64300**	ug/L	100	1	01/26/19 07:42	01/28/19 00:09	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:09	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:09	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:09	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:09	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:09	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:09	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:09	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:09	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:09	7440-62-2	
Zinc	**29.4**	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:09	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/26/19 10:00	01/29/19 12:25	7440-42-8	
Lithium	**25.4**	ug/L	2.5	1	01/26/19 10:00	01/28/19 21:27	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/19 10:00	01/28/19 21:27	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	01/28/19 21:27	01/29/19 12:58	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
Acetone	ND	ug/L	25.0	1		01/28/19 15:51	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/28/19 15:51	107-13-1	
Benzene	ND	ug/L	1.0	1		01/28/19 15:51	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/28/19 15:51	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/28/19 15:51	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/28/19 15:51	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/28/19 15:51	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/28/19 15:51	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/28/19 15:51	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/28/19 15:51	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/28/19 15:51	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/28/19 15:51	75-00-3	
Chloroform	ND	ug/L	5.0	1		01/28/19 15:51	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/28/19 15:51	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/28/19 15:51	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		01/28/19 15:51	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 15:51	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 15:51	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/28/19 15:51	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/28/19 15:51	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-4 **Lab ID: 92415385007** Collected: 01/22/19 17:45 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
1,2-Dichloroethane	ND	ug/L	1.0	1		01/28/19 15:51	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/28/19 15:51	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 15:51	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 15:51	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/28/19 15:51	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 15:51	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 15:51	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/28/19 15:51	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/28/19 15:51	591-78-6	
Iodomethane	ND	ug/L	20.0	1		01/28/19 15:51	74-88-4	
Methylene Chloride	ND	ug/L	5.0	1		01/28/19 15:51	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/28/19 15:51	108-10-1	
Styrene	ND	ug/L	1.0	1		01/28/19 15:51	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 15:51	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 15:51	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/28/19 15:51	127-18-4	
Toluene	ND	ug/L	1.0	1		01/28/19 15:51	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/28/19 15:51	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/28/19 15:51	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/28/19 15:51	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/28/19 15:51	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/28/19 15:51	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/28/19 15:51	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/28/19 15:51	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/28/19 15:51	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	98	%	70-130	1		01/28/19 15:51	460-00-4	
1,2-Dichloroethane-d4 (S)	105	%	70-130	1		01/28/19 15:51	17060-07-0	
Toluene-d8 (S)	99	%	70-130	1		01/28/19 15:51	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**1170**	mg/L	50.0	1		01/25/19 23:32		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**485**	mg/L	10.0	10		01/31/19 10:48	16887-00-6	
Fluoride	**0.29**	mg/L	0.10	1		01/31/19 00:57	16984-48-8	
Sulfate	**12.2**	mg/L	1.0	1		01/31/19 00:57	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-2 **Lab ID: 92415385008** Collected: 01/23/19 08:40 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:12	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:12	7440-38-2	
Barium	**360**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:12	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:12	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:12	7440-43-9	
Calcium	**207000**	ug/L	500	5	01/26/19 07:42	01/28/19 23:31	7440-70-2	
Chromium	**14.0**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:12	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:12	7440-48-4	
Copper	**17.2**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:12	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:12	7439-92-1	
Molybdenum	**7.9**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:12	7439-98-7	
Nickel	**9.7**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:12	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:12	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:12	7440-22-4	
Vanadium	**7.6**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:12	7440-62-2	
Zinc	**31.1**	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:12	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	**39.1**	ug/L	25.0	1	01/26/19 10:00	01/29/19 12:34	7440-42-8	
Lithium	**94.1**	ug/L	2.5	1	01/26/19 10:00	01/29/19 12:34	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/19 10:00	01/28/19 21:38	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	01/28/19 21:27	01/29/19 13:01	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
Acetone	ND	ug/L	25.0	1		01/28/19 16:08	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/28/19 16:08	107-13-1	
Benzene	ND	ug/L	1.0	1		01/28/19 16:08	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/28/19 16:08	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/28/19 16:08	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/28/19 16:08	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/28/19 16:08	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/28/19 16:08	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/28/19 16:08	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/28/19 16:08	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/28/19 16:08	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/28/19 16:08	75-00-3	
Chloroform	ND	ug/L	5.0	1		01/28/19 16:08	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/28/19 16:08	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/28/19 16:08	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		01/28/19 16:08	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 16:08	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 16:08	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/28/19 16:08	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/28/19 16:08	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-2 **Lab ID: 92415385008** Collected: 01/23/19 08:40 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
1,2-Dichloroethane	ND	ug/L	1.0	1		01/28/19 16:08	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/28/19 16:08	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 16:08	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 16:08	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/28/19 16:08	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 16:08	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 16:08	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/28/19 16:08	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/28/19 16:08	591-78-6	
Iodomethane	ND	ug/L	20.0	1		01/28/19 16:08	74-88-4	
Methylene Chloride	ND	ug/L	5.0	1		01/28/19 16:08	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/28/19 16:08	108-10-1	
Styrene	ND	ug/L	1.0	1		01/28/19 16:08	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 16:08	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 16:08	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/28/19 16:08	127-18-4	
Toluene	ND	ug/L	1.0	1		01/28/19 16:08	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/28/19 16:08	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/28/19 16:08	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/28/19 16:08	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/28/19 16:08	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/28/19 16:08	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/28/19 16:08	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/28/19 16:08	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/28/19 16:08	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	100	%	70-130	1		01/28/19 16:08	460-00-4	
1,2-Dichloroethane-d4 (S)	105	%	70-130	1		01/28/19 16:08	17060-07-0	
Toluene-d8 (S)	100	%	70-130	1		01/28/19 16:08	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**2590**	mg/L	250	1		01/25/19 23:32		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**1200**	mg/L	15.0	15		01/31/19 11:20	16887-00-6	
Fluoride	**0.26**	mg/L	0.10	1		01/31/19 01:13	16984-48-8	
Sulfate	**130**	mg/L	15.0	15		01/31/19 11:20	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-8 **Lab ID: 92415385009** Collected: 01/23/19 11:00 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:16	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:16	7440-38-2	
Barium	**1170**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:16	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:16	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:16	7440-43-9	
Calcium	**110000**	ug/L	500	5	01/26/19 07:42	01/28/19 23:34	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:16	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:16	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:16	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:16	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:16	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:16	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:16	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:16	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:16	7440-62-2	
Zinc	**13.6**	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:16	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/26/19 10:00	01/29/19 12:37	7440-42-8	
Lithium	**21.7**	ug/L	2.5	1	01/26/19 10:00	01/29/19 12:37	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/19 10:00	01/28/19 21:41	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	01/28/19 21:27	01/29/19 13:03	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
Acetone	ND	ug/L	25.0	1		01/28/19 16:25	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/28/19 16:25	107-13-1	
Benzene	ND	ug/L	1.0	1		01/28/19 16:25	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/28/19 16:25	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/28/19 16:25	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/28/19 16:25	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/28/19 16:25	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/28/19 16:25	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/28/19 16:25	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/28/19 16:25	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/28/19 16:25	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/28/19 16:25	75-00-3	
Chloroform	ND	ug/L	5.0	1		01/28/19 16:25	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/28/19 16:25	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/28/19 16:25	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		01/28/19 16:25	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 16:25	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 16:25	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/28/19 16:25	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/28/19 16:25	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-8 **Lab ID: 92415385009** Collected: 01/23/19 11:00 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
1,2-Dichloroethane	ND	ug/L	1.0	1		01/28/19 16:25	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/28/19 16:25	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 16:25	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 16:25	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/28/19 16:25	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 16:25	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 16:25	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/28/19 16:25	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/28/19 16:25	591-78-6	
Iodomethane	ND	ug/L	20.0	1		01/28/19 16:25	74-88-4	
Methylene Chloride	ND	ug/L	5.0	1		01/28/19 16:25	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/28/19 16:25	108-10-1	
Styrene	ND	ug/L	1.0	1		01/28/19 16:25	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 16:25	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 16:25	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/28/19 16:25	127-18-4	
Toluene	ND	ug/L	1.0	1		01/28/19 16:25	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/28/19 16:25	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/28/19 16:25	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/28/19 16:25	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/28/19 16:25	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/28/19 16:25	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/28/19 16:25	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/28/19 16:25	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/28/19 16:25	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	94	%	70-130	1		01/28/19 16:25	460-00-4	
1,2-Dichloroethane-d4 (S)	101	%	70-130	1		01/28/19 16:25	17060-07-0	
Toluene-d8 (S)	100	%	70-130	1		01/28/19 16:25	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**814**	mg/L	50.0	1		01/25/19 23:32		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**377**	mg/L	8.0	8		01/31/19 11:37	16887-00-6	M6
Fluoride	ND	mg/L	0.10	1		01/31/19 02:19	16984-48-8	
Sulfate	**7.9**	mg/L	1.0	1		01/31/19 02:19	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-6 **Lab ID: 92415385010** Collected: 01/23/19 13:50 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:19	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:19	7440-38-2	
Barium	**89.7**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:19	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:19	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:19	7440-43-9	
Calcium	**34400**	ug/L	100	1	01/26/19 07:42	01/28/19 00:19	7440-70-2	
Chromium	**5.3**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:19	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:19	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:19	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:19	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:19	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:19	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:19	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:19	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:19	7440-62-2	
Zinc	**17.7**	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:19	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/26/19 10:00	01/29/19 12:40	7440-42-8	
Lithium	**27.9**	ug/L	2.5	1	01/26/19 10:00	01/29/19 12:40	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/19 10:00	01/28/19 21:45	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	01/28/19 21:27	01/29/19 13:05	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
Acetone	ND	ug/L	25.0	1		01/28/19 16:43	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/28/19 16:43	107-13-1	
Benzene	ND	ug/L	1.0	1		01/28/19 16:43	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/28/19 16:43	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/28/19 16:43	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/28/19 16:43	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/28/19 16:43	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/28/19 16:43	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/28/19 16:43	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/28/19 16:43	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/28/19 16:43	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/28/19 16:43	75-00-3	
Chloroform	ND	ug/L	5.0	1		01/28/19 16:43	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/28/19 16:43	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/28/19 16:43	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		01/28/19 16:43	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 16:43	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 16:43	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/28/19 16:43	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/28/19 16:43	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-6 **Lab ID: 92415385010** Collected: 01/23/19 13:50 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
1,2-Dichloroethane	ND	ug/L	1.0	1		01/28/19 16:43	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/28/19 16:43	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 16:43	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 16:43	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/28/19 16:43	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 16:43	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 16:43	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/28/19 16:43	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/28/19 16:43	591-78-6	
Iodomethane	ND	ug/L	20.0	1		01/28/19 16:43	74-88-4	
Methylene Chloride	ND	ug/L	5.0	1		01/28/19 16:43	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/28/19 16:43	108-10-1	
Styrene	ND	ug/L	1.0	1		01/28/19 16:43	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 16:43	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 16:43	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/28/19 16:43	127-18-4	
Toluene	ND	ug/L	1.0	1		01/28/19 16:43	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/28/19 16:43	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/28/19 16:43	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/28/19 16:43	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/28/19 16:43	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/28/19 16:43	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/28/19 16:43	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/28/19 16:43	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/28/19 16:43	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	95	%	70-130	1		01/28/19 16:43	460-00-4	
1,2-Dichloroethane-d4 (S)	106	%	70-130	1		01/28/19 16:43	17060-07-0	
Toluene-d8 (S)	99	%	70-130	1		01/28/19 16:43	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**649**	mg/L	25.0	1		01/26/19 01:25		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**229**	mg/L	5.0	5		01/31/19 13:15	16887-00-6	
Fluoride	**0.40**	mg/L	0.10	1		01/31/19 03:09	16984-48-8	
Sulfate	**48.7**	mg/L	1.0	1		01/31/19 03:09	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: DUP **Lab ID: 92415385011** Collected: 01/23/19 12:50 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:22	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:22	7440-38-2	
Barium	**90.4**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:22	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:22	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:22	7440-43-9	
Calcium	**35200**	ug/L	100	1	01/26/19 07:42	01/28/19 00:22	7440-70-2	
Chromium	**5.2**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:22	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:22	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:22	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:22	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:22	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:22	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:22	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:22	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:22	7440-62-2	
Zinc	**17.5**	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:22	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/26/19 10:00	01/29/19 12:43	7440-42-8	
Lithium	**28.6**	ug/L	2.5	1	01/26/19 10:00	01/29/19 12:43	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/19 10:00	01/28/19 21:48	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	01/28/19 21:27	01/29/19 13:08	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
Acetone	ND	ug/L	25.0	1		01/28/19 17:00	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/28/19 17:00	107-13-1	
Benzene	ND	ug/L	1.0	1		01/28/19 17:00	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/28/19 17:00	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/28/19 17:00	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/28/19 17:00	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/28/19 17:00	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/28/19 17:00	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/28/19 17:00	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/28/19 17:00	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/28/19 17:00	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/28/19 17:00	75-00-3	
Chloroform	ND	ug/L	5.0	1		01/28/19 17:00	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/28/19 17:00	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/28/19 17:00	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		01/28/19 17:00	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 17:00	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 17:00	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/28/19 17:00	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/28/19 17:00	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: DUP **Lab ID: 92415385011** Collected: 01/23/19 12:50 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
1,2-Dichloroethane	ND	ug/L	1.0	1		01/28/19 17:00	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/28/19 17:00	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 17:00	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 17:00	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/28/19 17:00	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 17:00	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 17:00	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/28/19 17:00	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/28/19 17:00	591-78-6	
Iodomethane	ND	ug/L	20.0	1		01/28/19 17:00	74-88-4	
Methylene Chloride	ND	ug/L	5.0	1		01/28/19 17:00	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/28/19 17:00	108-10-1	
Styrene	ND	ug/L	1.0	1		01/28/19 17:00	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 17:00	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 17:00	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/28/19 17:00	127-18-4	
Toluene	ND	ug/L	1.0	1		01/28/19 17:00	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/28/19 17:00	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/28/19 17:00	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/28/19 17:00	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/28/19 17:00	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/28/19 17:00	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/28/19 17:00	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/28/19 17:00	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/28/19 17:00	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	98	%	70-130	1		01/28/19 17:00	460-00-4	
1,2-Dichloroethane-d4 (S)	102	%	70-130	1		01/28/19 17:00	17060-07-0	
Toluene-d8 (S)	100	%	70-130	1		01/28/19 17:00	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**649**	mg/L	25.0	1		01/26/19 01:27		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**228**	mg/L	5.0	5		01/31/19 13:31	16887-00-6	
Fluoride	**0.39**	mg/L	0.10	1		01/31/19 03:26	16984-48-8	
Sulfate	**49.3**	mg/L	1.0	1		01/31/19 03:26	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-5 **Lab ID: 92415385012** Collected: 01/24/19 08:50 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:31	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:31	7440-38-2	
Barium	**123**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:31	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:31	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:31	7440-43-9	
Calcium	**13700**	ug/L	100	1	01/26/19 07:42	01/28/19 00:31	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:31	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:31	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:31	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:31	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:31	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:31	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:31	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:31	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:31	7440-62-2	
Zinc	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:31	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/26/19 10:00	01/29/19 12:46	7440-42-8	
Lithium	**8.0**	ug/L	2.5	1	01/26/19 10:00	01/29/19 12:46	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/19 10:00	01/28/19 21:52	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	01/28/19 21:27	01/29/19 13:10	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
Acetone	ND	ug/L	25.0	1		01/28/19 17:17	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/28/19 17:17	107-13-1	
Benzene	ND	ug/L	1.0	1		01/28/19 17:17	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/28/19 17:17	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/28/19 17:17	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/28/19 17:17	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/28/19 17:17	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/28/19 17:17	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/28/19 17:17	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/28/19 17:17	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/28/19 17:17	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/28/19 17:17	75-00-3	
Chloroform	ND	ug/L	5.0	1		01/28/19 17:17	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/28/19 17:17	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/28/19 17:17	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		01/28/19 17:17	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 17:17	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 17:17	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/28/19 17:17	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/28/19 17:17	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-5 **Lab ID: 92415385012** Collected: 01/24/19 08:50 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
1,2-Dichloroethane	ND	ug/L	1.0	1		01/28/19 17:17	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/28/19 17:17	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 17:17	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 17:17	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/28/19 17:17	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 17:17	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 17:17	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/28/19 17:17	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/28/19 17:17	591-78-6	
Iodomethane	ND	ug/L	20.0	1		01/28/19 17:17	74-88-4	
Methylene Chloride	ND	ug/L	5.0	1		01/28/19 17:17	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/28/19 17:17	108-10-1	
Styrene	ND	ug/L	1.0	1		01/28/19 17:17	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 17:17	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 17:17	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/28/19 17:17	127-18-4	
Toluene	ND	ug/L	1.0	1		01/28/19 17:17	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/28/19 17:17	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/28/19 17:17	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/28/19 17:17	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/28/19 17:17	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/28/19 17:17	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/28/19 17:17	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/28/19 17:17	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/28/19 17:17	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	97	%	70-130	1		01/28/19 17:17	460-00-4	
1,2-Dichloroethane-d4 (S)	101	%	70-130	1		01/28/19 17:17	17060-07-0	
Toluene-d8 (S)	100	%	70-130	1		01/28/19 17:17	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**261**	mg/L	25.0	1		01/29/19 15:06		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**22.2**	mg/L	1.0	1		01/31/19 03:42	16887-00-6	
Fluoride	**0.57**	mg/L	0.10	1		01/31/19 03:42	16984-48-8	
Sulfate	**2.9**	mg/L	1.0	1		01/31/19 03:42	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-1 **Lab ID: 92415385013** Collected: 01/24/19 11:00 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:34	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:34	7440-38-2	
Barium	**242**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:34	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:34	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:34	7440-43-9	
Calcium	**205000**	ug/L	500	5	01/26/19 07:42	01/28/19 23:37	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:34	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:34	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:34	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:34	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:34	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:34	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:34	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:34	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:34	7440-62-2	
Zinc	**14.7**	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:34	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/26/19 10:00	01/29/19 12:49	7440-42-8	
Lithium	**30.9**	ug/L	2.5	1	01/26/19 10:00	01/29/19 12:49	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/19 10:00	01/28/19 21:55	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	01/28/19 21:27	01/29/19 13:12	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
Acetone	ND	ug/L	25.0	1		01/28/19 17:34	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/28/19 17:34	107-13-1	
Benzene	ND	ug/L	1.0	1		01/28/19 17:34	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/28/19 17:34	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/28/19 17:34	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/28/19 17:34	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/28/19 17:34	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/28/19 17:34	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/28/19 17:34	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/28/19 17:34	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/28/19 17:34	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/28/19 17:34	75-00-3	
Chloroform	ND	ug/L	5.0	1		01/28/19 17:34	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/28/19 17:34	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/28/19 17:34	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		01/28/19 17:34	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 17:34	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 17:34	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/28/19 17:34	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/28/19 17:34	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-1 **Lab ID: 92415385013** Collected: 01/24/19 11:00 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
1,2-Dichloroethane	ND	ug/L	1.0	1		01/28/19 17:34	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/28/19 17:34	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 17:34	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 17:34	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/28/19 17:34	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 17:34	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 17:34	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/28/19 17:34	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/28/19 17:34	591-78-6	
Iodomethane	ND	ug/L	20.0	1		01/28/19 17:34	74-88-4	
Methylene Chloride	ND	ug/L	5.0	1		01/28/19 17:34	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/28/19 17:34	108-10-1	
Styrene	ND	ug/L	1.0	1		01/28/19 17:34	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 17:34	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 17:34	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/28/19 17:34	127-18-4	
Toluene	ND	ug/L	1.0	1		01/28/19 17:34	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/28/19 17:34	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/28/19 17:34	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/28/19 17:34	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/28/19 17:34	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/28/19 17:34	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/28/19 17:34	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/28/19 17:34	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/28/19 17:34	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	98	%	70-130	1		01/28/19 17:34	460-00-4	
1,2-Dichloroethane-d4 (S)	104	%	70-130	1		01/28/19 17:34	17060-07-0	
Toluene-d8 (S)	101	%	70-130	1		01/28/19 17:34	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**1510**	mg/L	50.0	1		01/29/19 15:06		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**756**	mg/L	16.0	16		01/31/19 13:47	16887-00-6	
Fluoride	**0.16**	mg/L	0.10	1		01/31/19 03:58	16984-48-8	
Sulfate	**8.0**	mg/L	1.0	1		01/31/19 03:58	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-7R **Lab ID: 92415385014** Collected: 01/24/19 13:50 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:37	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:37	7440-38-2	
Barium	**255**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:37	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:37	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:37	7440-43-9	
Calcium	**89100**	ug/L	100	1	01/26/19 07:42	01/28/19 00:37	7440-70-2	
Chromium	**6.5**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:37	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:37	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:37	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:37	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:37	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:37	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:37	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:37	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:37	7440-62-2	
Zinc	**10.7**	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:37	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/26/19 10:00	01/29/19 12:52	7440-42-8	
Lithium	**25.4**	ug/L	2.5	1	01/26/19 10:00	01/29/19 12:52	7439-93-2	
Thallium	**0.12**	ug/L	0.10	1	01/26/19 10:00	01/28/19 21:59	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	01/28/19 21:27	01/29/19 13:15	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
Acetone	ND	ug/L	25.0	1		01/28/19 17:51	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/28/19 17:51	107-13-1	
Benzene	ND	ug/L	1.0	1		01/28/19 17:51	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/28/19 17:51	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/28/19 17:51	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/28/19 17:51	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/28/19 17:51	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/28/19 17:51	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/28/19 17:51	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/28/19 17:51	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/28/19 17:51	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/28/19 17:51	75-00-3	
Chloroform	ND	ug/L	5.0	1		01/28/19 17:51	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/28/19 17:51	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/28/19 17:51	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		01/28/19 17:51	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 17:51	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 17:51	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/28/19 17:51	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/28/19 17:51	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-7R **Lab ID: 92415385014** Collected: 01/24/19 13:50 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
1,2-Dichloroethane	ND	ug/L	1.0	1		01/28/19 17:51	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/28/19 17:51	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 17:51	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 17:51	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/28/19 17:51	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 17:51	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 17:51	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/28/19 17:51	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/28/19 17:51	591-78-6	
Iodomethane	ND	ug/L	20.0	1		01/28/19 17:51	74-88-4	
Methylene Chloride	ND	ug/L	5.0	1		01/28/19 17:51	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/28/19 17:51	108-10-1	
Styrene	ND	ug/L	1.0	1		01/28/19 17:51	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 17:51	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 17:51	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/28/19 17:51	127-18-4	
Toluene	ND	ug/L	1.0	1		01/28/19 17:51	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/28/19 17:51	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/28/19 17:51	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/28/19 17:51	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/28/19 17:51	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/28/19 17:51	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/28/19 17:51	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/28/19 17:51	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/28/19 17:51	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	96	%	70-130	1		01/28/19 17:51	460-00-4	
1,2-Dichloroethane-d4 (S)	103	%	70-130	1		01/28/19 17:51	17060-07-0	
Toluene-d8 (S)	99	%	70-130	1		01/28/19 17:51	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**820**	mg/L	50.0	1		01/29/19 15:06		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**289**	mg/L	6.0	6		01/31/19 14:03	16887-00-6	
Fluoride	**0.11**	mg/L	0.10	1		01/31/19 04:15	16984-48-8	
Sulfate	**18.3**	mg/L	1.0	1		01/31/19 04:15	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-3 **Lab ID: 92415385015** Collected: 01/25/19 08:40 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:41	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:41	7440-38-2	
Barium	**715**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:41	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:41	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:41	7440-43-9	
Calcium	**194000**	ug/L	500	5	01/26/19 07:42	01/28/19 23:40	7440-70-2	
Chromium	**179**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:41	7440-47-3	
Cobalt	**6.2**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:41	7440-48-4	
Copper	**36.0**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:41	7440-50-8	
Lead	**7.3**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:41	7439-92-1	
Molybdenum	**12.0**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:41	7439-98-7	
Nickel	**86.0**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:41	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:41	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:41	7440-22-4	
Vanadium	**13.9**	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:41	7440-62-2	
Zinc	**42.7**	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:41	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/26/19 10:00	01/29/19 12:55	7440-42-8	
Lithium	**72.6**	ug/L	2.5	1	01/26/19 10:00	01/29/19 12:55	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/19 10:00	01/28/19 22:02	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	01/28/19 21:27	01/29/19 13:22	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
Acetone	ND	ug/L	25.0	1		01/28/19 18:08	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/28/19 18:08	107-13-1	
Benzene	ND	ug/L	1.0	1		01/28/19 18:08	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/28/19 18:08	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/28/19 18:08	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/28/19 18:08	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/28/19 18:08	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/28/19 18:08	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/28/19 18:08	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/28/19 18:08	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/28/19 18:08	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/28/19 18:08	75-00-3	
Chloroform	ND	ug/L	5.0	1		01/28/19 18:08	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/28/19 18:08	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/28/19 18:08	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		01/28/19 18:08	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 18:08	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 18:08	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/28/19 18:08	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/28/19 18:08	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-3 **Lab ID: 92415385015** Collected: 01/25/19 08:40 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
1,2-Dichloroethane	ND	ug/L	1.0	1		01/28/19 18:08	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/28/19 18:08	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 18:08	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 18:08	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/28/19 18:08	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 18:08	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 18:08	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/28/19 18:08	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/28/19 18:08	591-78-6	
Iodomethane	ND	ug/L	20.0	1		01/28/19 18:08	74-88-4	
Methylene Chloride	ND	ug/L	5.0	1		01/28/19 18:08	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/28/19 18:08	108-10-1	
Styrene	ND	ug/L	1.0	1		01/28/19 18:08	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 18:08	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 18:08	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/28/19 18:08	127-18-4	
Toluene	ND	ug/L	1.0	1		01/28/19 18:08	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/28/19 18:08	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/28/19 18:08	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/28/19 18:08	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/28/19 18:08	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/28/19 18:08	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/28/19 18:08	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/28/19 18:08	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/28/19 18:08	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	97	%	70-130	1		01/28/19 18:08	460-00-4	
1,2-Dichloroethane-d4 (S)	103	%	70-130	1		01/28/19 18:08	17060-07-0	
Toluene-d8 (S)	101	%	70-130	1		01/28/19 18:08	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**2360**	mg/L	50.0	1		01/30/19 21:12		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**1120**	mg/L	20.0	20		01/31/19 14:20	16887-00-6	
Fluoride	**0.42**	mg/L	0.10	1		01/31/19 04:31	16984-48-8	
Sulfate	**80.2**	mg/L	1.0	1		01/31/19 04:31	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: EQUIP BLANK **Lab ID: 92415385016** Collected: 01/25/19 11:50 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:44	7440-36-0	
Arsenic	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:44	7440-38-2	
Barium	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:44	7440-39-3	
Beryllium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:44	7440-41-7	
Cadmium	ND	ug/L	1.0	1	01/26/19 07:42	01/28/19 00:44	7440-43-9	
Calcium	ND	ug/L	100	1	01/26/19 07:42	01/28/19 00:44	7440-70-2	
Chromium	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:44	7440-47-3	
Cobalt	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:44	7440-48-4	
Copper	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:44	7440-50-8	
Lead	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:44	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:44	7439-98-7	
Nickel	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:44	7440-02-0	
Selenium	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:44	7782-49-2	
Silver	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:44	7440-22-4	
Vanadium	ND	ug/L	5.0	1	01/26/19 07:42	01/28/19 00:44	7440-62-2	
Zinc	ND	ug/L	10.0	1	01/26/19 07:42	01/28/19 00:44	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	01/26/19 10:00	01/29/19 12:58	7440-42-8	
Lithium	ND	ug/L	2.5	1	01/26/19 10:00	01/29/19 12:58	7439-93-2	
Thallium	ND	ug/L	0.10	1	01/26/19 10:00	01/28/19 22:06	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	01/28/19 21:27	01/29/19 13:24	7439-97-6	
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
Acetone	ND	ug/L	25.0	1		01/28/19 14:09	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		01/28/19 14:09	107-13-1	
Benzene	ND	ug/L	1.0	1		01/28/19 14:09	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		01/28/19 14:09	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		01/28/19 14:09	75-27-4	
Bromoform	ND	ug/L	1.0	1		01/28/19 14:09	75-25-2	
Bromomethane	ND	ug/L	2.0	1		01/28/19 14:09	74-83-9	
2-Butanone (MEK)	ND	ug/L	5.0	1		01/28/19 14:09	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		01/28/19 14:09	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		01/28/19 14:09	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		01/28/19 14:09	108-90-7	
Chloroethane	ND	ug/L	1.0	1		01/28/19 14:09	75-00-3	
Chloroform	ND	ug/L	5.0	1		01/28/19 14:09	67-66-3	
Chloromethane	ND	ug/L	1.0	1		01/28/19 14:09	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		01/28/19 14:09	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		01/28/19 14:09	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 14:09	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		01/28/19 14:09	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		01/28/19 14:09	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		01/28/19 14:09	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: EQUIP BLANK **Lab ID: 92415385016** Collected: 01/25/19 11:50 Received: 01/25/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260 MSV Low Level Landfill	Analytical Method: EPA 8260B							
1,2-Dichloroethane	ND	ug/L	1.0	1		01/28/19 14:09	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		01/28/19 14:09	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 14:09	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		01/28/19 14:09	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		01/28/19 14:09	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 14:09	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		01/28/19 14:09	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		01/28/19 14:09	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		01/28/19 14:09	591-78-6	
Iodomethane	ND	ug/L	20.0	1		01/28/19 14:09	74-88-4	
Methylene Chloride	ND	ug/L	5.0	1		01/28/19 14:09	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		01/28/19 14:09	108-10-1	
Styrene	ND	ug/L	1.0	1		01/28/19 14:09	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 14:09	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		01/28/19 14:09	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		01/28/19 14:09	127-18-4	
Toluene	ND	ug/L	1.0	1		01/28/19 14:09	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		01/28/19 14:09	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		01/28/19 14:09	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		01/28/19 14:09	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		01/28/19 14:09	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		01/28/19 14:09	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		01/28/19 14:09	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		01/28/19 14:09	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		01/28/19 14:09	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	96	%	70-130	1		01/28/19 14:09	460-00-4	
1,2-Dichloroethane-d4 (S)	104	%	70-130	1		01/28/19 14:09	17060-07-0	
Toluene-d8 (S)	100	%	70-130	1		01/28/19 14:09	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	ND	mg/L	25.0	1		01/30/19 21:12		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	ND	mg/L	1.0	1		01/31/19 04:48	16887-00-6	
Fluoride	ND	mg/L	0.10	1		01/31/19 04:48	16984-48-8	
Sulfate	ND	mg/L	1.0	1		01/31/19 04:48	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL DATA

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

QC Batch: 454874 Analysis Method: EPA 7470A
QC Batch Method: EPA 7470A Analysis Description: 7470 Mercury
Associated Lab Samples: 92415385002, 92415385003, 92415385004, 92415385005, 92415385006, 92415385007, 92415385008, 92415385009, 92415385010, 92415385011, 92415385012, 92415385013, 92415385014, 92415385015, 92415385016

METHOD BLANK: 2483654 Matrix: Water
Associated Lab Samples: 92415385002, 92415385003, 92415385004, 92415385005, 92415385006, 92415385007, 92415385008, 92415385009, 92415385010, 92415385011, 92415385012, 92415385013, 92415385014, 92415385015, 92415385016

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	01/29/19 12:32	

LABORATORY CONTROL SAMPLE: 2483655

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	2.5	2.1	83	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2483656 2483657

Parameter	Units	92415385002 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	2.5	2.5	1.8	1.8	73	72	75-125	1	25	M1

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REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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(704)875-9092

QUALITY CONTROL DATA

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

QC Batch: 454679 Analysis Method: EPA 6010D
QC Batch Method: EPA 3010A Analysis Description: 6010 MET
Associated Lab Samples: 92415385002, 92415385003, 92415385004, 92415385005, 92415385006, 92415385007, 92415385008, 92415385009, 92415385010, 92415385011, 92415385012, 92415385013, 92415385014, 92415385015, 92415385016

METHOD BLANK: 2483019 Matrix: Water
Associated Lab Samples: 92415385002, 92415385003, 92415385004, 92415385005, 92415385006, 92415385007, 92415385008, 92415385009, 92415385010, 92415385011, 92415385012, 92415385013, 92415385014, 92415385015, 92415385016

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	5.0	01/27/19 23:25	
Arsenic	ug/L	ND	10.0	01/27/19 23:25	
Barium	ug/L	ND	5.0	01/27/19 23:25	
Beryllium	ug/L	ND	1.0	01/27/19 23:25	
Cadmium	ug/L	ND	1.0	01/27/19 23:25	
Calcium	ug/L	ND	100	01/27/19 23:25	
Chromium	ug/L	ND	5.0	01/27/19 23:25	
Cobalt	ug/L	ND	5.0	01/27/19 23:25	
Copper	ug/L	ND	5.0	01/27/19 23:25	
Lead	ug/L	ND	5.0	01/27/19 23:25	
Molybdenum	ug/L	ND	5.0	01/27/19 23:25	
Nickel	ug/L	ND	5.0	01/27/19 23:25	
Selenium	ug/L	ND	10.0	01/27/19 23:25	
Silver	ug/L	ND	5.0	01/27/19 23:25	
Vanadium	ug/L	ND	5.0	01/27/19 23:25	
Zinc	ug/L	ND	10.0	01/27/19 23:25	

LABORATORY CONTROL SAMPLE: 2483020

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	500	442	88	80-120	
Arsenic	ug/L	500	418	84	80-120	
Barium	ug/L	500	450	90	80-120	
Beryllium	ug/L	500	454	91	80-120	
Cadmium	ug/L	500	438	88	80-120	
Calcium	ug/L	5000	4430	89	80-120	
Chromium	ug/L	500	444	89	80-120	
Cobalt	ug/L	500	430	86	80-120	
Copper	ug/L	500	446	89	80-120	
Lead	ug/L	500	427	85	80-120	
Molybdenum	ug/L	500	457	91	80-120	
Nickel	ug/L	500	432	86	80-120	
Selenium	ug/L	500	427	85	80-120	
Silver	ug/L	250	221	88	80-120	
Vanadium	ug/L	500	434	87	80-120	
Zinc	ug/L	500	424	85	80-120	

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REPORT OF LABORATORY ANALYSIS

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(704)875-9092

QUALITY CONTROL DATA

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2483021 2483022

Parameter	Units	92415385002 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	500	500	482	502	96	100	75-125	4	20	
Arsenic	ug/L	ND	500	500	468	487	92	96	75-125	4	20	
Barium	ug/L	73.4	500	500	554	572	96	100	75-125	3	20	
Beryllium	ug/L	ND	500	500	479	494	96	99	75-125	3	20	
Cadmium	ug/L	ND	500	500	474	489	95	98	75-125	3	20	
Calcium	ug/L	227000	5000	5000	234000	239000	124	228	75-125	2	20	M6
Chromium	ug/L	ND	500	500	464	475	93	95	75-125	2	20	
Cobalt	ug/L	ND	500	500	440	455	88	91	75-125	3	20	
Copper	ug/L	ND	500	500	486	502	97	100	75-125	3	20	
Lead	ug/L	ND	500	500	437	449	87	90	75-125	3	20	
Molybdenum	ug/L	147	500	500	631	655	97	102	75-125	4	20	
Nickel	ug/L	5.4	500	500	444	458	88	91	75-125	3	20	
Selenium	ug/L	ND	500	500	475	498	95	99	75-125	5	20	
Silver	ug/L	ND	250	250	237	242	95	97	75-125	2	20	
Vanadium	ug/L	6.5	500	500	470	482	93	95	75-125	3	20	
Zinc	ug/L	ND	500	500	444	455	88	90	75-125	2	20	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

QC Batch: 454686 Analysis Method: EPA 6020B
QC Batch Method: EPA 3010A Analysis Description: 6020 MET
Associated Lab Samples: 92415385002, 92415385003, 92415385004, 92415385005, 92415385006, 92415385007, 92415385008, 92415385009, 92415385010, 92415385011, 92415385012, 92415385013, 92415385014, 92415385015, 92415385016

METHOD BLANK: 2483051 Matrix: Water
Associated Lab Samples: 92415385002, 92415385003, 92415385004, 92415385005, 92415385006, 92415385007, 92415385008, 92415385009, 92415385010, 92415385011, 92415385012, 92415385013, 92415385014, 92415385015, 92415385016

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	ug/L	ND	25.0	01/28/19 20:30	
Lithium	ug/L	ND	2.5	01/28/19 20:30	
Thallium	ug/L	ND	0.10	01/28/19 20:30	

LABORATORY CONTROL SAMPLE: 2483052

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	50	44.4	89	80-120	
Lithium	ug/L	50	47.2	94	80-120	
Thallium	ug/L	10	9.2	92	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2483053 2483054

Parameter	Units	92415385002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	1760	50	50	1990	2090	471	663	75-125	5	20	M6
Lithium	ug/L	26.5	50	50	72.6	72.7	92	93	75-125	0	20	
Thallium	ug/L	0.47	10	10	10.6	10.6	101	101	75-125	0	20	

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REPORT OF LABORATORY ANALYSIS

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(704)875-9092

QUALITY CONTROL DATA

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

QC Batch: 454833 Analysis Method: EPA 8260B
QC Batch Method: EPA 8260B Analysis Description: 8260 MSV Low Level Landfill
Associated Lab Samples: 92415385001, 92415385002, 92415385003, 92415385004, 92415385005, 92415385006, 92415385007, 92415385008, 92415385009, 92415385010, 92415385011, 92415385012, 92415385013, 92415385014, 92415385015, 92415385016

METHOD BLANK: 2483529 Matrix: Water
Associated Lab Samples: 92415385001, 92415385002, 92415385003, 92415385004, 92415385005, 92415385006, 92415385007, 92415385008, 92415385009, 92415385010, 92415385011, 92415385012, 92415385013, 92415385014, 92415385015, 92415385016

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	1.0	01/28/19 13:18	
1,1,1-Trichloroethane	ug/L	ND	1.0	01/28/19 13:18	
1,1,2,2-Tetrachloroethane	ug/L	ND	1.0	01/28/19 13:18	
1,1,2-Trichloroethane	ug/L	ND	1.0	01/28/19 13:18	
1,1-Dichloroethane	ug/L	ND	1.0	01/28/19 13:18	
1,1-Dichloroethene	ug/L	ND	1.0	01/28/19 13:18	
1,2,3-Trichloropropane	ug/L	ND	1.0	01/28/19 13:18	
1,2-Dichlorobenzene	ug/L	ND	1.0	01/28/19 13:18	
1,2-Dichloroethane	ug/L	ND	1.0	01/28/19 13:18	
1,2-Dichloropropane	ug/L	ND	1.0	01/28/19 13:18	
1,4-Dichlorobenzene	ug/L	ND	1.0	01/28/19 13:18	
2-Butanone (MEK)	ug/L	ND	5.0	01/28/19 13:18	
2-Hexanone	ug/L	ND	5.0	01/28/19 13:18	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	5.0	01/28/19 13:18	
Acetone	ug/L	ND	25.0	01/28/19 13:18	
Acrylonitrile	ug/L	ND	10.0	01/28/19 13:18	
Benzene	ug/L	ND	1.0	01/28/19 13:18	
Bromochloromethane	ug/L	ND	1.0	01/28/19 13:18	
Bromodichloromethane	ug/L	ND	1.0	01/28/19 13:18	
Bromoform	ug/L	ND	1.0	01/28/19 13:18	
Bromomethane	ug/L	ND	2.0	01/28/19 13:18	
Carbon disulfide	ug/L	ND	2.0	01/28/19 13:18	
Carbon tetrachloride	ug/L	ND	1.0	01/28/19 13:18	
Chlorobenzene	ug/L	ND	1.0	01/28/19 13:18	
Chloroethane	ug/L	ND	1.0	01/28/19 13:18	
Chloroform	ug/L	ND	5.0	01/28/19 13:18	
Chloromethane	ug/L	ND	1.0	01/28/19 13:18	
cis-1,2-Dichloroethene	ug/L	ND	1.0	01/28/19 13:18	
cis-1,3-Dichloropropene	ug/L	ND	1.0	01/28/19 13:18	
Dibromochloromethane	ug/L	ND	1.0	01/28/19 13:18	
Dibromomethane	ug/L	ND	1.0	01/28/19 13:18	
Ethylbenzene	ug/L	ND	1.0	01/28/19 13:18	
Iodomethane	ug/L	ND	20.0	01/28/19 13:18	
Methylene Chloride	ug/L	ND	5.0	01/28/19 13:18	
Styrene	ug/L	ND	1.0	01/28/19 13:18	
Tetrachloroethene	ug/L	ND	1.0	01/28/19 13:18	
Toluene	ug/L	ND	1.0	01/28/19 13:18	
trans-1,2-Dichloroethene	ug/L	ND	1.0	01/28/19 13:18	

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REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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(704)875-9092

QUALITY CONTROL DATA

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

METHOD BLANK: 2483529 Matrix: Water

Associated Lab Samples: 92415385001, 92415385002, 92415385003, 92415385004, 92415385005, 92415385006, 92415385007, 92415385008, 92415385009, 92415385010, 92415385011, 92415385012, 92415385013, 92415385014, 92415385015, 92415385016

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
trans-1,3-Dichloropropene	ug/L	ND	1.0	01/28/19 13:18	
trans-1,4-Dichloro-2-butene	ug/L	ND	1.0	01/28/19 13:18	
Trichloroethene	ug/L	ND	1.0	01/28/19 13:18	
Trichlorofluoromethane	ug/L	ND	1.0	01/28/19 13:18	
Vinyl acetate	ug/L	ND	2.0	01/28/19 13:18	
Vinyl chloride	ug/L	ND	1.0	01/28/19 13:18	
Xylene (Total)	ug/L	ND	1.0	01/28/19 13:18	
1,2-Dichloroethane-d4 (S)	%	103	70-130	01/28/19 13:18	
4-Bromofluorobenzene (S)	%	96	70-130	01/28/19 13:18	
Toluene-d8 (S)	%	99	70-130	01/28/19 13:18	

LABORATORY CONTROL SAMPLE: 2483530

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	50	46.5	93	70-130	
1,1,1-Trichloroethane	ug/L	50	47.2	94	70-130	
1,1,2,2-Tetrachloroethane	ug/L	50	47.8	96	70-130	
1,1,2-Trichloroethane	ug/L	50	47.1	94	70-130	
1,1-Dichloroethane	ug/L	50	47.0	94	70-130	
1,1-Dichloroethene	ug/L	50	48.0	96	70-130	
1,2,3-Trichloropropane	ug/L	50	49.4	99	70-130	
1,2-Dichlorobenzene	ug/L	50	45.5	91	70-130	
1,2-Dichloroethane	ug/L	50	45.7	91	70-130	
1,2-Dichloropropane	ug/L	50	46.6	93	70-130	
1,4-Dichlorobenzene	ug/L	50	45.8	92	70-130	
2-Butanone (MEK)	ug/L	100	108	108	64-135	
2-Hexanone	ug/L	100	101	101	66-135	
4-Methyl-2-pentanone (MIBK)	ug/L	100	102	102	70-130	
Acetone	ug/L	100	99.3	99	61-157	
Acrylonitrile	ug/L	250	238	95	61-143	
Benzene	ug/L	50	45.8	92	70-130	
Bromochloromethane	ug/L	50	48.9	98	70-130	
Bromodichloromethane	ug/L	50	47.6	95	70-130	
Bromoform	ug/L	50	49.3	99	70-130	
Bromomethane	ug/L	50	42.5	85	38-130	
Carbon disulfide	ug/L	50	47.4	95	68-130	
Carbon tetrachloride	ug/L	50	47.2	94	70-130	
Chlorobenzene	ug/L	50	46.2	92	70-130	
Chloroethane	ug/L	50	44.4	89	37-142	
Chloroform	ug/L	50	46.4	93	70-130	
Chloromethane	ug/L	50	42.8	86	48-130	
cis-1,2-Dichloroethene	ug/L	50	46.9	94	70-130	

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REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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QUALITY CONTROL DATA

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

LABORATORY CONTROL SAMPLE: 2483530

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
cis-1,3-Dichloropropene	ug/L	50	49.2	98	70-130	
Dibromochloromethane	ug/L	50	49.7	99	70-130	
Dibromomethane	ug/L	50	47.1	94	70-130	
Ethylbenzene	ug/L	50	45.8	92	70-130	
Iodomethane	ug/L	100	92.5	93	40-130	
Methylene Chloride	ug/L	50	48.2	96	67-132	
Styrene	ug/L	50	47.8	96	70-130	
Tetrachloroethene	ug/L	50	45.7	91	69-130	
Toluene	ug/L	50	45.5	91	70-130	
trans-1,2-Dichloroethene	ug/L	50	49.9	100	70-130	
trans-1,3-Dichloropropene	ug/L	50	49.8	100	70-130	
trans-1,4-Dichloro-2-butene	ug/L	50	53.3	107	35-189	
Trichloroethene	ug/L	50	45.2	90	70-130	
Trichlorofluoromethane	ug/L	50	43.0	86	63-130	
Vinyl acetate	ug/L	100	104	104	55-143	
Vinyl chloride	ug/L	50	48.1	96	70-131	
Xylene (Total)	ug/L	150	141	94	70-130	
1,2-Dichloroethane-d4 (S)	%			98	70-130	
4-Bromofluorobenzene (S)	%			102	70-130	
Toluene-d8 (S)	%			102	70-130	

MATRIX SPIKE SAMPLE: 2483532

Parameter	Units	92415385005 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	20	20.5	103	73-134	
1,1,1-Trichloroethane	ug/L	ND	20	23.8	119	82-143	
1,1,2,2-Tetrachloroethane	ug/L	ND	20	21.8	109	70-136	
1,1,2-Trichloroethane	ug/L	ND	20	23.6	118	70-135	
1,1-Dichloroethane	ug/L	ND	20	23.4	117	70-139	
1,1-Dichloroethene	ug/L	ND	20	23.0	115	70-154	
1,2,3-Trichloropropane	ug/L	ND	20	22.2	111	71-137	
1,2-Dichlorobenzene	ug/L	ND	20	22.5	112	70-133	
1,2-Dichloroethane	ug/L	ND	20	21.7	108	70-137	
1,2-Dichloropropane	ug/L	ND	20	24.1	120	70-140	
1,4-Dichlorobenzene	ug/L	ND	20	21.6	108	70-133	
2-Butanone (MEK)	ug/L	ND	40	48.0	120	60-139	
2-Hexanone	ug/L	ND	40	42.9	107	65-138	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	40	42.3	106	65-135	
Acetone	ug/L	ND	40	47.0	117	60-148	
Acrylonitrile	ug/L	ND	100	108	108	64-147	
Benzene	ug/L	ND	20	24.0	120	70-151	
Bromochloromethane	ug/L	ND	20	24.3	121	70-141	
Bromodichloromethane	ug/L	ND	20	23.4	117	70-138	
Bromoform	ug/L	ND	20	17.6	88	63-130	
Bromomethane	ug/L	ND	20	30.1	150	15-152	

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QUALITY CONTROL DATA

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

MATRIX SPIKE SAMPLE: 2483532

Parameter	Units	92415385005 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Carbon disulfide	ug/L	ND	20	22.8	114	69-149	
Carbon tetrachloride	ug/L	ND	20	23.5	117	70-143	
Chlorobenzene	ug/L	ND	20	22.5	113	70-138	
Chloroethane	ug/L	ND	20	25.0	125	52-163	
Chloroform	ug/L	ND	20	21.4	107	70-139	
Chloromethane	ug/L	ND	20	24.0	120	41-139	
cis-1,2-Dichloroethene	ug/L	ND	20	22.9	115	70-141	
cis-1,3-Dichloropropene	ug/L	ND	20	24.8	124	70-137	
Dibromochloromethane	ug/L	ND	20	21.0	105	70-134	
Dibromomethane	ug/L	ND	20	21.6	108	70-138	
Ethylbenzene	ug/L	ND	20	22.5	113	66-153	
Iodomethane	ug/L	ND	40	42.3	106	20-138	
Methylene Chloride	ug/L	ND	20	22.5	112	42-159	
Styrene	ug/L	ND	20	22.8	114	70-135	
Tetrachloroethene	ug/L	ND	20	23.5	118	59-143	
Toluene	ug/L	ND	20	22.0	110	59-148	
trans-1,2-Dichloroethene	ug/L	ND	20	23.4	117	70-146	
trans-1,3-Dichloropropene	ug/L	ND	20	24.2	121	70-135	
trans-1,4-Dichloro-2-butene	ug/L	ND	20	16.1	80	47-135	
Trichloroethene	ug/L	ND	20	24.6	123	70-147	
Trichlorofluoromethane	ug/L	ND	20	23.4	117	70-148	
Vinyl acetate	ug/L	ND	40	45.4	113	49-151	
Vinyl chloride	ug/L	ND	20	23.5	118	70-156	
Xylene (Total)	ug/L	ND	60	67.5	112	63-158	
1,2-Dichloroethane-d4 (S)	%				98	70-130	
4-Bromofluorobenzene (S)	%				100	70-130	
Toluene-d8 (S)	%				100	70-130	

SAMPLE DUPLICATE: 2483531

Parameter	Units	92415385003 Result	Dup Result	RPD	Max RPD	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,1-Trichloroethane	ug/L	ND	ND		30	
1,1,2,2-Tetrachloroethane	ug/L	ND	ND		30	
1,1,2-Trichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethane	ug/L	ND	ND		30	
1,1-Dichloroethene	ug/L	ND	ND		30	
1,2,3-Trichloropropane	ug/L	ND	ND		30	
1,2-Dichlorobenzene	ug/L	ND	ND		30	
1,2-Dichloroethane	ug/L	ND	ND		30	
1,2-Dichloropropane	ug/L	ND	ND		30	
1,4-Dichlorobenzene	ug/L	ND	ND		30	
2-Butanone (MEK)	ug/L	ND	ND		30	
2-Hexanone	ug/L	ND	ND		30	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	ND		30	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

SAMPLE DUPLICATE: 2483531

Parameter	Units	92415385003 Result	Dup Result	RPD	Max RPD	Qualifiers
Acetone	ug/L	ND	ND		30	
Acrylonitrile	ug/L	ND	ND		30	
Benzene	ug/L	ND	ND		30	
Bromochloromethane	ug/L	ND	ND		30	
Bromodichloromethane	ug/L	ND	ND		30	
Bromoform	ug/L	ND	ND		30	
Bromomethane	ug/L	ND	ND		30	
Carbon disulfide	ug/L	ND	ND		30	
Carbon tetrachloride	ug/L	ND	ND		30	
Chlorobenzene	ug/L	ND	ND		30	
Chloroethane	ug/L	ND	ND		30	
Chloroform	ug/L	ND	ND		30	
Chloromethane	ug/L	ND	ND		30	
cis-1,2-Dichloroethene	ug/L	ND	ND		30	
cis-1,3-Dichloropropene	ug/L	ND	ND		30	
Dibromochloromethane	ug/L	ND	ND		30	
Dibromomethane	ug/L	ND	ND		30	
Ethylbenzene	ug/L	ND	ND		30	
Iodomethane	ug/L	ND	ND		30	
Methylene Chloride	ug/L	ND	ND		30	
Styrene	ug/L	ND	ND		30	
Tetrachloroethene	ug/L	ND	ND		30	
Toluene	ug/L	ND	ND		30	
trans-1,2-Dichloroethene	ug/L	ND	ND		30	
trans-1,3-Dichloropropene	ug/L	ND	ND		30	
trans-1,4-Dichloro-2-butene	ug/L	ND	ND		30	
Trichloroethene	ug/L	ND	ND		30	
Trichlorofluoromethane	ug/L	ND	ND		30	
Vinyl acetate	ug/L	ND	ND		30	
Vinyl chloride	ug/L	ND	ND		30	
Xylene (Total)	ug/L	ND	ND		30	
1,2-Dichloroethane-d4 (S)	%	104	105	1		
4-Bromofluorobenzene (S)	%	98	106	8		
Toluene-d8 (S)	%	101	108	7		

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QUALITY CONTROL DATA

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

QC Batch: 454658 Analysis Method: SM 2540C-2011
QC Batch Method: SM 2540C-2011 Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 92415385002, 92415385003, 92415385004, 92415385005, 92415385006, 92415385007, 92415385008, 92415385009

METHOD BLANK: 2482951 Matrix: Water
Associated Lab Samples: 92415385002, 92415385003, 92415385004, 92415385005, 92415385006, 92415385007, 92415385008, 92415385009

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	25.0	01/25/19 23:32	

LABORATORY CONTROL SAMPLE: 2482952

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	251	250	100	90-110	

SAMPLE DUPLICATE: 2482953

Parameter	Units	92415385002 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	1110	1090	2	5	

SAMPLE DUPLICATE: 2482954

Parameter	Units	92415105012 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	576	587	2	5	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

QC Batch: 454659 Analysis Method: SM 2540C-2011
QC Batch Method: SM 2540C-2011 Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 92415385010, 92415385011

METHOD BLANK: 2482955 Matrix: Water
Associated Lab Samples: 92415385010, 92415385011

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	25.0	01/26/19 01:25	

LABORATORY CONTROL SAMPLE: 2482956

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	251	246	98	90-110	

SAMPLE DUPLICATE: 2482957

Parameter	Units	92415385010 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	649	645	1	5	

SAMPLE DUPLICATE: 2482958

Parameter	Units	92415293002 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	118	125	6	5	D6

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QUALITY CONTROL DATA

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

QC Batch: 455139 Analysis Method: SM 2540C-2011
QC Batch Method: SM 2540C-2011 Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 92415385012, 92415385013, 92415385014

METHOD BLANK: 2484718 Matrix: Water
Associated Lab Samples: 92415385012, 92415385013, 92415385014

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	25.0	01/29/19 15:06	

LABORATORY CONTROL SAMPLE: 2484719

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	250	274	110	90-110	

SAMPLE DUPLICATE: 2484720

Parameter	Units	92415330006 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	203	203	0	5	

SAMPLE DUPLICATE: 2484721

Parameter	Units	92415373006 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	256	252	2	5	

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QUALITY CONTROL DATA

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

QC Batch: 455488 Analysis Method: SM 2540C-2011
QC Batch Method: SM 2540C-2011 Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 92415385015, 92415385016

METHOD BLANK: 2486233 Matrix: Water
Associated Lab Samples: 92415385015, 92415385016

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	25.0	01/30/19 21:12	

LABORATORY CONTROL SAMPLE: 2486234

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	250	266	106	90-110	

SAMPLE DUPLICATE: 2486235

Parameter	Units	92415385015 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	2360	2380	1	5	

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QUALITY CONTROL DATA

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

QC Batch: 455292 Analysis Method: EPA 300.0 Rev 2.1 1993
QC Batch Method: EPA 300.0 Rev 2.1 1993 Analysis Description: 300.0 IC Anions
Associated Lab Samples: 92415385002, 92415385003, 92415385004, 92415385005, 92415385006, 92415385007, 92415385008, 92415385009, 92415385010, 92415385011, 92415385012, 92415385013, 92415385014, 92415385015, 92415385016

METHOD BLANK: 2485205 Matrix: Water
Associated Lab Samples: 92415385002, 92415385003, 92415385004, 92415385005, 92415385006, 92415385007, 92415385008, 92415385009, 92415385010, 92415385011, 92415385012, 92415385013, 92415385014, 92415385015, 92415385016

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	01/30/19 20:16	
Fluoride	mg/L	ND	0.10	01/30/19 20:16	
Sulfate	mg/L	ND	1.0	01/30/19 20:16	

LABORATORY CONTROL SAMPLE: 2485206

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	50	50.8	102	90-110	
Fluoride	mg/L	2.5	2.3	91	90-110	
Sulfate	mg/L	50	52.0	104	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2485207 2485208

Parameter	Units	92415293016 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	60.3	50	50	95.9	100	71	79	90-110	4	10	M1
Fluoride	mg/L	0.056J	2.5	2.5	2.5	2.6	98	101	90-110	4	10	
Sulfate	mg/L	186	50	50	222	231	74	91	90-110	4	10	M1

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2485209 2485210

Parameter	Units	92415385009 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	377	50	50	424	411	94	68	90-110	3	10	M6
Fluoride	mg/L	ND	2.5	2.5	2.4	2.4	93	95	90-110	1	10	
Sulfate	mg/L	7.9	50	50	62.6	63.2	109	110	90-110	1	10	

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REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: LEACHATE **Lab ID: 92415385002** Collected: 01/21/19 13:20 Received: 01/25/19 12:00 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 ± 0.359 (0.759) C:NA T:87%**	pCi/L	02/07/19 20:27	13982-63-3	
Radium-228	EPA 904.0	**1.06 ± 0.408 (0.624) C:97% T:83%**	pCi/L	02/05/19 16:03	15262-20-1	
Total Radium	Total Radium Calculation	**1.06 ± 0.767 (1.38)**	pCi/L	02/08/19 12:45	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: SW-2 **Lab ID: 92415385003** Collected: 01/21/19 14:00 Received: 01/25/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.289 ± 0.496 (0.869) C:NA T:86%**	pCi/L	02/07/19 20:27	13982-63-3	
Radium-228	EPA 904.0	**0.220 ± 1.84 (4.24) C:74% T:29%**	pCi/L	02/07/19 14:04	15262-20-1	
Total Radium	Total Radium Calculation	**0.509 ± 2.34 (5.11)**	pCi/L	02/08/19 12:45	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: SW-1 **Lab ID: 92415385004** Collected: 01/21/19 14:00 Received: 01/25/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.458 ± 0.499 (0.785) C:NA T:86%**	pCi/L	02/07/19 20:27	13982-63-3	
Radium-228	EPA 904.0	**0.602 ± 0.352 (0.652) C:95% T:81%**	pCi/L	02/05/19 16:03	15262-20-1	
Total Radium	Total Radium Calculation	**1.06 ± 0.851 (1.44)**	pCi/L	02/08/19 12:45	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: BG-1 **Lab ID: 92415385005** Collected: 01/22/19 10:10 Received: 01/25/19 12:00 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 ± 0.321 (0.678) C:NA T:92%**	pCi/L	02/07/19 20:27	13982-63-3	
Radium-228	EPA 904.0	**1.08 ± 0.403 (0.608) C:96% T:87%**	pCi/L	02/05/19 16:03	15262-20-1	
Total Radium	Total Radium Calculation	**1.08 ± 0.724 (1.29)**	pCi/L	02/08/19 12:45	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: BG-2 **Lab ID: 92415385006** Collected: 01/22/19 13:45 Received: 01/25/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.236 ± 0.401 (0.708) C:NA T:88%**	pCi/L	02/07/19 20:27	13982-63-3	
Radium-228	EPA 904.0	**1.06 ± 0.418 (0.649) C:94% T:82%**	pCi/L	02/05/19 16:04	15262-20-1	
Total Radium	Total Radium Calculation	**1.30 ± 0.819 (1.36)**	pCi/L	02/08/19 12:45	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-4 **Lab ID: 92415385007** Collected: 01/22/19 17:45 Received: 01/25/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.913 ± 0.558 (0.685) C:NA T:87%**	pCi/L	02/07/19 20:42	13982-63-3	
Radium-228	EPA 904.0	**1.35 ± 0.429 (0.538) C:95% T:85%**	pCi/L	02/05/19 16:04	15262-20-1	
Total Radium	Total Radium Calculation	**2.26 ± 0.987 (1.22)**	pCi/L	02/08/19 12:45	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-2 **Lab ID: 92415385008** Collected: 01/23/19 08:40 Received: 01/25/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**1.21 ± 0.623 (0.718) C:NA T:86%**	pCi/L	02/07/19 20:42	13982-63-3	
Radium-228	EPA 904.0	**1.49 ± 0.464 (0.590) C:96% T:86%**	pCi/L	02/05/19 16:04	15262-20-1	
Total Radium	Total Radium Calculation	**2.70 ± 1.09 (1.31)**	pCi/L	02/08/19 12:45	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-8 **Lab ID: 92415385009** Collected: 01/23/19 11:00 Received: 01/25/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.743 ± 0.567 (0.806) C:NA T:88%**	pCi/L	02/07/19 20:42	13982-63-3	
Radium-228	EPA 904.0	**1.20 ± 0.439 (0.647) C:94% T:82%**	pCi/L	02/05/19 16:04	15262-20-1	
Total Radium	Total Radium Calculation	**1.94 ± 1.01 (1.45)**	pCi/L	02/08/19 12:45	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-6 **Lab ID: 92415385010** Collected: 01/23/19 13:50 Received: 01/25/19 12:00 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 (0.719) C:NA T:90%**	pCi/L	02/07/19 20:42	13982-63-3	
Radium-228	EPA 904.0	**0.628 ± 0.315 (0.538) C:92% T:88%**	pCi/L	02/05/19 16:04	15262-20-1	
Total Radium	Total Radium Calculation	**0.628 ± 0.655 (1.26)**	pCi/L	02/08/19 12:45	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: DUP **Lab ID: 92415385011** Collected: 01/23/19 12:50 Received: 01/25/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.510 ± 0.461 (0.680) C:NA T:89%**	pCi/L	02/07/19 20:42	13982-63-3	
Radium-228	EPA 904.0	**0.757 ± 0.351 (0.585) C:94% T:81%**	pCi/L	02/05/19 16:04	15262-20-1	
Total Radium	Total Radium Calculation	**1.27 ± 0.812 (1.27)**	pCi/L	02/08/19 12:45	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-5 **Lab ID: 92415385012** Collected: 01/24/19 08:50 Received: 01/25/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.108 ± 0.366 (0.706) C:NA T:87%**	pCi/L	02/07/19 20:42	13982-63-3	
Radium-228	EPA 904.0	**0.695 ± 0.324 (0.517) C:93% T:79%**	pCi/L	02/05/19 16:04	15262-20-1	
Total Radium	Total Radium Calculation	**0.803 ± 0.690 (1.22)**	pCi/L	02/08/19 12:45	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-1 **Lab ID: 92415385013** Collected: 01/24/19 11:00 Received: 01/25/19 12:00 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 ± 0.425 (0.512) C:NA T:95%**	pCi/L	02/07/19 20:57	13982-63-3	
Radium-228	EPA 904.0	**0.737 ± 0.337 (0.550) C:93% T:85%**	pCi/L	02/05/19 16:04	15262-20-1	
Total Radium	Total Radium Calculation	**1.34 ± 0.762 (1.06)**	pCi/L	02/08/19 12:45	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-7R **Lab ID: 92415385014** Collected: 01/24/19 13:50 Received: 01/25/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.987 ± 0.578 (0.733) C:NA T:93%**	pCi/L	02/07/19 20:57	13982-63-3	
Radium-228	EPA 904.0	**1.01 ± 0.361 (0.496) C:94% T:88%**	pCi/L	02/05/19 16:04	15262-20-1	
Total Radium	Total Radium Calculation	**2.00 ± 0.939 (1.23)**	pCi/L	02/08/19 12:45	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: MW-3 **Lab ID: 92415385015** Collected: 01/25/19 08:40 Received: 01/25/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**1.92 ± 0.716 (0.622) C:NA T:93%**	pCi/L	02/07/19 20:57	13982-63-3	
Radium-228	EPA 904.0	**2.00 ± 0.570 (0.657) C:94% T:81%**	pCi/L	02/05/19 16:05	15262-20-1	
Total Radium	Total Radium Calculation	**3.92 ± 1.29 (1.28)**	pCi/L	02/08/19 12:45	7440-14-4	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Sample: EQUIP BLANK **Lab ID: 92415385016** Collected: 01/25/19 11:50 Received: 01/25/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.303 ± 0.397 (0.661) C:NA T:94%**	pCi/L	02/07/19 20:57	13982-63-3	
Radium-228	EPA 904.0	**0.676 ± 0.315 (0.523) C:91% T:92%**	pCi/L	02/05/19 16:05	15262-20-1	
Total Radium	Total Radium Calculation	**0.979 ± 0.712 (1.18)**	pCi/L	02/08/19 12:45	7440-14-4	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL - RADIOCHEMISTRY

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

QC Batch: 328350 Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0 Analysis Description: 904.0 Radium 228
Associated Lab Samples: 92415385002, 92415385004, 92415385005, 92415385006, 92415385007, 92415385008, 92415385009, 92415385010, 92415385011, 92415385012, 92415385013, 92415385014, 92415385015, 92415385016

METHOD BLANK: 1598270 Matrix: Water
Associated Lab Samples: 92415385002, 92415385004, 92415385005, 92415385006, 92415385007, 92415385008, 92415385009, 92415385010, 92415385011, 92415385012, 92415385013, 92415385014, 92415385015, 92415385016

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.433 ± 0.300 (0.572) C:96% T:83%	pCi/L	02/05/19 16:04	

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

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL - RADIOCHEMISTRY

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

QC Batch: 328833 Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0 Analysis Description: 904.0 Radium 228
Associated Lab Samples: 92415385003

METHOD BLANK: 1600149 Matrix: Water
Associated Lab Samples: 92415385003

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.313 ± 0.323 (0.669) C:80% T:88%	pCi/L	02/07/19 14:03	

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

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL - RADIOCHEMISTRY

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

QC Batch: 328348 Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1 Analysis Description: 903.1 Radium-226
Associated Lab Samples: 92415385002, 92415385003, 92415385004, 92415385005, 92415385006, 92415385007, 92415385008, 92415385009, 92415385010, 92415385011, 92415385012, 92415385013, 92415385014, 92415385015, 92415385016

METHOD BLANK: 1598268 Matrix: Water
Associated Lab Samples: 92415385002, 92415385003, 92415385004, 92415385005, 92415385006, 92415385007, 92415385008, 92415385009, 92415385010, 92415385011, 92415385012, 92415385013, 92415385014, 92415385015, 92415385016

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.210 ± 0.357 (0.631) C:NA T:90%	pCi/L	02/07/19 20:27	

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

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALIFIERS

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

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.

Acid preservation may not be appropriate for 2 Chloroethylvinyl ether.

A separate vial preserved to a pH of 4-5 is recommended in SW846 Chapter 4 for the analysis of Acrolein and Acrylonitrile by EPA Method 8260.

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-A	Pace Analytical Services - Asheville
PASI-C	Pace Analytical Services - Charlotte
PASI-PA	Pace Analytical Services - Greensburg

ANALYTE QUALIFIERS

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.
M6	Matrix spike and Matrix spike duplicate recovery not evaluated against control limits due to sample dilution.

Pace Analytical Services, LLC
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Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92415385002	**LEACHATE**	EPA 3010A	454679	EPA 6010D	454703
92415385003	**SW-2**	EPA 3010A	454679	EPA 6010D	454703
92415385004	**SW-1**	EPA 3010A	454679	EPA 6010D	454703
92415385005	**BG-1**	EPA 3010A	454679	EPA 6010D	454703
92415385006	**BG-2**	EPA 3010A	454679	EPA 6010D	454703
92415385007	**MW-4**	EPA 3010A	454679	EPA 6010D	454703
92415385008	**MW-2**	EPA 3010A	454679	EPA 6010D	454703
92415385009	**MW-8**	EPA 3010A	454679	EPA 6010D	454703
92415385010	**MW-6**	EPA 3010A	454679	EPA 6010D	454703
92415385011	**DUP**	EPA 3010A	454679	EPA 6010D	454703
92415385012	**MW-5**	EPA 3010A	454679	EPA 6010D	454703
92415385013	**MW-1**	EPA 3010A	454679	EPA 6010D	454703
92415385014	**MW-7R**	EPA 3010A	454679	EPA 6010D	454703
92415385015	**MW-3**	EPA 3010A	454679	EPA 6010D	454703
92415385016	**EQUIP BLANK**	EPA 3010A	454679	EPA 6010D	454703
92415385002	**LEACHATE**	EPA 3010A	454686	EPA 6020B	454710
92415385003	**SW-2**	EPA 3010A	454686	EPA 6020B	454710
92415385004	**SW-1**	EPA 3010A	454686	EPA 6020B	454710
92415385005	**BG-1**	EPA 3010A	454686	EPA 6020B	454710
92415385006	**BG-2**	EPA 3010A	454686	EPA 6020B	454710
92415385007	**MW-4**	EPA 3010A	454686	EPA 6020B	454710
92415385008	**MW-2**	EPA 3010A	454686	EPA 6020B	454710
92415385009	**MW-8**	EPA 3010A	454686	EPA 6020B	454710
92415385010	**MW-6**	EPA 3010A	454686	EPA 6020B	454710
92415385011	**DUP**	EPA 3010A	454686	EPA 6020B	454710
92415385012	**MW-5**	EPA 3010A	454686	EPA 6020B	454710
92415385013	**MW-1**	EPA 3010A	454686	EPA 6020B	454710
92415385014	**MW-7R**	EPA 3010A	454686	EPA 6020B	454710
92415385015	**MW-3**	EPA 3010A	454686	EPA 6020B	454710
92415385016	**EQUIP BLANK**	EPA 3010A	454686	EPA 6020B	454710
92415385002	**LEACHATE**	EPA 7470A	454874	EPA 7470A	454974
92415385003	**SW-2**	EPA 7470A	454874	EPA 7470A	454974
92415385004	**SW-1**	EPA 7470A	454874	EPA 7470A	454974
92415385005	**BG-1**	EPA 7470A	454874	EPA 7470A	454974
92415385006	**BG-2**	EPA 7470A	454874	EPA 7470A	454974
92415385007	**MW-4**	EPA 7470A	454874	EPA 7470A	454974
92415385008	**MW-2**	EPA 7470A	454874	EPA 7470A	454974
92415385009	**MW-8**	EPA 7470A	454874	EPA 7470A	454974
92415385010	**MW-6**	EPA 7470A	454874	EPA 7470A	454974
92415385011	**DUP**	EPA 7470A	454874	EPA 7470A	454974
92415385012	**MW-5**	EPA 7470A	454874	EPA 7470A	454974
92415385013	**MW-1**	EPA 7470A	454874	EPA 7470A	454974
92415385014	**MW-7R**	EPA 7470A	454874	EPA 7470A	454974
92415385015	**MW-3**	EPA 7470A	454874	EPA 7470A	454974
92415385016	**EQUIP BLANK**	EPA 7470A	454874	EPA 7470A	454974
92415385001	**TRIP BLANK**	EPA 8260B	454833		
92415385002	**LEACHATE**	EPA 8260B	454833		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92415385003	**SW-2**	EPA 8260B	454833		
92415385004	**SW-1**	EPA 8260B	454833		
92415385005	**BG-1**	EPA 8260B	454833		
92415385006	**BG-2**	EPA 8260B	454833		
92415385007	**MW-4**	EPA 8260B	454833		
92415385008	**MW-2**	EPA 8260B	454833		
92415385009	**MW-8**	EPA 8260B	454833		
92415385010	**MW-6**	EPA 8260B	454833		
92415385011	**DUP**	EPA 8260B	454833		
92415385012	**MW-5**	EPA 8260B	454833		
92415385013	**MW-1**	EPA 8260B	454833		
92415385014	**MW-7R**	EPA 8260B	454833		
92415385015	**MW-3**	EPA 8260B	454833		
92415385016	**EQUIP BLANK**	EPA 8260B	454833		
92415385002	**LEACHATE**	EPA 903.1	328348		
92415385003	**SW-2**	EPA 903.1	328348		
92415385004	**SW-1**	EPA 903.1	328348		
92415385005	**BG-1**	EPA 903.1	328348		
92415385006	**BG-2**	EPA 903.1	328348		
92415385007	**MW-4**	EPA 903.1	328348		
92415385008	**MW-2**	EPA 903.1	328348		
92415385009	**MW-8**	EPA 903.1	328348		
92415385010	**MW-6**	EPA 903.1	328348		
92415385011	**DUP**	EPA 903.1	328348		
92415385012	**MW-5**	EPA 903.1	328348		
92415385013	**MW-1**	EPA 903.1	328348		
92415385014	**MW-7R**	EPA 903.1	328348		
92415385015	**MW-3**	EPA 903.1	328348		
92415385016	**EQUIP BLANK**	EPA 903.1	328348		
92415385002	**LEACHATE**	EPA 904.0	328350		
92415385003	**SW-2**	EPA 904.0	328833		
92415385004	**SW-1**	EPA 904.0	328350		
92415385005	**BG-1**	EPA 904.0	328350		
92415385006	**BG-2**	EPA 904.0	328350		
92415385007	**MW-4**	EPA 904.0	328350		
92415385008	**MW-2**	EPA 904.0	328350		
92415385009	**MW-8**	EPA 904.0	328350		
92415385010	**MW-6**	EPA 904.0	328350		
92415385011	**DUP**	EPA 904.0	328350		
92415385012	**MW-5**	EPA 904.0	328350		
92415385013	**MW-1**	EPA 904.0	328350		
92415385014	**MW-7R**	EPA 904.0	328350		
92415385015	**MW-3**	EPA 904.0	328350		
92415385016	**EQUIP BLANK**	EPA 904.0	328350		
92415385002	**LEACHATE**	Total Radium Calculation	329546		
92415385003	**SW-2**	Total Radium Calculation	329546		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: CHARAH BRICKHAVEN
Pace Project No.: 92415385

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92415385004	SW-1	Total Radium Calculation	329546		
92415385005	BG-1	Total Radium Calculation	329546		
92415385006	BG-2	Total Radium Calculation	329546		
92415385007	MW-4	Total Radium Calculation	329546		
92415385008	MW-2	Total Radium Calculation	329546		
92415385009	MW-8	Total Radium Calculation	329546		
92415385010	MW-6	Total Radium Calculation	329546		
92415385011	DUP	Total Radium Calculation	329546		
92415385012	MW-5	Total Radium Calculation	329546		
92415385013	MW-1	Total Radium Calculation	329546		
92415385014	MW-7R	Total Radium Calculation	329546		
92415385015	MW-3	Total Radium Calculation	329546		
92415385016	EQUIP BLANK	Total Radium Calculation	329546		
92415385002	LEACHATE	SM 2540C-2011	454658		
92415385003	SW-2	SM 2540C-2011	454658		
92415385004	SW-1	SM 2540C-2011	454658		
92415385005	BG-1	SM 2540C-2011	454658		
92415385006	BG-2	SM 2540C-2011	454658		
92415385007	MW-4	SM 2540C-2011	454658		
92415385008	MW-2	SM 2540C-2011	454658		
92415385009	MW-8	SM 2540C-2011	454658		
92415385010	MW-6	SM 2540C-2011	454659		
92415385011	DUP	SM 2540C-2011	454659		
92415385012	MW-5	SM 2540C-2011	455139		
92415385013	MW-1	SM 2540C-2011	455139		
92415385014	MW-7R	SM 2540C-2011	455139		
92415385015	MW-3	SM 2540C-2011	455488		
92415385016	EQUIP BLANK	SM 2540C-2011	455488		
92415385002	LEACHATE	EPA 300.0 Rev 2.1 1993	455292		
92415385003	SW-2	EPA 300.0 Rev 2.1 1993	455292		
92415385004	SW-1	EPA 300.0 Rev 2.1 1993	455292		
92415385005	BG-1	EPA 300.0 Rev 2.1 1993	455292		
92415385006	BG-2	EPA 300.0 Rev 2.1 1993	455292		
92415385007	MW-4	EPA 300.0 Rev 2.1 1993	455292		
92415385008	MW-2	EPA 300.0 Rev 2.1 1993	455292		
92415385009	MW-8	EPA 300.0 Rev 2.1 1993	455292		
92415385010	MW-6	EPA 300.0 Rev 2.1 1993	455292		
92415385011	DUP	EPA 300.0 Rev 2.1 1993	455292		
92415385012	MW-5	EPA 300.0 Rev 2.1 1993	455292		
92415385013	MW-1	EPA 300.0 Rev 2.1 1993	455292		
92415385014	MW-7R	EPA 300.0 Rev 2.1 1993	455292		
92415385015	MW-3	EPA 300.0 Rev 2.1 1993	455292		
92415385016	EQUIP BLANK	EPA 300.0 Rev 2.1 1993	455292		

REPORT OF LABORATORY ANALYSIS

Laboratory receiving samples:

Asheville ☐ Eden ☐ Greenwood ☐ Huntersville ☑ Raleigh ☐ Mechanicsville ☐

Sample Condition Upon Receipt

Client Name: HDR

Project #: WO# : 92415385

92415385

Courier: ☐ Commercial ☐ Fed Ex ☐ Pace ☐ UPS ☐ USPS ☐ Other:____ ☐ Client

Custody Seal Present? ☐ Yes ☑ No **Seals Intact?** ☐ Yes ☑ No

Date/Initials Person Examining Contents: MD 1-25-19

Packing Material: ☑ Bubble Wrap ☐ Bubble Bags ☐ None ☐ Other

Thermometer: ☑ IR Gun ID: 92T048 **Type of Ice:** ☑ Wet ☐ Blue ☐ None

Biological Tissue Frozen? ☐ Yes ☐ No ☐ N/A

Cooler Temp (°C): 4.7, 4.9, 1.8, 3.1 **Correction Factor:** Add/Subtract (°C) 0.0

Cooler Temp Corrected (°C): _____

Temp should be above freezing to 6°C

☐ Samples out of temp criteria. Samples on ice, cooling process has begun

USDA Regulated Soil (☑ N/A, water sample)

Did samples originate in a quarantine zone within the United States: CA, NY, or SC (check maps)? ☐ Yes ☐ No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☐ No

				Comments/Discrepancy:
Chain of Custody Present?	☑ Yes	☐ No	☐ N/A	1.
Samples Arrived within Hold Time?	☑ Yes	☐ No	☐ N/A	2.
Short Hold Time Analysis (<72 hr.)?	☐ Yes	☑ No	☐ N/A	3.
Rush Turn Around Time Requested?	☐ Yes	☑ No	☐ N/A	4.
Sufficient Volume?	☑ Yes	☐ No	☐ N/A	5.
Correct Containers Used?	☑ Yes	☐ No	☐ N/A	6.
-Pace Containers Used?	☑ Yes	☐ No	☐ N/A	
Containers Intact?	☑ Yes	☐ No	☐ N/A	7.
Dissolved analysis: Samples Field Filtered?	☐ Yes	☐ No	☑ N/A	8.
Sample Labels Match COC? -Includes Date/Time/ID/Analysis Matrix: WT	☑ Yes	☐ No	☐ N/A	9.
Headspace in VOA Vials (>5-6mm)?	☑ Yes	☐ No	☐ N/A	10.
Trip Blank Present?	☑ Yes	☐ No	☐ N/A	11.
Trip Blank Custody Seals Present?	☑ Yes	☐ No	☐ N/A	

COMMENTS/SAMPLE DISCREPANCY

Field Data Required? ☐ Yes ☐ No

7 container (RADs) slightly out of pH Range = 2.5

Lot ID of split containers:

CLIENT NOTIFICATION/RESOLUTION

Person contacted: _____ Date/Time: _____

Project Manager SCURF Review: _____ **Date:** _____

Project Manager SRF Review: _____ **Date:** _____

***Check mark top half of box if pH and/or dechlorination is verified and within the acceptance range for preservation samples.**

Exceptions: VOA, Coliform, TOC, Oil and Grease, DRO/8015 (water) DOC, LLHg

****Bottom half of box is to list number of bottle**

Project

WO# : 92415385
PM: KLH1 Due Date: 02/01/19
CLIENT: 92-HDR

Ps 1

Item#	BP4U-125 mL Plastic Unpreserved (N/A) (Cl-)	BP3U-250 mL Plastic Unpreserved (N/A)	BP2U-500 mL Plastic Unpreserved (N/A)	BP1U-1 liter Plastic Unpreserved (N/A)	BP4S-125 mL Plastic H2SO4 (pH < 2) (Cl-)	BP3N-250 mL plastic HNO3 (pH < 2)	BP4Z-125 mL Plastic ZN Acetate & NaOH (>9)	BP4C-125 mL Plastic NaOH (pH > 12) (Cl-)	WGFU-Wide-mouthed Glass jar Unpreserved	AG1U-1 liter Amber Unpreserved (N/A) (Cl-)	AG1H-1 liter Amber HCl (pH < 2)	AG3U-250 mL Amber Unpreserved (N/A) (Cl-)	AG1S-1 liter Amber H2SO4 (pH < 2)	AG3S-250 mL Amber H2SO4 (pH < 2)	AG3A(DG3A)-250 mL Amber NH4Cl (N/A)(Cl-)	DG9H-40 mL VOA HCl (N/A)	VG9T-40 mL VOA Na2S2O3 (N/A)	VG9U-40 mL VOA Unp (N/A)	DG9P-40 mL VOA H3PO4 (N/A)	VOAK (6 vials per kit)-5035 kit (N/A)	V/GK (3 vials per kit)-VPH/Gas kit (N/A)	SP5T-125 mL Sterile Plastic (N/A – lab)	SP2T-250 mL Sterile Plastic (N/A – lab)	RADS	BP3A-250 mL Plastic (NH2)2SO4 (9.3-9.7)	AG0U-100 mL Amber Unpreserved vials (N/A)	VSGU-20 mL Scintillation vials (N/A)	DG9U-40 mL Amber Unpreserved vials (N/A)
1			+																										
2																													
3																													
4																													
5																													
6																													
7																													
8																													
9																													
10																													
11																													
12																													

pH Adjustment Log for Preserved Samples

Sample ID	Type of Preservative	pH upon receipt	Date preservation adjusted	Time preservation adjusted	Amount of Preservative added	Lot #

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.

***Check mark top half of box if pH and/or dechlorination is verified and within the acceptance range for preservation samples.**

Exceptions: VOA, Coliform, TOC, Oil and Grease, DRO/8015 (water) DOC, LLHg

****Bottom half of box is to list number of bottle**

Project # WO#:92415385

PM: KLH1 Due Date: 02/01/19

CLIENT: 92-HDR

Item#	BP4U-125 mL Plastic Unpreserved (N/A) (Cl-)	BP3U-250 mL Plastic Unpreserved (N/A)	BP2U-500 mL Plastic Unpreserved (N/A)	BP1U-1 liter Plastic Unpreserved (N/A)	BP4S-125 mL Plastic H2SO4 (pH < 2) (Cl-)	BP3N-250 mL plastic HNO3 (pH < 2)	BP4Z-125 mL Plastic ZN Acetate & NaOH (>9)	BP4C-125 mL Plastic NaOH (pH > 12) (Cl-)	WGFU-Wide-mouthed Glass jar Unpreserved	AG1U-1 liter Amber Unpreserved (N/A) (Cl-)	AG1H-1 liter Amber HCl (pH < 2)	AG3U-250 mL Amber Unpreserved (N/A) (Cl-)	AG1S-1 liter Amber H2SO4 (pH < 2)	AG3S-250 mL Amber H2SO4 (pH < 2)	AG3A(DG3A)-250 mL Amber NH4Cl (N/A)(Cl-)	DG9H-40 mL VOA HCl (N/A)	VG9T-40 mL VOA Na2S2O3 (N/A)	VG9U-40 mL VOA Unp (N/A)	DG9P-40 mL VOA H3PO4 (N/A)	VOAK (6 vials per kit)-5035 kit (N/A)	V/GK (3 vials per kit)-VPH/Gas kit (N/A)	SP5T-125 mL Sterile Plastic (N/A – lab)	SP2T-250 mL Sterile Plastic (N/A – lab)	RAPs	BP3A-250 mL Plastic (NH2)2SO4 (9.3-9.7)	AG0U-100 mL Amber Unpreserved vials (N/A)	VSGU-20 mL Scintillation vials (N/A)	DG9U-40 mL Amber Unpreserved vials (N/A)
1		1	1			2										3									2				
2		1	1			2										3									2				
3		1	1			2										3									2				
4		1	1			2										3									2				
5																									2				
6																													
7																													
8																													
9																													
10																													
11																													
12																													

pH Adjustment Log for Preserved Samples

Sample ID	Type of Preservative	pH upon receipt	Date preservation adjusted	Time preservation adjusted	Amount of Preservative added	Lot #

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.

Pace Analytical

CHAIN-OF-CUSTODY / Analytical Request Document

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

Page : 1 Of 2

Section A – Required Client Information:		Section B – Required Project Information:		Section C – Invoice Information:	
Company:	HDR	Report To:	JACOB RUFFING	Attention:	
Address:	440 S CHURCH STREET	Copy To:		Company Name:	
Suite 900, CHARLOTTE, NC 28202				Address:	
Email:		Purchase Order #:		Pace Quote:	
Phone:	Fax	Project Name:	Charah Brickhaven	Pace Project Manager:	kevin.herring@pacelabs.com,
Requested Due Date:		Project #:		Pace Profile #:	7672-1

Regulatory Agency	
State / Location	NC

ITEM #	SAMPLE ID (One Character per box. (A-Z, 0-9 / , -) Sample Ids must be unique)	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S203	Methanol	Other	Analyses Test Y/N	Requested Analysis Filtered (Y/N): 8260 Full List	300.0-Cl, SO4, F	2540C TDS	Radium 226/228	6010/7470	6020-B, Li, Tl	Trip BLANK	Residual Chlorine (Y/N)	92415365
1	Trip Blank	WT	G	1/21/19	1300	—	—		2				2													X		001
2	Leachate	WW	G	1/21/19	1325	—	—		9	2		4	3						X	X	X	X	X	X				002
3	SW-2			1/21/19	1420	—	—		9	2		4	3						X	X	X	X	X	X				003
4	SW-1			1/21/19	1400	—	—		9	2		4	3						X	X	X	X	X	X				004
5	BG-1			1/22/19	1010	—	—		9	2		4	3						X	X	X	X	X	X				005
6	BG-2			1/22/19	1345	—	—		9	2		4	3						X	X	X	X	X	X				006
7	MW-4			1/22/19	1745	—	—		9	2		4	3						X	X	X	X	X	X				007
8	MW-2			1/23/19	0940	—	—		9	2		4	3						X	X	X	X	X	X				008
9	MW-8			1/23/19	1100	—	—		9	2		4	~~3~~ 2						X	X	X	X	X	X				009
10	MW-6			1/23/19	1350	—	—		9	2		4	3						X	X	X	X	X	X				010
11	DUP			1/23/19	1250	—	—		9	2		4	3						X	X	X	X	X	X				011
12	MW-5			1/24/19	0850	—	—		9	2		4	3						X	X	X	X	X	X				012

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
	HDR	1/25/19	1200		1-25-19	1200	7.6	Y	N	Y
							5.8			
							2.4			

SAMPLER NAME AND SIGNATURE				
PRINT Name of SAMPLER:				
SIGNATURE of SAMPLER:	DATE Signed:	TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

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Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevent fields

WO#: 92415385

PM: KLH1 Due Date: 02/01/19

CLIENT: 92-HDR

Company: HDR	Billing Information:
Address: 440 S Church St	
Report To: Jacob Ruffing	Email To: Jacob.ruffing@hdinc.com
Copy To:	Site Collection Info/Address:
Customer Project Name/Number: Charah Brickhaven	State: NC / County/City: Moncure / Time Zone Collected: [ ] PT [ ] MT [ ] CT [✓] ET
Phone: / Email:	Site/Facility ID #: / Compliance Monitoring? [ ] Yes [ ] No
Collected By (print):	Purchase Order #: / Quote #: / DW PWS ID #: / DW Location Code:
Collected By (signature):	Turnaround Date Required: / Immediately Packed on Ice: [✓] Yes [ ] No
Sample Disposal: Dispose as appropriate [ ] Return Archive: ____ Hold: ____	Rush: [ ] Same Day [ ] Next Day [ ] 2 Day [ ] 3 Day [ ] 4 Day [ ] 5 Day (Expedite Charges Apply) / Field Filtered (if applicable): [ ] Yes [✓] No / 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)

Customer Sample ID	Matrix *	Comp / Grab	Collected (or Composite Start) Date	Collected (or Composite Start) Time	Composite End Date	Composite End Time	Res Cl	# of Ctns	8260 Full List	300.0 - Cl, SO4, F	2540C - TDS	Radium 226/228	6010/7470	6020 - B, Li, Ti	Lab Sample # / Comments
MW-1	GW	Grab	1/24/19	1100				9	X	X	X	X	X	X	013
MW-7R	GW	Grab	1/24/19	1350				9	X	X	X	X	X	X	014
MW-3	GW	Grab	1/25/19	0840				9	X	X	X	X	X	X	015
Equip Blank	GW	Grab	1/25/19	~~0900~~ 1150				9	X	X	X	X	X	X	016

Container Preservative Type **

Lab Project Manager:

** Preservative Types: (1) nitric acid, (2) sulfuric acid, (3) hydrochloric acid, (4) sodium hydroxide, (5) zinc acetate, (6) methanol, (7) sodium bisulfate, (8) sodium thiosulfate, (9) hexane, (A) ascorbic acid, (B) ammonium sulfate, (C) ammonium hydroxide, (D) TSP, (U) Unpreserved, (O) Other ____

Analyses

Lab Profile/Line:

Lab Sample Receipt Checklist:

Custody Seals Present/Intact	Y N (NA)
Custody Signatures Present	Y N (NA)
Collector Signature Present	Y (N) NA
Bottles Intact	(Y) N NA
Correct Bottles	(Y) N NA
Sufficient Volume	(Y) N NA
Samples Received on Ice	(Y) N NA
VOA - Headspace Acceptable	Y (N) NA
USDA Regulated Soils	Y N (NA)
Samples in Holding Time	Y N (NA)
Residual Chlorine Present	Y N (NA)
Cl Strips: ____	
Sample pH Acceptable	(Y) N NA
pH Strips: ____	
Sulfide Present	Y N (NA)
Lead Acetate Strips: ____	

LAB USE ONLY:
Lab Sample # / Comments:

Customer Remarks / Special Conditions / Possible Hazards:

Type of Ice Used: (Wet) Blue Dry None

Packing Material Used:

Radchem sample(s) screened (<500 cpm): Y N NA

SHORT HOLDS PRESENT (<72 hours): Y N (N/A)

Lab Tracking #:

Samples received via: FEDEX UPS (Client) Courier Pace Courier

Lab Sample Temperature Info:

Temp Blank Received: Y (N) NA

Therm ID#: 92706

Cooler 1 Temp Upon Receipt: 1.7 4.9 oC

Cooler 1 Therm Corr. Factor: 1.8 3.1 oC

Cooler 1 Corrected Temp: ____ oC

Comments: ~D 1-25-19

Trip Blank Received: (Y) N NA

(HCL) MeOH TSP Other

Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:	MTJL LAB USE ONLY
[illegible] HDR	1/25/19 1200	[signature]	1-25-19 1200	Table #:
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:	Acctnum: / Template: / Prelogin: / PM:
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:	Non Conformance(s): / Page:

D

Appendix D – Electronic Data Deliverables (CD-ROM only)

E

Appendix E – Statistical Analysis Memo

Summary of Statistical Analysis and Evaluation for SSIs

Background and Downgradient Wells

Charah, LLC

Moncure, Chatham County, North Carolina
June 7, 2019

Contents

Tables

Figures

1 Introduction

This report summarizes the statistical analysis of background and downgradient groundwater quality for the Charah, LLC Brickhaven No. Mine Tract 'A' Site (Brickhaven Mine) and operating under the Facility Permit #1910-STRUC-2015 as a municipal solid waste land fill (MSWLF). Background groundwater quality was evaluated such that statistically-derived background concentrations could be established for the site. Groundwater quality in downgradient wells was then compared to background concentrations to determine if a statistically significant increase (SSI) over background has occurred, as required by Section .1600 rules of the North Carolina Solid Waste Management Rules 15A NCAC 13B .1600. Sampling results used to establish background threshold values (BTVs) were obtained during sixteen monitoring events performed between October 2015 and January 2019. Downgradient sampling results from the detection monitoring round in January 2019 were used to evaluate for SSIs. The current Brickhaven Mine groundwater monitoring network is presented in **Table 1**.

Software packages ProUCL [1], NCSS [2], R [3], and SPSS [4] were used in the production of the statistics. ProUCL is offered by the USEPA, R is a free software environment, NCSS and SPSS are licensed software packages.

Table 1: Brickhaven Mine Monitoring Well Network

Background	Downgradient
BG-1	MW-1
BG-2	MW-2
	MW-3
	MW-4
	MW-5
	MW-6
	MW-7R
	MW-8

Groundwater samples collected as part of the 15A NCAC 13B .1600 monitoring program were analyzed for EPA Appendix III and Appendix IV constituents, Appendix I metals, and Appendix I volatile organic compounds (VOCs). Only non-filtered sample results were utilized for the statistical analysis of monitored constituents. A summary of constituents included in the data analysis is provided in **Table 2**.

Table 2: Brickhaven Mine Monitored Constituents

Appendix I VOCs	Appendix I Metals	Appendix III Constituents	Appendix IV Constituents
1,4-Dichlorobenzene	Copper	Boron	Antimony
Acetone	Nickel	Calcium	Arsenic
Bromodichloromethane	Silver	Chloride	Barium
Bromoform	Vanadium	Fluoride	Beryllium
Carbon disulfide	Zinc	pH (Field)	Cadmium
Chloroform		Sulfate	Chromium
Dibromochloromethane		Total Dissolved Solids	Cobalt
Dibromomethane			Fluoride
			Lead
			Lithium
			Mercury
			Molybdenum
			Radium-226
			Radium-228
			Selenium
			Thallium
			Total Radium

2 Statistical Analysis

The background sample size (i.e., quantity of qualifying samples) was evaluated per constituent. Descriptive statistics were calculated for the background data set including non-detect (ND) values and excluding ND values. When NDs were included in the data set, the method detection limit (MDL) was substituted as the ND value for simple descriptive statistics. The analysis was performed with NDs removed to better understand the central tendency and range of the detected values. A summary of the descriptive statistics for the background data set is provided in **Table 3**. Note that for the trend analyses in Section 2.3 and for the establishment of statistically-derived background concentration levels in Section 4, imputation methods using the maximum likelihood method (MLE) for NDs, regression on order statistics (ROS) or Kaplan-Meier (KM) methods, where appropriate, were used.

Following the calculation of descriptive statistics the statistical analysis for the background data set was performed to evaluate for outliers, data distributions, and trends for Appendix I metals, Appendix I VOCs, and Appendix III and IV constituents, where data quantity and quality permit. Spatial variability between the background wells was evaluated for each consistent to assess whether the data can be pooled for establishing background concentrations. A total of seventeen samples (sixteen monitoring events from well BG-1 and one monitoring event from well BG-2) were included for the descriptive analysis of the background monitoring well results for the monitored constituents. The first monitoring round sampled in August 2015 was not included in the analysis as it was deemed not representative of the other monitoring events as the samples were tested at a different lab.

For downgradient monitoring results, the data analysis included the calculation of descriptive statistics for Appendix I metals, Appendix I VOCs, and Appendix III and IV constituents (for the data sets including and excluding ND values), followed by an evaluation of outliers and trends. A total of fifteen monitoring events performed between November 2015 and January 2018 were included for the descriptive analysis of the downgradient monitoring well results for the monitored constituents. A summary of the descriptive statistics for each downgradient well is provided in **Appendix E.A**.

Table 3: Summary of Background Data Set Descriptive Statistics (BG-1 and BG-2)

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Appendix I VOCs											
1,4-Dichlorobenzene	ug/L	17	17	0.260	0.330	0.322	0.330	--	--	--	--
Acetone	ug/L	17	17	6.20	10.0	9.55	10.0	--	--	--	--
Bromodichloromethane	ug/L	17	17	0.180	0.260	0.189	0.180	--	--	--	--
Bromoform	ug/L	17	17	0.260	0.620	0.302	0.260	--	--	--	--
Carbon disulfide	ug/L	17	17	0.400	1.20	1.11	1.20	--	--	--	--
Chloroform	ug/L	17	17	0.140	2.30	0.394	0.140	--	--	--	--
Dibromochloromethane	ug/L	17	17	0.210	0.410	0.234	0.210	--	--	--	--
Dibromomethane	ug/L	17	17	0.210	0.460	0.239	0.210	--	--	--	--
Appendix I Metals											
Copper	ug/L	17	17	2.50	2.50	2.50	2.50	--	--	--	--
Nickel	ug/L	17	17	2.50	2.50	2.50	2.50	--	--	--	--
Silver	ug/L	17	17	2.50	2.50	2.50	2.50	--	--	--	--
Vanadium	ug/L	17	12	2.50	5.50	3.30	2.50	5.10	5.50	5.22	5.10
Zinc	ug/L	17	16	5.00	10.0	5.29	5.00	10.0	10.0	10.0	10.0
Appendix III Constituents											
Boron	ug/L	17	8	0.570	7.50	4.06	5.50	5.50	7.50	6.46	6.10
Calcium	ug/L	17	0	23,900	89,600	32,912	29,000	23,900	89,600	32,912	29,000
Chloride	mg/L	17	0	213	311	269	277	213	311	269	277
Fluoride	mg/L	17	0	0.100	0.170	0.131	0.130	0.100	0.170	0.131	0.130
pH (Field)	S.U.	13	0	6.24	6.80	6.55	6.52	6.24	6.80	6.55	6.52
Sulfate	mg/L	17	0	15.1	64.7	21.4	18.6	15.1	64.7	21.4	18.6
Total Dissolved Solids	mg/L	17	0	546	2,630	762	643	546	2,630	762	643
Appendix IV Constituents											
Antimony	ug/L	17	17	3.80	3.90	3.86	3.90	--	--	--	--

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Arsenic	ug/L	17	17	2.50	5.00	3.97	5.00	--	--	--	--
Barium	ug/L	17	0	123	443	324	329	123	443	324	329
Beryllium	ug/L	17	17	0.500	0.500	0.500	0.500	--	--	--	--
Cadmium	ug/L	17	17	0.500	0.500	0.500	0.500	--	--	--	--
Chromium	ug/L	17	17	2.50	2.50	2.50	2.50	--	--	--	--
Cobalt	ug/L	17	17	2.50	2.50	2.50	2.50	--	--	--	--
Fluoride	mg/L	17	0	0.100	0.170	0.131	0.130	0.100	0.170	0.131	0.130
Lead	ug/L	17	17	2.50	2.50	2.50	2.50	--	--	--	--
Lithium	ug/L	17	0	12.1	36.8	20.2	17.9	12.1	36.8	20.2	17.9
Mercury	ug/L	17	17	0.100	0.100	0.100	0.100	--	--	--	--
Molybdenum	ug/L	17	16	2.50	6.80	2.75	2.50	6.80	6.80	6.80	6.80
Radium-226	pCi/L	16	0	-0.206	0.800	0.355	0.360	--	--	--	--
Radium-228	pCi/L	16	0	0.0108	1.29	0.633	0.645	--	--	--	--
Selenium	ug/L	17	17	5.00	5.00	5.00	5.00	--	--	--	--
Thallium	ug/L	17	16	0.0200	13.7	2.59	0.0600	13.7	13.7	13.7	13.7
Total Radium	pCi/L	16	0	0.271	2.09	1.00	0.957	--	--	--	--

Notes:
1. ND = not detected above the laboratory method detection limit.
2. MDL = method detection limit.
3. "--" indicates all results for the respective constituent were NDs, or with the case of total radium, NDs were flagged but the laboratory did not provide a value for the MDL.
4. Numbers are displayed using the same number of significant figures as reported by the laboratory.
5. If a constituent had 100% detections the descriptive statistics provided above are identical for the data including NDs and excluding NDs.

2.1 Outliers

Outliers are values that are not representative of the population from which they are sampled. The background and downgradient data sets were screened for outliers using Dixon's outlier test, which is suitable for data sets containing less than 25 samples. The outlier test was conducted using a significance of one percent. For constituents that had NDs, the NDs were removed prior to testing for outliers.

2.1.1 Background

Statistical outliers were identified in the background data set evaluated for three Appendix III constituents (calcium, sulfate, and total dissolved solids) and one Appendix IV constituent (barium). The constituent concentrations identified as statistical outliers were sampled from the newly installed background well BG-2, except for total dissolved solids, and are listed in **Table 4**.

Table 4: Dixon's Outlier Test Results – Background

Well	Constituent	Constituent Type	Potential Outlier Value	Units	Sampling Event	Sample Date
BG-1	Total Dissolved Solids	Appendix III	2,630	mg/L	R10	4/3/2017
	Total Dissolved Solids	Appendix III	546	mg/L	R17	1/22/2019
BG-2	Calcium	Appendix III	89,600	ug/L	R17	1/22/2019
	Sulfate	Appendix III	64.7	mg/L	R17	1/22/2019
	Barium	Appendix IV	123	ug/L	R17	1/22/2019

A visual inspection of concentration vs. time scatter plots for barium (**Figure 1**), calcium (**Figure 2**), sulfate (**Figure 3**), and total dissolved solids (**Figure 4**) reveal the presence of the potential outliers. The statistical outliers were investigated as possible data entry or measurement errors. The values were all within one order of magnitude of other observations and deemed correct. Although the elevated values appears as a statistical outliers, it is within a reasonable range of the remaining concentrations throughout the monitoring period and should not be removed from the data set at this time for purposes of determining background concentrations. Given the variable nature of groundwater samples, the small sample sizes and that it is common for groundwater quality samples to have very low or very high concentrations over time, statistical outliers are expected but do not necessarily signify that the outliers are from different distributions. As additional background samples are collected over time, the variability in concentrations will be better understood. Outlier test results may change and earlier observations thought to be outliers may no longer be outliers.

Figure 1: Barium Concentrations (ug/L) vs. Time

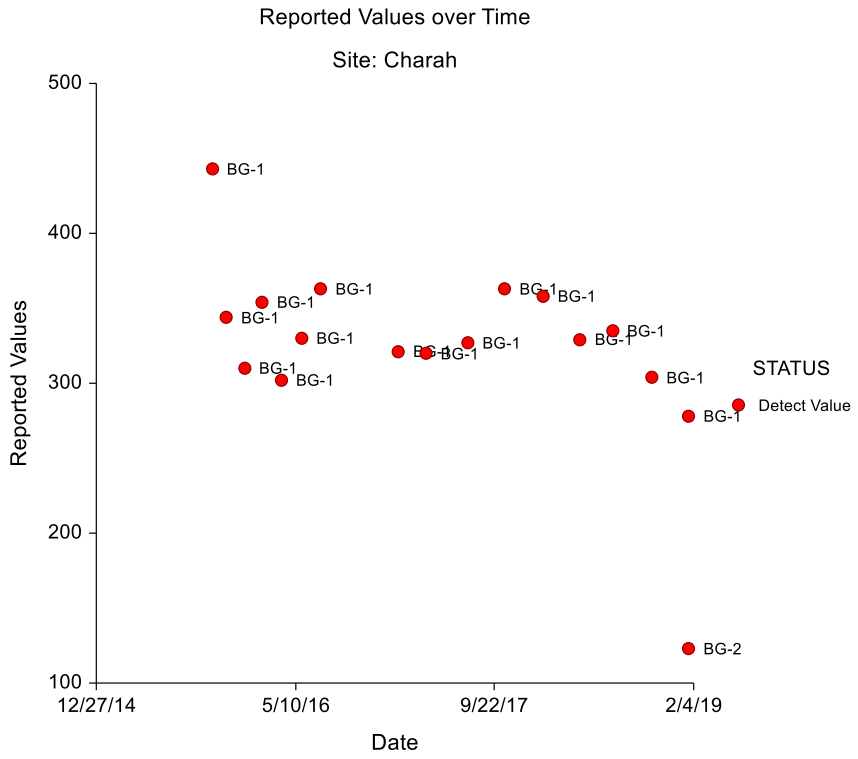


Figure 2: Calcium Concentrations (ug/L) vs. Time

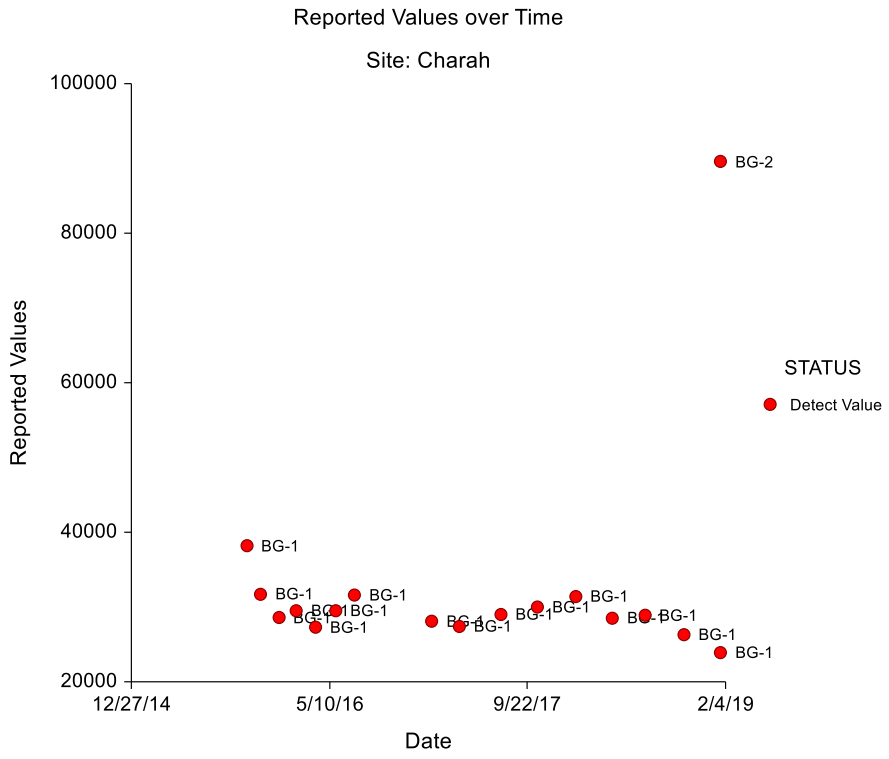


Figure 3: Sulfate Concentrations (mg/L) vs. Time

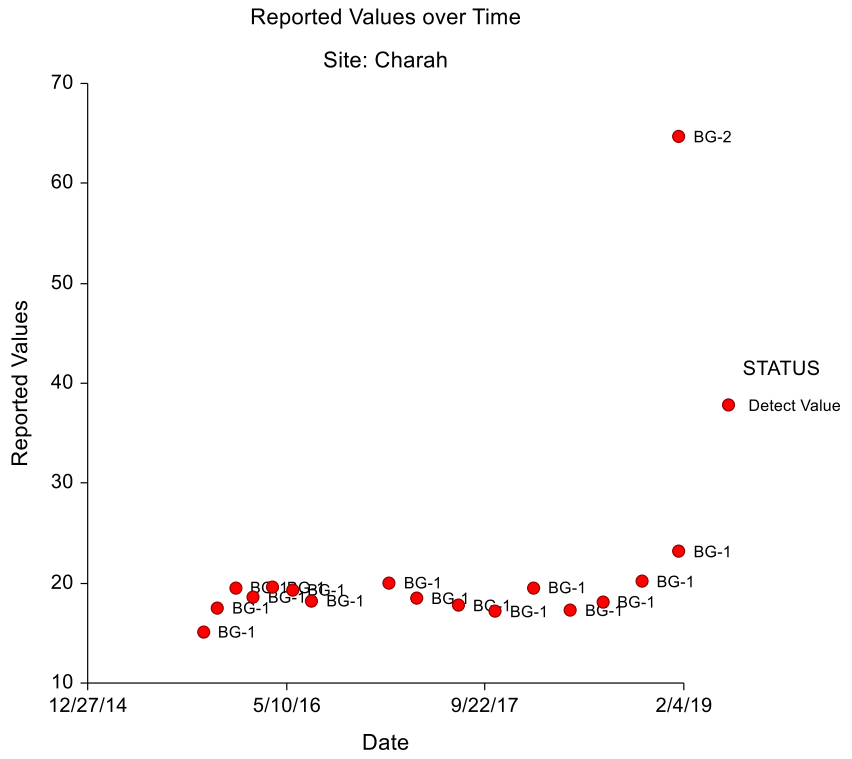
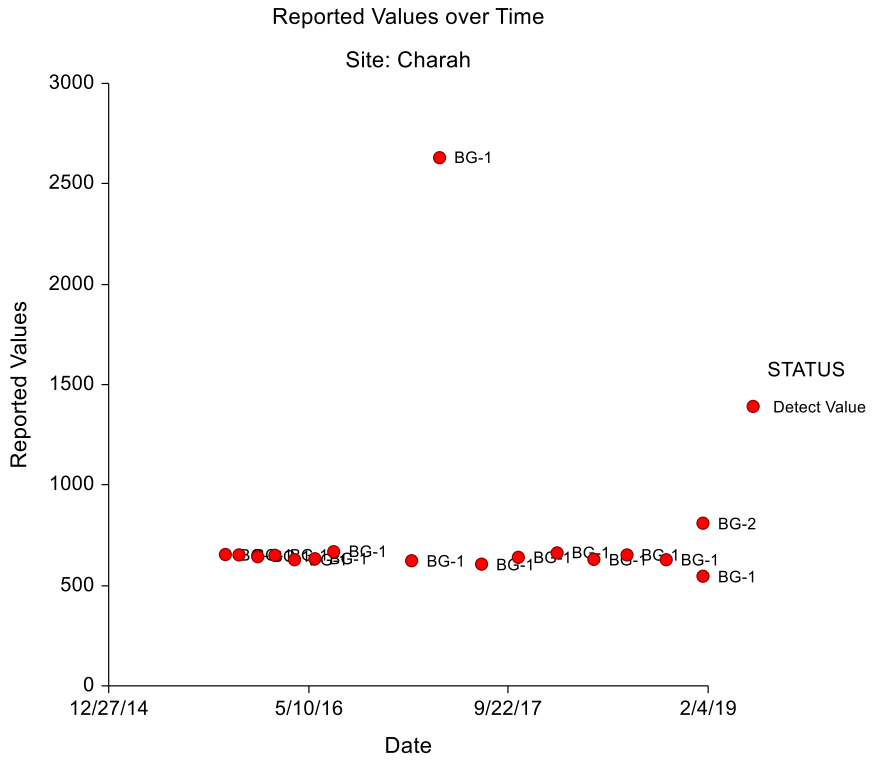


Figure 4: Total Dissolved Solids Concentrations (mg/L) vs. Time



2.1.2 Downgradient

Statistical outliers were identified for Appendix I metals, Appendix III and Appendix IV constituents in the data sets evaluated for downgradient monitoring wells throughout the monitoring period, and are listed in **Table 5**.

Table 5: Dixon's Outlier Test Results – Downgradient

Well	Constituent	Constituent Type	Potential Outlier Value	Units	Sampling Event	Sample Date
MW-1	pH (Field)	App. III	7.30	S.U.	R09	1/25/2017
MW-2	Total Dissolved Solids	App. III	257	mg/L	R03	11/19/2015
MW-3	Lithium	App. IV	236	ug/L	R12	10/18/2017
	Copper	App. I Metals	36.0	ug/L	R17	1/25/2019
MW-4	Boron	App. III	165	ug/L	R12	10/17/2017
MW-5	Radium-226	App. IV	0.592	pCi/L	R03	11/18/2015
	Boron	App. III	39.3	ug/L	R09	1/23/2017
	Total Dissolved Solids	App. III	1,160	mg/L	R12	10/17/2017
MW-6	Chloride	App. III	15.3	mg/L	R06	4/5/2016
	Total Dissolved Solids	App. III	371	mg/L	R12	10/17/2017
MW-7R	Fluoride	App. III	0.320	mg/L	R11	7/20/2017
	pH (Field)	App. III	9.60	S.U.	R11	7/20/2017
	Sulfate	App. III	51.2	mg/L	R11	7/20/2017
MW-8	Nickel	App. I Metals	42.1	ug/L	R09	1/24/2017

A visual inspection of concentration vs. time scatter plots for constituents included in the outliers listed in **Table 5** reveal the presence of the potential outliers.[1] Following review of the sampling protocols and field sampling records, there were no obvious reasons for the outliers noted on the sampling dates. The value for each statistical outlier listed above is within a reasonable range of the remaining concentrations for each constituent throughout the monitoring period. The variability in concentrations will be better understood as additional samples are obtained.

2.2 Data Distribution

Groundwater data was fitted to known distribution models using Goodness-of-Fit (GOF) tests incorporated into ProUCL. For data sets comprised of 50 or fewer samples, ProUCL's GOF module incorporates the Shapiro-Wilk GOF test to determine normal or lognormal distribution and Anderson-Darling to determine gamma distribution. Normal, lognormal and gamma distributions are parametric distributions. If a data set could not be fit with any of these three parametric distributions, it was considered to follow a nonparametric distribution. Note that ProUCL does not provide GOF results for data sets with less than three detected values due to insufficient data. For purposes of estimating background concentrations, these data sets were treated under non-parametric distribution assumptions with the maximum detected value

[1] See Appendix E.B for scatter plots of constituents with downgradient statistically-derived outliers.

chosen to represent the background concentrations. In addition, the data for total radium is set to nonparametric as the MDL values were not provided by the laboratory. Data distributions are listed in **Table 6**.

Table 6: Data Distributions – Background

Constituent	Sample Size	No. of NDs	Distribution Fit[1]
Appendix I VOCs			
1,4-Dichlorobenzene	17	17	Nonparametric
Acetone	17	17	Nonparametric
Bromodichloromethane	17	17	Nonparametric
Bromoform	17	17	Nonparametric
Carbon disulfide	17	17	Nonparametric
Chloroform	17	17	Nonparametric
Dibromochloromethane	17	17	Nonparametric
Dibromomethane	17	17	Nonparametric
Appendix I Metals			
Copper	17	17	Nonparametric
Nickel	17	17	Nonparametric
Silver	17	17	Nonparametric
Vanadium	17	12	Nonparametric
Zinc	17	16	Nonparametric
Appendix III Constituents			
Boron	17	8	Parametric
Calcium	17	0	Nonparametric
Chloride	17	0	Parametric
Fluoride	17	0	Parametric
pH (Field)	13	0	Parametric
Sulfate	17	0	Nonparametric
Total Dissolved Solids	17	0	Nonparametric
Appendix IV Constituents			
Antimony	17	17	Nonparametric
Arsenic	17	17	Nonparametric
Barium	17	0	Nonparametric
Beryllium	17	17	Nonparametric
Cadmium	17	17	Nonparametric
Chromium	17	17	Nonparametric
Cobalt	17	17	Nonparametric
Fluoride	17	0	Parametric
Lead	17	17	Nonparametric

Constituent	Sample Size	No. of NDs	Distribution Fit[1]
Lithium	17	0	Parametric
Mercury	17	17	Nonparametric
Molybdenum	17	16	Nonparametric
Radium-226	16	0	Nonparametric
Radium-228	16	0	Nonparametric
Selenium	17	17	Nonparametric
Thallium	17	16	Nonparametric
Total Radium	16	0	Nonparametric

[1]Best fit is based on detected data.

2.3 Trends

2.3.1 Background

Background constituent concentrations in groundwater should demonstrate stationary conditions through time, free of trends. Constituents were analyzed for trends within the data set using a maximum likelihood estimate (MLE) regression for constituents which followed parametric distributions and Mann-Kendall tests for those that were treated under nonparametric distributional assumptions. The MLE regression can be applied to data sets that can be fitted to a specific distribution model and that contain NDs with multiple MDLs. The Mann-Kendall test is suitable for data series with no discernable distributions and only one MDL value for NDs.

Constituents treated under nonparametric data assumptions (either tested as nonparametric or having more than 50 percent NDs) and with multiple MDLs or with less than three detected values were not assessed for trends. A summary of the trend analysis results for constituents with sufficient detected values in the background data set is provided in **Table 7**.

The background well regression analysis showed a potential increasing trend for one Appendix III constituent (fluoride) and a potential decreasing trend for two Appendix III constituents (boron and chloride) and one Appendix IV constituent (barium).There were no increasing or decreasing trends identified for other monitoring constituents with sufficient data quantity and quality for testing with the MLE analysis or Mann-Kendall test. Although statistical trends were identified for boron, barium, chloride, and fluoride, the results can be misleading due to the short duration of the sampling program.

Table 7: Summary of Trend Analysis Results – Background

Constituent	Trend
Appendix III Constituents	
Boron	↓

Constituent	Trend
Chloride	↓
Fluoride	↑
Appendix IV Constituents	
Barium	↓
Fluoride	↑

2.3.2 Downgradient

Trends were also evaluated for constituents in each downgradient well using the same methods as described above for the background data set. Trends were identified for select constituents at select monitoring well locations, and should be monitored as additional downgradient groundwater data are collected at the site. A summary of the statistical trends identified within the downgradient data set is provided in **Table 8**.

Table 8: Summary of Trend Analysis Results – Downgradient

Constituent	Downgradient Well with Increasing or Decreasing Trend							
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7R	MW-8
Appendix I Metals								
Copper		↑	↑					
Nickel	↑		↑					
Zinc								↓
Appendix III Constituents								
Boron	↓		↓			↓		
Calcium	↑			↑		↓		↓
Chloride	↑		↓	↑				↓
Fluoride			↑	↓				
pH (Field)				↓				↑
Sulfate	↓	↓	↑	↑				↑
Total Dissolved Solids	↑			↑				
Appendix IV Constituents								
Antimony		↓	↓					↓
Barium			↓			↓		↓
Chromium	↑		↑		↑			
Lithium	↑			↑				↓
Molybdenum		↓	↓					
Radium-226				↑				
Total Radium				↑				

2.4 Spatial Variability

Spatial variability refers to identifying whether or not there are statistically identifiable differences in mean concentrations or variance levels across the well field (i.e., the pooled background data). The results from background wells BG-1 and BG-2 were assessed to determine if it is appropriate to pool the data and use it to calculate background concentrations. The sampling round from well BG-2 was compared to the BTVs established in 2018 with the BG-1 well concentrations. The majority of the concentrations in BG-2 were below the former BTVs, therefore no evidence of spatial variability was identified. The constituents in BG-2 will be monitored as additional background groundwater data are collected at the site.

3 Summary of Statistical Analysis

A summary of the statistical analysis results is provided in **Table 9** and discussed below.

- The statistical outliers identified for barium, calcium, sulfate, and total dissolved solids should not be removed from the data set to be used for developing background concentrations for the site at this time.
- For the background data set, all of the five Appendix I metals exhibited high percentages of NDs and will be treated under nonparametric distribution assumptions with the maximum detected value chosen to represent background, until additional results can be included in the data sets.
- For the background data set, there are currently sufficient data to fit the Appendix III constituents to known parametric distribution models (e.g., gamma, lognormal, or normal) using GOF tests, except for calcium, sulfate, and total dissolved solids, which are nonparametric. Statistical tests conducted under parametric distribution assumptions have more power to detect a SSI when compared to tests conducted under nonparametric distribution assumptions.
- For the background data set, eleven of the seventeen Appendix IV constituents exhibited high percentages of NDs and will be treated under nonparametric distribution assumptions with the maximum detected value chosen to represent background, until additional results can be included in the data sets. The data for radium-226, radium-228 and total radium is set to a nonparametric distribution as the MDL values were not provided by the laboratory. Currently, the background data sets for fluoride and lithium can be fitted to known parametric distribution models using GOF tests.
- Based on the small data set and short duration of the monitoring program, results from the outlier and trend analyses should be considered preliminary until additional sample results are included in the data set and re-evaluated.
- At this time, for the purpose of calculating background concentrations and testing for SSIs over background for Appendix I metals, and Appendix III and IV constituents, results from seventeen samples (sixteen monitoring events taken during October 2015 to January 2019 from BG-1 and one monitoring event taken January 2019 from BG-2) were used. The statistically-derived background concentrations and the evaluation for SSIs over background for Appendix I metals, Appendix III and Appendix IV constituents are included in **Section 4**.

Table 9: Summary of Background Preliminary Data Analysis

Constituent	Statistical Outlier	Nonparametric Data Distribution	Trend
Appendix I VOCs			
1,4-Dichlorobenzene		✓	
Acetone		✓	
Bromodichloromethane		✓	
Bromoform		✓	
Carbon disulfide		✓	
Chloroform		✓	
Dibromochloromethane		✓	
Dibromomethane		✓	
Appendix I Metals			
Copper		✓	
Nickel		✓	
Silver		✓	
Vanadium		✓	
Zinc		✓	
Appendix III Constituents			
Boron			✓
Calcium	✓	✓	
Chloride			✓
Fluoride			✓
Sulfate	✓	✓	
Total Dissolved Solids	✓	✓	
Appendix IV Constituents			
Antimony		✓	
Arsenic		✓	
Barium	✓	✓	✓
Beryllium		✓	
Cadmium		✓	
Chromium		✓	
Cobalt		✓	
Fluoride			✓
Lead		✓	
Mercury		✓	
Molybdenum		✓	
Radium-226		✓	
Radium-228		✓	

Constituent	Statistical Outlier	Nonparametric Data Distribution	Trend
Selenium		✓	
Thallium		✓	
Total Radium		✓	

✓Constituent was flagged during the statistical analysis

4 Evaluation for SSIs over Background

Based on the statistical evaluations performed, background threshold values (BTVs) were determined for the detection monitoring program at the site for Appendix I metals, and Appendix III and IV constituents. Note that BTVs were not calculated for Appendix I VOCs as all of these constituents were 100 percent non-detects. For constituents that have all ND background values, the maximum MDL is chosen to represent background and the double quantification rule (DQR) is used to evaluate whether or not there is an SSI. The BTV provided for detection monitoring constituents is the statistically-derived background concentration (i.e., upper prediction limit [UPL]), the maximum detected value or the maximum MDL depending on the level of censorship in each of the background samples. For pH (field), both the UPL and the lower prediction limit (LPL) were computed as pH values above or below the prediction limits at the downgradient wells can be considered statistically significant. The test significance level per constituent has been estimated such that the cumulative false positive rate over all constituent/well pair comparisons is approximately ten percent. The number of verification samples per constituent has been selected to provide sufficient statistical power to detect an SSI when an SSI as occurred conditional to the background sample size, its distributional properties, and the total number of statistical test comparisons. The calculated background concentrations, or BTVs, for each detection monitoring constituent is provided below in **Table 10**.

Table 10: Background Concentrations for Detection Monitoring Constituents

Constituent	Unit	No. of Verification Samples.	BTV (UPL)
Appendix I VOCs			
1,4-Dichlorobenzene	ug/L	**na**	***0.330***
Acetone	ug/L	**na**	***10.0***
Bromodichloromethane	ug/L	**na**	***0.260***
Bromoform	ug/L	**na**	***0.620***
Carbon disulfide	ug/L	**na**	***1.20***
Chloroform	ug/L	**na**	***2.30***
Dibromochloromethane	ug/L	**na**	***0.410***
Dibromomethane	ug/L	**na**	***0.460***
Appendix I Metals			
Copper	ug/L	**na**	***2.50***
Nickel	ug/L	**na**	***2.50***
Silver	ug/L	**na**	***2.50***
Vanadium	ug/L	**3**	**5.50**
Zinc	ug/L	**3**	**10.0**
Appendix III Constituents			

Constituent	Unit	No. of Verification Samples.	BTV (UPL)
Boron	ug/L	**1**	**9.26**
Calcium	ug/L	**3**	**89,600**
Chloride	mg/L	**1**	**355**
Fluoride	mg/L	**1**	**0.189**
pH (Field)	S.U.	**1**	**6.05 - 7.07***
Sulfate	mg/L	**3**	**64.7**
Total Dissolved Solids	mg/L	**3**	**2,630**
Appendix IV Constituents			
Antimony	ug/L	**na**	***3.90***
Arsenic	ug/L	**na**	***5.00***
Barium	ug/L	**3**	**443**
Beryllium	ug/L	**na**	***0.500***
Cadmium	ug/L	**na**	***0.500***
Chromium	ug/L	**na**	***2.50***
Cobalt	ug/L	**na**	***2.50***
Fluoride	mg/L	**1**	**0.189**
Lead	ug/L	**na**	***2.50***
Lithium	ug/L	**1**	**42.7**
Mercury	ug/L	**na**	***0.100***
Molybdenum	ug/L	**3**	**6.80**
Radium-226	pCi/L	**3**	**0.800**
Radium-228	pCi/L	**3**	**1.29**
Selenium	ug/L	**na**	***5.00***
Thallium	ug/L	**3**	**13.7**
Total Radium	pCi/L	**3**	**2.09**

Note:
* indicates the lower bound of the pH range is the lower prediction limit (LPL). The upper bound is the UPL. The BTVs were obtained during thirteen monitoring events performed between October 2015 and July 2018 at well BG-1.
Italic concentration indicates a non-detect value and that the DQR is recommended for statistical evaluation.

Downgradient sampling results from the first detection monitoring round in January 2019 were used to test for SSIs. For constituents that have all ND background values, the DQR is applied; that is, an SSI is registered for the well-constituent pair if the downgradient concentrations exhibit detects in two consecutive sampling events. Downgradient concentrations were compared to the BTVs and are summarized below in **Table 11** through **Table 14**. Eight monitoring wells (MW-1 through MW-8) were installed and sampled (October 2015) prior to ash placement, thus representing pre-ash conditions at the site. The range of the concentrations of the pre-ash conditions are included in the tables below as a relative comparison to the current downgradient conditions.

Table 11: Summary of Evaluation for SSIs over Background for Appendix I Metals (Detection Monitoring)

Appendix I Metals					
	Copper	Nickel	Silver	Vanadium	Zinc
Unit	ug/L	ug/L	ug/L	ug/L	ug/L
BTV (UPL)	*2.5*	*2.5*	*2.50*	5.50	10
Pre-Ash Range	2.50 - 16.4	2.50 - 18.2	2.50 - 2.50	2.50 - 9.90	5.00 - 106
Well	*First Detection Monitoring Round Results*				
MW-1	*2.50*	*2.50*	*2.50*	*2.50*	**14.7**
MW-2	17.2	9.70	*2.50*	**7.60**	**31.1**
MW-3	36.0	86.0	*2.50*	**13.9**	**42.7**
MW-4	*2.50*	*2.50*	*2.50*	*2.50*	**29.4**
MW-5	*2.50*	*2.50*	*2.50*	*2.50*	*5.00*
MW-6	*2.50*	*2.50*	*2.50*	*2.50*	**17.7**
MW-7	*2.50*	*2.50*	*2.50*	*2.50*	**10.7**
MW-8	*2.50*	*2.50*	*2.50*	*2.50*	**13.6**

Notes:
Underlined concentration indicates a detect value in the first DM round result for constituents with 100% background non-detects.
Bold and underlined concentration indicates an SSI over background.

Table 12: Summary of Evaluation for SSIs over Background for Appendix I VOCs (Detection Monitoring)

Appendix I VOCs								
	1,4-Dichloro-benzene	Acetone	Bromo-dichloro-methane	Bromo-form	Carbon disulfide	Chloroform	Dibro-mochloro-methane	Dibromo-methane
Unit	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
BTV (UPL)	*0.330*	*10.0*	*0.260*	*0.620*	*1.20*	*2.30*	*0.410*	*0.460*
Pre-Ash Range	0.330 - 0.330	10.0 - 10.0	0.180 - 0.180	0.260 - 0.260	1.20 - 1.20	0.140 - 1.80	0.210 - 0.210	0.210 - 0.210
Well	*First Detection Monitoring Round Results*							
MW-1	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*
MW-2	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*
MW-3	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*
MW-4	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*
MW-5	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*
MW-6	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*
MW-7	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*
MW-8	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*

Notes:
Underlined concentration indicates a detect value in the first DM round result for constituents with 100% background non-detects.

Bold and underlined concentration indicates an SSI over background.

Table 13: Summary of Evaluation for SSIs over Background for Appendix III Constituents (Detection Monitoring)

	Appendix III Constituents						
	Boron	Calcium	Chloride	Fluoride	pH (Field)	Sulfate	TDS
Unit	ug/L	ug/L	mg/L	mg/L	S.U.	mg/L	mg/L
BTV (UPL)	9.3	89,600	355	0.189	6.05 - 7.07*	65	2,630
Pre-Ash Range	6.20 - 53.1	16,900 - 185,000	22.2 - 1,160	0.0200 - 0.590	6.17 - 7.70	3.70 - 199	296 - 2,770
Well	*First Detection Monitoring Round Results*						
MW-1	*2.60*	**205,000**	**756**	0.160	6.41	8.00	1,510
MW-2	**39.1**	**207,000**	**1,200**	**0.260**	**7.53**	**130**	2,590
MW-3	*2.60*	**194,000**	**1,120**	**0.420**	**7.13**	**80.2**	2,360
MW-4	*2.60*	64,300	**485**	**0.290**	6.10	12.2	1,170
MW-5	*2.60*	13,700	22.2	**0.570**	**7.26**	2.90	261
MW-6	*2.60*	34,400	229	**0.400**	6.23	48.7	649
MW-7	*2.60*	89,100	289	0.110	**7.27**	18.3	820
MW-8	*2.60*	**110,000**	**377**	*0.0500*	6.94	7.90	814

Notes:
Underlined concentration indicates a detect value in the first DM round result for constituents with 100% background non-detects.
Bold and underlined concentration indicates an SSI over background.
* indicates the lower bound of the pH range is the LPL. The upper bound is the UPL.

Table 14: Summary of Evaluation for SSIs over Background for Appendix IV Constituents (Detection Monitoring)

	Appendix IV Constituents								
	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Fluoride	Lead
Unit	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L
BTV (UPL)	*3.9*	*5.00*	443	0.500	*0.500*	*2.5*	*2.50*	0.189	*2.50*
Pre-Ash Range	3.80 - 12.0	2.50 - 2.50	117 - 1,240	0.500 - 0.500	0.500 - 0.500	2.50 - 33.9	2.50 - 7.00	0.0200 - 0.590	2.50 - 6.30
Well	*First Detection Monitoring Round Results*								
MW-1	*3.90*	*5.00*	242	*0.500*	*0.500*	*2.50*	*2.50*	0.160	*2.50*
MW-2	*3.90*	*5.00*	360	*0.500*	*0.500*	14.0	*2.50*	**0.260**	*2.50*
MW-3	*3.90*	*5.00*	**715**	*0.500*	*0.500*	179	6.20	**0.420**	7.30
MW-4	*3.90*	*5.00*	268	*0.500*	*0.500*	*2.50*	*2.50*	**0.290**	*2.50*
MW-5	*3.90*	*5.00*	123	*0.500*	*0.500*	*2.50*	*2.50*	**0.570**	*2.50*
MW-6	*3.90*	*5.00*	89.7	*0.500*	*0.500*	5.30	*2.50*	**0.400**	*2.50*
MW-7	*3.90*	*5.00*	255	*0.500*	*0.500*	6.50	*2.50*	0.110	*2.50*

Appendix IV Constituents									
MW-8	*3.90*	*5.00*	**1,170**	*0.500*	*0.500*	*2.50*	*2.50*	*0.0500*	*2.50*
	Lithium	**Mercury**	**Molybdenum**	**Radium-226**	**Radium-228**	**Selenium**	**Thallium**	**Total Radium**	
Unit	ug/L	ug/L	ug/L	pCi/L	pCi/L	ug/L	ug/L	pCi/L	
BTV (UPL)	62.0	*0.100*	20.6	0.820	1.56	*5.00*	13.7	2.93	
Pre-Ash Range	7.50 - 70.4	0.100 - 0.100	2.50 - 20.6	0.0774 - 0.820	0.0230 - 1.56	5.00 - 5.00	5.00 - 5.00	0.304 - 2.93	
Well	*First Detection Monitoring Round Results*								
MW-1	30.9	*0.100*	*2.50*	0.607	0.737	*5.00*	*0.0600*	1.34	
MW-2	**94.1**	*0.100*	**7.90**	**1.21**	**1.49**	*5.00*	*0.0600*	**2.70**	
MW-3	**72.6**	*0.100*	**12.0**	**1.92**	**2.00**	*5.00*	*0.0600*	**3.92**	
MW-4	25.4	*0.100*	*2.50*	**0.913**	**1.35**	*5.00*	*0.0600*	**2.26**	
MW-5	8.00	*0.100*	*2.50*	0.108	0.695	*5.00*	*0.0600*	0.803	
MW-6	27.9	*0.100*	*2.50*	0.00	0.628	*5.00*	*0.0600*	0.628	
MW-7	25.4	*0.100*	*2.50*	**0.987**	1.01	*5.00*	0.120	2.00	
MW-8	21.7	*0.100*	*2.50*	0.743	1.20	*5.00*	*0.0600*	1.94	

Notes:
Underlined concentration indicates a detect value in the first DM round result for constituents with 100% background non-detects.
Bold and underlined concentration indicates an SSI over background.

SSIs were found for six Appendix III constituents (boron, calcium, chloride, fluoride, pH (field), and sulfate), seven Appendix IV constituents (barium, fluoride, lithium, molybdenum, radium-226, radium-228, and total radium), and two Appendix I metals (vanadium and zinc). Three Appendix IV constituents (chromium, cobalt, and lithium) and two Appendix I metals (copper and nickel) were flagged as potential SSIs as they are non-detected constituents that had detected values. If the downgradient concentrations for these constituents exhibit detects in the consecutive sampling event, then an SSI would be registered. When results of the January 2019 sampling event are compared to the pre-ash sampling results from those eight wells, current downgradient groundwater constituent concentrations are generally similar to concentrations reported prior to ash placement. Of the fourteen constituents with observed SSIs, eight of them are within the range of pre-ash conditions. Depending on the data distribution of the constituent, the BTVs have been computed to allow for one to three verification samples. With verification sampling, the validity of the SSIs can be confirmed.

5 Appendix E.A: Downgradient Well Descriptive Statistics

Table 15: Summary of Well MW-1 Data Set Descriptive Statistics

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Appendix I VOCs											
1,4-Dichlorobenzene	ug/L	15	15	0.260	0.330	0.325	0.330	--	--	--	--
Acetone	ug/L	15	15	6.20	10.0	9.75	10.0	--	--	--	--
Bromodichloromethane	ug/L	15	15	0.180	0.260	0.185	0.180	--	--	--	--
Bromoform	ug/L	15	15	0.260	0.620	0.284	0.260	--	--	--	--
Carbon disulfide	ug/L	15	15	0.400	1.20	1.15	1.20	--	--	--	--
Chloroform	ug/L	15	15	0.140	2.30	0.284	0.140	--	--	--	--
Dibromochloromethane	ug/L	15	15	0.210	0.410	0.223	0.210	--	--	--	--
Dibromomethane	ug/L	15	15	0.210	0.460	0.227	0.210	--	--	--	--
Appendix I Metals											
Copper	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Nickel	ug/L	15	12	2.50	13.3	3.79	2.50	5.60	13.3	8.93	7.90
Silver	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Vanadium	ug/L	15	12	2.50	6.20	3.12	2.50	5.00	6.20	5.60	5.60
Zinc	ug/L	15	9	5.00	28.0	9.37	5.00	10.2	28.0	15.9	14.0
Appendix III Constituents											
Boron	ug/L	15	7	0.570	14.5	5.69	6.20	6.20	14.5	9.63	9.65
Calcium	ug/L	15	0	57,700	205,000	119,407	124,000	57,700	205,000	119,407	124,000
Chloride	mg/L	15	0	167	756	461	455	167	756	461	455
Fluoride	mg/L	15	1	0.0200	0.170	0.128	0.130	0.110	0.170	0.136	0.130
pH (Field)	S.U.	13	0	6.41	7.30	6.72	6.70	6.41	7.30	6.72	6.70
Sulfate	mg/L	15	0	6.20	11.2	8.39	8.00	6.20	11.2	8.39	8.00
Total Dissolved Solids	mg/L	15	0	569	1,510	1,014	1,020	569	1,510	1,014	1,020
Appendix IV Constituents											
Antimony	ug/L	15	14	3.80	6.10	4.01	3.90	6.10	6.10	6.10	6.10
Arsenic	ug/L	15	15	2.50	5.00	4.00	5.00	--	--	--	--

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Barium	ug/L	15	0	70.3	242	162	155	70.3	242	162	155
Beryllium	ug/L	15	15	0.500	0.500	0.500	0.500	--	--	--	--
Cadmium	ug/L	15	15	0.500	0.500	0.500	0.500	--	--	--	--
Chromium	ug/L	15	11	2.50	18.4	4.68	2.50	6.60	18.4	10.7	8.85
Cobalt	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Fluoride	mg/L	15	1	0.0200	0.170	0.128	0.130	0.110	0.170	0.136	0.130
Lead	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Lithium	ug/L	15	0	19.2	36.1	30.2	31.2	19.2	36.1	30.2	31.2
Mercury	ug/L	15	15	0.100	0.100	0.100	0.100	--	--	--	--
Molybdenum	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Radium-226	pCi/L	14	0	-0.188	1.03	0.331	0.265	--	--	--	--
Radium-228	pCi/L	14	0	-0.0467	0.915	0.483	0.483	--	--	--	--
Selenium	ug/L	15	15	5.00	5.00	5.00	5.00	--	--	--	--
Thallium	ug/L	15	15	0.0200	5.00	2.02	0.0300	--	--	--	--
Total Radium	pCi/L	14	0	0.237	1.47	0.844	0.755	--	--	--	--

Notes:

1. ND = not detected above the method detection limit.
2. MDL = method detection limit.
3. "--" indicates all results for the respective constituent were NDs, or with the case of total radium, NDs were flagged but the laboratory did not provide a value for the MDL.
4. Numbers are displayed using the same number of significant figures as reported by the laboratory.
5. If a constituent had 100% detections the descriptive statistics provided above are identical for the data including NDs and excluding NDs.

Table 16: Summary of Well MW-2 Data Set Descriptive Statistics

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Appendix I VOCs											
1,4-Dichlorobenzene	ug/L	14	14	0.260	0.330	0.325	0.330	--	--	--	--
Acetone	ug/L	14	14	6.20	10.0	9.73	10.0	--	--	--	--
Bromodichloromethane	ug/L	14	14	0.180	0.260	0.186	0.180	--	--	--	--
Bromoform	ug/L	14	14	0.260	0.620	0.286	0.260	--	--	--	--
Carbon disulfide	ug/L	14	14	0.400	1.20	1.14	1.20	--	--	--	--
Chloroform	ug/L	14	14	0.140	2.30	0.294	0.140	--	--	--	--
Dibromochloromethane	ug/L	14	14	0.210	0.410	0.224	0.210	--	--	--	--
Dibromomethane	ug/L	14	14	0.210	0.460	0.228	0.210	--	--	--	--
Appendix I Metals											
Copper	ug/L	14	10	2.50	17.2	4.29	2.50	5.00	17.2	8.78	6.45
Nickel	ug/L	14	7	2.50	54.4	12.6	5.60	8.70	54.4	22.6	15.2
Silver	ug/L	14	14	2.50	2.50	2.50	2.50	--	--	--	--
Vanadium	ug/L	14	13	2.50	7.60	2.86	2.50	7.60	7.60	7.60	7.60
Zinc	ug/L	14	7	5.00	113	23.0	7.85	10.7	113	40.9	31.1
Appendix III Constituents											
Boron	ug/L	14	0	37.4	63.9	45.4	43.4	37.4	63.9	45.4	43.4
Calcium	ug/L	14	0	130,000	217,000	192,000	193,500	130,000	217,000	192,000	193,500
Chloride	mg/L	14	0	910	1,360	1,167	1,190	910	1,360	1,167	1,190
Fluoride	mg/L	14	1	0.0200	0.400	0.216	0.220	0.130	0.400	0.232	0.220
pH (Field)	S.U.	12	0	7.50	8.50	7.76	7.62	7.50	8.50	7.76	7.62
Sulfate	mg/L	14	0	73.3	338	198	216	73.3	338	198	216
Total Dissolved Solids	mg/L	14	0	257	3,290	2,360	2,475	257	3,290	2,360	2,475
Appendix IV Constituents											
Antimony	ug/L	14	6	3.90	12.3	6.89	6.25	5.60	12.3	9.13	9.10
Arsenic	ug/L	14	14	2.50	5.00	3.93	5.00	--	--	--	--
Barium	ug/L	14	0	177	360	254	246	177	360	254	246
Beryllium	ug/L	14	14	0.500	0.500	0.500	0.500	--	--	--	--
Cadmium	ug/L	14	14	0.500	0.500	0.500	0.500	--	--	--	--

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Chromium	ug/L	14	3	2.50	84.0	21.8	10.9	5.20	84.0	27.1	15.8
Cobalt	ug/L	14	14	2.50	2.50	2.50	2.50	--	--	--	--
Fluoride	mg/L	14	1	0.0200	0.400	0.216	0.220	0.130	0.400	0.232	0.220
Lead	ug/L	14	14	2.50	2.50	2.50	2.50	--	--	--	--
Lithium	ug/L	14	0	53.1	356	156	132	53.1	356	156	132
Mercury	ug/L	14	14	0.100	0.100	0.100	0.100	--	--	--	--
Molybdenum	ug/L	14	0	7.10	21.1	11.7	9.65	7.10	21.1	11.7	9.65
Radium-226	pCi/L	13	0	0.580	1.94	0.973	0.945	--	--	--	--
Radium-228	pCi/L	13	0	0.433	1.75	1.22	1.17	--	--	--	--
Selenium	ug/L	14	14	5.00	5.00	5.00	5.00	--	--	--	--
Thallium	ug/L	14	13	0.0200	10.3	2.54	0.0450	10.3	10.3	10.3	10.3
Total Radium	pCi/L	13	0	1.12	3.02	2.19	2.37	--	--	--	--

Notes:

1. ND = not detected above the method detection limit.
2. MDL = method detection limit.
3. "--" indicates all results for the respective constituent were NDs, or with the case of total radium, NDs were flagged but the laboratory did not provide a value for the MDL.
4. Numbers are displayed using the same number of significant figures as reported by the laboratory.
5. If a constituent had 100% detections the descriptive statistics provided above are identical for the data including NDs and excluding NDs.

Table 17: Summary of Well MW-3 Data Set Descriptive Statistics

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Appendix I VOCs											
1,4-Dichlorobenzene	ug/L	15	15	0.260	0.330	0.325	0.330	--	--	--	--
Acetone	ug/L	15	15	6.20	10.0	9.75	10.0	--	--	--	--
Bromodichloromethane	ug/L	15	15	0.180	0.260	0.185	0.180	--	--	--	--
Bromoform	ug/L	15	15	0.260	0.620	0.284	0.260	--	--	--	--
Carbon disulfide	ug/L	15	15	0.400	1.20	1.15	1.20	--	--	--	--
Chloroform	ug/L	15	15	0.140	2.30	0.284	0.140	--	--	--	--
Dibromochloromethane	ug/L	15	15	0.210	0.410	0.223	0.210	--	--	--	--
Dibromomethane	ug/L	15	15	0.210	0.460	0.227	0.210	--	--	--	--
Appendix I Metals											
Copper	ug/L	15	12	2.50	36.0	5.13	2.50	5.30	36.0	15.6	5.60
Nickel	ug/L	15	12	2.50	86.0	11.4	2.50	5.50	86.0	47.0	49.4
Silver	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Vanadium	ug/L	15	14	2.50	13.9	3.26	2.50	13.9	13.9	13.9	13.9
Zinc	ug/L	15	13	5.00	42.7	8.01	5.00	12.5	42.7	27.6	27.6
Appendix III Constituents											
Boron	ug/L	15	6	0.570	49.4	22.3	16.6	9.70	49.4	36.3	41.9
Calcium	ug/L	15	0	117,000	194,000	161,067	161,000	117,000	194,000	161,067	161,000
Chloride	mg/L	15	0	893	1,280	1,093	1,060	893	1,280	1,093	1,060
Fluoride	mg/L	15	1	0.0200	0.610	0.368	0.420	0.210	0.610	0.393	0.425
pH (Field)	S.U.	13	0	7.10	7.50	7.27	7.30	7.10	7.50	7.27	7.30
Sulfate	mg/L	15	0	9.10	174	80.6	88.1	9.10	174	80.6	88.1
Total Dissolved Solids	mg/L	15	0	256	3,180	1,921	2,140	256	3,180	1,921	2,140
Appendix IV Constituents											
Antimony	ug/L	15	8	3.90	11.4	6.53	3.90	5.80	11.4	9.53	10.1
Arsenic	ug/L	15	15	2.50	5.00	4.00	5.00	--	--	--	--
Barium	ug/L	15	0	353	855	608	570	353	855	608	570
Beryllium	ug/L	15	15	0.500	0.500	0.500	0.500	--	--	--	--
Cadmium	ug/L	15	15	0.500	0.500	0.500	0.500	--	--	--	--

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Chromium	ug/L	15	8	2.50	179	21.6	2.50	5.30	179	43.4	10.3
Cobalt	ug/L	15	14	2.50	6.20	2.75	2.50	6.20	6.20	6.20	6.20
Fluoride	mg/L	15	1	0.0200	0.610	0.368	0.420	0.210	0.610	0.393	0.425
Lead	ug/L	15	14	2.50	7.30	2.82	2.50	7.30	7.30	7.30	7.30
Lithium	ug/L	15	0	36.7	236	107	90.2	36.7	236	107	90.2
Mercury	ug/L	15	15	0.100	0.100	0.100	0.100	--	--	--	--
Molybdenum	ug/L	15	0	5.10	13.8	8.83	8.10	5.10	13.8	8.83	8.10
Radium-226	pCi/L	14	0	0.213	1.92	0.896	0.953	--	--	--	--
Radium-228	pCi/L	14	0	0.387	2.27	1.42	1.53	--	--	--	--
Selenium	ug/L	15	15	5.00	5.00	5.00	5.00	--	--	--	--
Thallium	ug/L	15	15	0.0200	5.00	2.02	0.0300	--	--	--	--
Total Radium	pCi/L	14	0	0.857	3.92	2.31	2.30	--	--	--	--

Notes:

1. ND = not detected above the method detection limit.
2. MDL = method detection limit.
3. "--" indicates all results for the respective constituent were NDs, or with the case of total radium, NDs were flagged but the laboratory did not provide a value for the MDL.
4. Numbers are displayed using the same number of significant figures as reported by the laboratory.
5. If a constituent had 100% detections the descriptive statistics provided above are identical for the data including NDs and excluding NDs.

Table 18: Summary of Well MW-4 Data Set Descriptive Statistics

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Appendix I VOCs											
1,4-Dichlorobenzene	ug/L	15	15	0.260	0.330	0.325	0.330	--	--	--	--
Acetone	ug/L	15	15	6.20	10.0	9.75	10.0	--	--	--	--
Bromodichloromethane	ug/L	15	15	0.180	0.260	0.185	0.180	--	--	--	--
Bromoform	ug/L	15	15	0.260	0.620	0.284	0.260	--	--	--	--
Carbon disulfide	ug/L	15	15	0.400	1.20	1.15	1.20	--	--	--	--
Chloroform	ug/L	15	15	0.140	2.30	0.284	0.140	--	--	--	--
Dibromochloromethane	ug/L	15	15	0.210	0.410	0.223	0.210	--	--	--	--
Dibromomethane	ug/L	15	15	0.210	0.460	0.227	0.210	--	--	--	--
Appendix I Metals											
Copper	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Nickel	ug/L	15	10	2.50	6.90	3.61	2.50	5.20	6.90	5.82	5.60
Silver	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Vanadium	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Zinc	ug/L	15	14	5.00	29.4	6.63	5.00	29.4	29.4	29.4	29.4
Appendix III Constituents											
Boron	ug/L	15	7	0.570	165	14.6	5.70	5.70	165	26.3	6.60
Calcium	ug/L	15	0	17,900	68,200	51,693	62,100	17,900	68,200	51,693	62,100
Chloride	mg/L	15	0	144	567	409	492	144	567	409	492
Fluoride	mg/L	15	0	0.210	0.420	0.321	0.310	0.210	0.420	0.321	0.310
pH (Field)	S.U.	13	0	6.10	6.50	6.33	6.33	6.10	6.50	6.33	6.33
Sulfate	mg/L	15	0	3.40	12.3	8.84	10.0	3.40	12.3	8.84	10.0
Total Dissolved Solids	mg/L	15	0	395	1,260	969	1,130	395	1,260	969	1,130
Appendix IV Constituents											
Antimony	ug/L	15	14	3.80	5.00	3.94	3.90	5.00	5.00	5.00	5.00
Arsenic	ug/L	15	15	2.50	5.00	4.00	5.00	--	--	--	--
Barium	ug/L	15	0	85.9	332	245	271	85.9	332	245	271
Beryllium	ug/L	15	15	0.500	0.500	0.500	0.500	--	--	--	--
Cadmium	ug/L	15	15	0.500	0.500	0.500	0.500	--	--	--	--

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Chromium	ug/L	15	14	2.50	5.70	2.71	2.50	5.70	5.70	5.70	5.70
Cobalt	ug/L	15	11	2.50	8.40	3.57	2.50	5.30	8.40	6.50	6.15
Fluoride	mg/L	15	0	0.210	0.420	0.321	0.310	0.210	0.420	0.321	0.310
Lead	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Lithium	ug/L	15	0	15.8	29.2	24.9	26.2	15.8	29.2	24.9	26.2
Mercury	ug/L	15	15	0.100	0.100	0.100	0.100	--	--	--	--
Molybdenum	ug/L	15	14	2.50	8.90	2.93	2.50	8.90	8.90	8.90	8.90
Radium-226	pCi/L	14	0	-0.120	0.913	0.393	0.415	--	--	--	--
Radium-228	pCi/L	14	0	0.0190	1.35	0.506	0.468	--	--	--	--
Selenium	ug/L	15	15	5.00	5.00	5.00	5.00	--	--	--	--
Thallium	ug/L	15	15	0.0200	5.00	2.02	0.0300	--	--	--	--
Total Radium	pCi/L	14	0	0.240	2.26	0.907	0.675	--	--	--	--

Notes:

1. ND = not detected above the method detection limit.
2. MDL = method detection limit.
3. "--" indicates all results for the respective constituent were NDs, or with the case of total radium, NDs were flagged but the laboratory did not provide a value for the MDL.
4. Numbers are displayed using the same number of significant figures as reported by the laboratory.
5. If a constituent had 100% detections the descriptive statistics provided above are identical for the data including NDs and excluding NDs.

Table 19: Summary of Well MW-5 Data Set Descriptive Statistics

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Appendix I VOCs											
1,4-Dichlorobenzene	ug/L	15	15	0.260	0.330	0.325	0.330	--	--	--	--
Acetone	ug/L	15	15	6.20	10.0	9.75	10.0	--	--	--	--
Bromodichloromethane	ug/L	15	15	0.180	0.260	0.185	0.180	--	--	--	--
Bromoform	ug/L	15	15	0.260	0.620	0.284	0.260	--	--	--	--
Carbon disulfide	ug/L	15	15	0.400	1.20	1.15	1.20	--	--	--	--
Chloroform	ug/L	15	15	0.140	2.30	0.284	0.140	--	--	--	--
Dibromochloromethane	ug/L	15	15	0.210	0.410	0.223	0.210	--	--	--	--
Dibromomethane	ug/L	15	15	0.210	0.460	0.227	0.210	--	--	--	--
Appendix I Metals											
Copper	ug/L	15	14	2.50	6.90	2.79	2.50	6.90	6.90	6.90	6.90
Nickel	ug/L	15	13	2.50	9.00	3.31	2.50	8.10	9.00	8.55	8.55
Silver	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Vanadium	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Zinc	ug/L	15	11	5.00	36.1	9.49	5.00	13.5	36.1	21.9	18.9
Appendix III Constituents											
Boron	ug/L	15	5	0.570	39.3	9.52	10.2	9.80	39.3	13.8	11.0
Calcium	ug/L	15	0	9,140	16,900	11,969	11,700	9,140	16,900	11,969	11,700
Chloride	mg/L	15	0	17.6	22.2	19.7	19.6	17.6	22.2	19.7	19.6
Fluoride	mg/L	15	0	0.410	0.680	0.519	0.520	0.410	0.680	0.519	0.520
pH (Field)	S.U.	13	0	6.80	7.26	7.02	7.00	6.80	7.26	7.02	7.00
Sulfate	mg/L	15	0	2.60	5.60	3.82	3.70	2.60	5.60	3.82	3.70
Total Dissolved Solids	mg/L	15	0	194	1,160	294	233	194	1,160	294	233
Appendix IV Constituents											
Antimony	ug/L	15	15	3.80	3.90	3.86	3.90	--	--	--	--
Arsenic	ug/L	15	15	2.50	5.00	4.00	5.00	--	--	--	--
Barium	ug/L	15	0	90.7	129	106	102	90.7	129	106	102
Beryllium	ug/L	15	15	0.500	0.500	0.500	0.500	--	--	--	--
Cadmium	ug/L	15	15	0.500	0.500	0.500	0.500	--	--	--	--

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Chromium	ug/L	15	11	2.50	16.8	4.67	2.50	5.10	16.8	10.6	10.3
Cobalt	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Fluoride	mg/L	15	0	0.410	0.680	0.519	0.520	0.410	0.680	0.519	0.520
Lead	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Lithium	ug/L	15	0	6.30	9.90	8.45	8.90	6.30	9.90	8.45	8.90
Mercury	ug/L	15	15	0.100	0.100	0.100	0.100	--	--	--	--
Molybdenum	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Radium-226	pCi/L	14	0	-0.142	0.592	0.0961	0.0749	--	--	--	--
Radium-228	pCi/L	14	0	-0.0690	1.08	0.397	0.364	--	--	--	--
Selenium	ug/L	15	15	5.00	5.00	5.00	5.00	--	--	--	--
Thallium	ug/L	15	14	0.0200	14.8	2.67	0.0300	14.8	14.8	14.8	14.8
Total Radium	pCi/L	14	0	0.0766	1.15	0.526	0.457	--	--	--	--

Notes:

1. ND = not detected above the method detection limit.
2. MDL = method detection limit.
3. "--" indicates all results for the respective constituent were NDs, or with the case of total radium, NDs were flagged but the laboratory did not provide a value for the MDL.
4. Numbers are displayed using the same number of significant figures as reported by the laboratory.
5. If a constituent had 100% detections the descriptive statistics provided above are identical for the data including NDs and excluding NDs.

Table 20: Summary of Well MW-6 Data Set Descriptive Statistics

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Appendix I VOCs											
1,4-Dichlorobenzene	ug/L	15	15	0.260	0.330	0.325	0.330	--	--	--	--
Acetone	ug/L	15	15	6.20	10.0	9.75	10.0	--	--	--	--
Bromodichloromethane	ug/L	15	15	0.180	0.260	0.185	0.180	--	--	--	--
Bromoform	ug/L	15	15	0.260	0.620	0.284	0.260	--	--	--	--
Carbon disulfide	ug/L	15	15	0.400	1.20	1.15	1.20	--	--	--	--
Chloroform	ug/L	15	15	0.140	2.30	0.284	0.140	--	--	--	--
Dibromochloromethane	ug/L	15	15	0.210	0.410	0.223	0.210	--	--	--	--
Dibromomethane	ug/L	15	15	0.210	0.460	0.227	0.210	--	--	--	--
Appendix I Metals											
Copper	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Nickel	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Silver	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Vanadium	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Zinc	ug/L	15	12	5.00	17.7	6.72	5.00	11.3	17.7	13.6	11.8
Appendix III Constituents											
Boron	ug/L	15	7	0.570	10.8	4.86	6.10	6.10	10.8	8.07	8.15
Calcium	ug/L	15	0	31,300	39,200	34,473	34,400	31,300	39,200	34,473	34,400
Chloride	mg/L	15	0	15.3	276	228	240	15.3	276	228	240
Fluoride	mg/L	15	0	0.180	0.520	0.395	0.410	0.180	0.520	0.395	0.410
pH (Field)	S.U.	13	0	6.23	7.00	6.55	6.60	6.23	7.00	6.55	6.60
Sulfate	mg/L	15	0	48.7	214	110	90.9	48.7	214	110	90.9
Total Dissolved Solids	mg/L	15	0	371	946	684	689	371	946	684	689
Appendix IV Constituents											
Antimony	ug/L	15	15	3.80	3.90	3.86	3.90	--	--	--	--
Arsenic	ug/L	15	15	2.50	5.00	4.00	5.00	--	--	--	--
Barium	ug/L	15	0	88.3	142	109	104	88.3	142	109	104
Beryllium	ug/L	15	15	0.500	0.500	0.500	0.500	--	--	--	--
Cadmium	ug/L	15	15	0.500	0.500	0.500	0.500	--	--	--	--

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Chromium	ug/L	15	13	2.50	6.00	2.92	2.50	5.30	6.00	5.65	5.65
Cobalt	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Fluoride	mg/L	15	0	0.180	0.520	0.395	0.410	0.180	0.520	0.395	0.410
Lead	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Lithium	ug/L	15	0	27.9	60.5	43.9	45.3	27.9	60.5	43.9	45.3
Mercury	ug/L	15	14	0.100	0.320	0.115	0.100	0.320	0.320	0.320	0.320
Molybdenum	ug/L	15	14	2.50	5.40	2.69	2.50	5.40	5.40	5.40	5.40
Radium-226	pCi/L	14	0	-0.0750	0.910	0.227	0.177	--	--	--	--
Radium-228	pCi/L	14	0	0.148	1.07	0.646	0.654	--	--	--	--
Selenium	ug/L	15	15	5.00	5.00	5.00	5.00	--	--	--	--
Thallium	ug/L	15	14	0.0200	6.20	2.10	0.0300	6.20	6.20	6.20	6.20
Total Radium	pCi/L	14	0	0.148	1.47	0.883	0.910	--	--	--	--

Notes:

1. ND = not detected above the method detection limit.
2. MDL = method detection limit.
3. "--" indicates all results for the respective constituent were NDs, or with the case of total radium, NDs were flagged but the laboratory did not provide a value for the MDL.
4. Numbers are displayed using the same number of significant figures as reported by the laboratory.
5. If a constituent had 100% detections the descriptive statistics provided above are identical for the data including NDs and excluding NDs.

Table 20: Summary of Well MW-7R Data Set Descriptive Statistics

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Appendix I VOCs											
1,4-Dichlorobenzene	ug/L	5	5	0.260	0.330	0.316	0.330	--	--	--	--
Acetone	ug/L	5	5	6.20	10.0	9.24	10.0	--	--	--	--
Bromodichloromethane	ug/L	5	5	0.180	0.260	0.196	0.180	--	--	--	--
Bromoform	ug/L	5	5	0.260	0.620	0.332	0.260	--	--	--	--
Carbon disulfide	ug/L	5	5	0.400	1.20	1.04	1.20	--	--	--	--
Chloroform	ug/L	5	5	0.140	2.30	0.572	0.140	--	--	--	--
Dibromochloromethane	ug/L	5	5	0.210	0.410	0.250	0.210	--	--	--	--
Dibromomethane	ug/L	5	5	0.210	0.460	0.260	0.210	--	--	--	--
Appendix I Metals											
Copper	ug/L	5	4	2.50	7.10	3.42	2.50	7.10	7.10	7.10	7.10
Nickel	ug/L	5	3	2.50	18.0	8.58	2.50	17.4	18.0	17.7	17.7
Silver	ug/L	5	5	2.50	2.50	2.50	2.50	--	--	--	--
Vanadium	ug/L	5	4	2.50	17.6	5.52	2.50	17.6	17.6	17.6	17.6
Zinc	ug/L	5	4	5.00	10.7	6.14	5.00	10.7	10.7	10.7	10.7
Appendix III Constituents											
Boron	ug/L	5	1	2.60	25.3	15.0	16.5	13.8	25.3	18.1	16.6
Calcium	ug/L	5	0	74,000	89,700	84,160	87,700	74,000	89,700	84,160	87,700
Chloride	mg/L	5	0	279	312	290	285	279	312	290	285
Fluoride	mg/L	5	0	0.110	0.320	0.158	0.120	0.110	0.320	0.158	0.120
pH (Field)	S.U.	5	0	7.27	9.60	7.95	7.60	7.27	9.60	7.95	7.60
Sulfate	mg/L	5	0	18.3	51.2	26.3	20.0	18.3	51.2	26.3	20.0
Total Dissolved Solids	mg/L	5	0	740	855	807	820	740	855	807	820
Appendix IV Constituents											
Antimony	ug/L	5	5	3.90	3.90	3.90	3.90	--	--	--	--
Arsenic	ug/L	5	5	5.00	5.00	5.00	5.00	--	--	--	--
Barium	ug/L	5	0	50.1	255	192	212	50.1	255	192	212
Beryllium	ug/L	5	5	0.500	0.500	0.500	0.500	--	--	--	--
Cadmium	ug/L	5	5	0.500	0.500	0.500	0.500	--	--	--	--

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Chromium	ug/L	5	0	6.50	33.7	18.2	9.60	6.50	33.7	18.2	9.60
Cobalt	ug/L	5	5	2.50	2.50	2.50	2.50	--	--	--	--
Fluoride	mg/L	5	0	0.110	0.320	0.158	0.120	0.110	0.320	0.158	0.120
Lead	ug/L	5	5	2.50	2.50	2.50	2.50	--	--	--	--
Lithium	ug/L	5	0	5.60	25.4	19.3	23.0	5.60	25.4	19.3	23.0
Mercury	ug/L	5	5	0.100	0.100	0.100	0.100	--	--	--	--
Molybdenum	ug/L	5	4	2.50	19.5	5.90	2.50	19.5	19.5	19.5	19.5
Radium-226	pCi/L	4	0	-0.0590	0.987	0.265	0.0660	--	--	--	--
Radium-228	pCi/L	4	0	-0.454	1.01	0.384	0.489	--	--	--	--
Selenium	ug/L	5	5	5.00	5.00	5.00	5.00	--	--	--	--
Thallium	ug/L	5	3	0.0280	0.480	0.138	0.0300	0.120	0.480	0.300	0.300
Total Radium	pCi/L	4	0	0.0741	2.00	0.778	0.518	--	--	--	--

Notes:

1. ND = not detected above the method detection limit.
2. MDL = method detection limit.
3. "--" indicates all results for the respective constituent were NDs, or with the case of total radium, NDs were flagged but the laboratory did not provide a value for the MDL.
4. Numbers are displayed using the same number of significant figures as reported by the laboratory.
5. If a constituent had 100% detections the descriptive statistics provided above are identical for the data including NDs and excluding NDs.

Table 21: Summary of Well MW-8 Data Set Descriptive Statistics

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Appendix I VOCs											
1,4-Dichlorobenzene	ug/L	15	15	0.260	0.330	0.325	0.330	--	--	--	--
Acetone	ug/L	15	15	6.20	10.0	9.75	10.0	--	--	--	--
Bromodichloromethane	ug/L	15	15	0.180	0.260	0.185	0.180	--	--	--	--
Bromoform	ug/L	15	15	0.260	0.620	0.284	0.260	--	--	--	--
Carbon disulfide	ug/L	15	15	0.400	1.20	1.15	1.20	--	--	--	--
Chloroform	ug/L	15	15	0.140	2.30	0.284	0.140	--	--	--	--
Dibromochloromethane	ug/L	15	15	0.210	0.410	0.223	0.210	--	--	--	--
Dibromomethane	ug/L	15	15	0.210	0.460	0.227	0.210	--	--	--	--
Appendix I Metals											
Copper	ug/L	15	14	2.50	10.2	3.01	2.50	10.2	10.2	10.2	10.2
Nickel	ug/L	15	11	2.50	42.1	7.10	2.50	10.8	42.1	19.8	13.1
Silver	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Vanadium	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Zinc	ug/L	15	7	5.00	50.7	16.6	13.6	13.6	50.7	26.8	20.4
Appendix III Constituents											
Boron	ug/L	15	6	0.570	12.3	6.21	8.90	8.70	12.3	9.74	9.30
Calcium	ug/L	15	0	98,100	194,000	129,560	117,000	98,100	194,000	129,560	117,000
Chloride	mg/L	15	0	355	939	519	437	355	939	519	437
Fluoride	mg/L	15	15	0.0200	0.0500	0.0340	0.0200	--	--	--	--
pH (Field)	S.U.	13	0	6.70	7.20	6.94	6.94	6.70	7.20	6.94	6.94
Sulfate	mg/L	15	0	4.40	8.00	6.43	6.30	4.40	8.00	6.43	6.30
Total Dissolved Solids	mg/L	15	0	224	1,530	1,003	944	224	1,530	1,003	944
Appendix IV Constituents											
Antimony	ug/L	15	9	3.90	10.1	5.47	3.90	6.50	10.1	7.83	7.55
Arsenic	ug/L	15	15	2.50	5.00	4.00	5.00	--	--	--	--
Barium	ug/L	15	0	1,020	1,550	1,225	1,200	1,020	1,550	1,225	1,200
Beryllium	ug/L	15	15	0.500	0.500	0.500	0.500	--	--	--	--
Cadmium	ug/L	15	15	0.500	0.500	0.500	0.500	--	--	--	--

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Chromium	ug/L	15	11	2.50	82.0	12.0	2.50	16.6	82.0	38.1	26.9
Cobalt	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Fluoride	mg/L	15	15	0.0200	0.0500	0.0340	0.0200	--	--	--	--
Lead	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Lithium	ug/L	15	0	21.7	50.1	31.0	27.7	21.7	50.1	31.0	27.7
Mercury	ug/L	15	14	0.100	0.370	0.118	0.100	0.370	0.370	0.370	0.370
Molybdenum	ug/L	15	14	2.50	5.60	2.71	2.50	5.60	5.60	5.60	5.60
Radium-226	pCi/L	14	0	0.00	1.16	0.573	0.572	--	--	--	--
Radium-228	pCi/L	14	0	0.239	1.20	0.742	0.648	--	--	--	--
Selenium	ug/L	15	15	5.00	5.00	5.00	5.00	--	--	--	--
Thallium	ug/L	15	14	0.0200	8.80	2.27	0.0300	8.80	8.80	8.80	8.80
Total Radium	pCi/L	14	0	0.454	1.94	1.31	1.38	--	--	--	--

Notes:

1. ND = not detected above the method detection limit.
2. MDL = method detection limit.
3. "--" indicates all results for the respective constituent were NDs, or with the case of total radium, NDs were flagged but the laboratory did not provide a value for the MDL.
4. Numbers are displayed using the same number of significant figures as reported by the laboratory.
5. If a constituent had 100% detections the descriptive statistics provided above are identical for the data including NDs and excluding NDs.

6 Appendix E.B: Scatter Plots for Constituents with Downgradient Statistical Outliers

Figure 5: pH (Field) Concentrations (SU) vs. Time (MW-1)

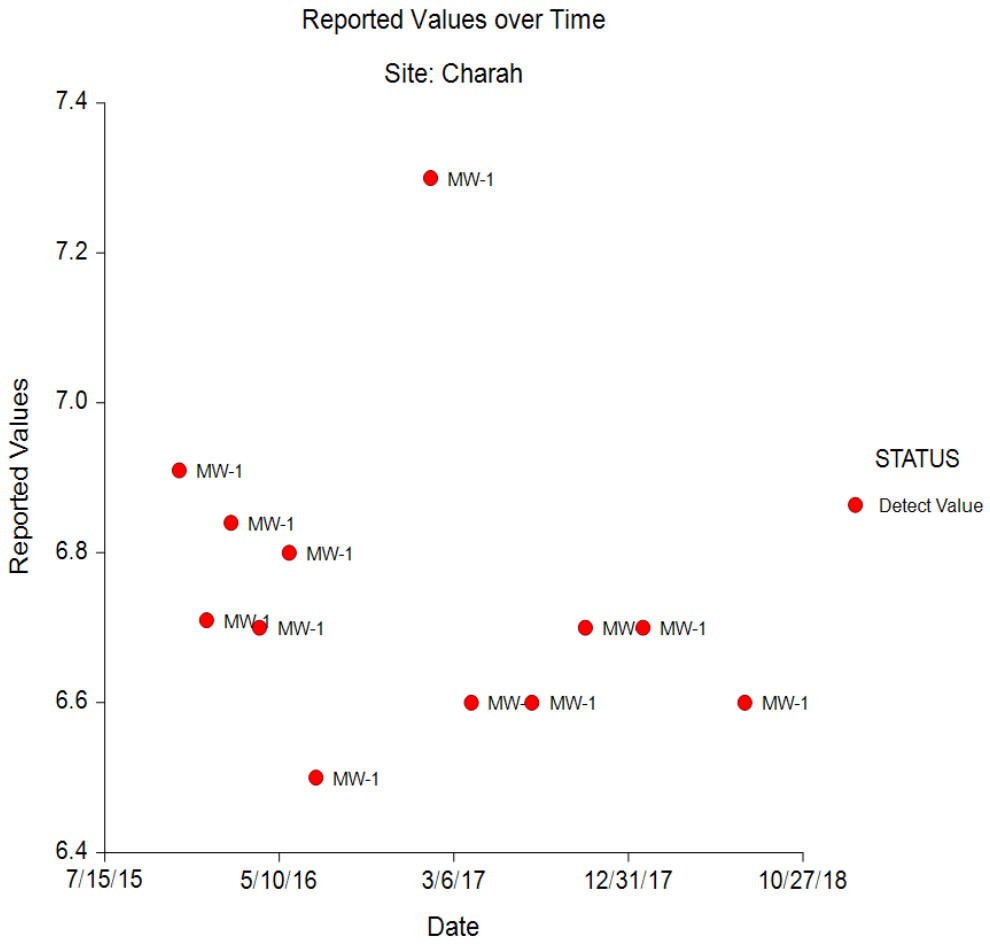


Figure 6: Total Dissolved Solids (mg/L) vs. Time (MW-2)

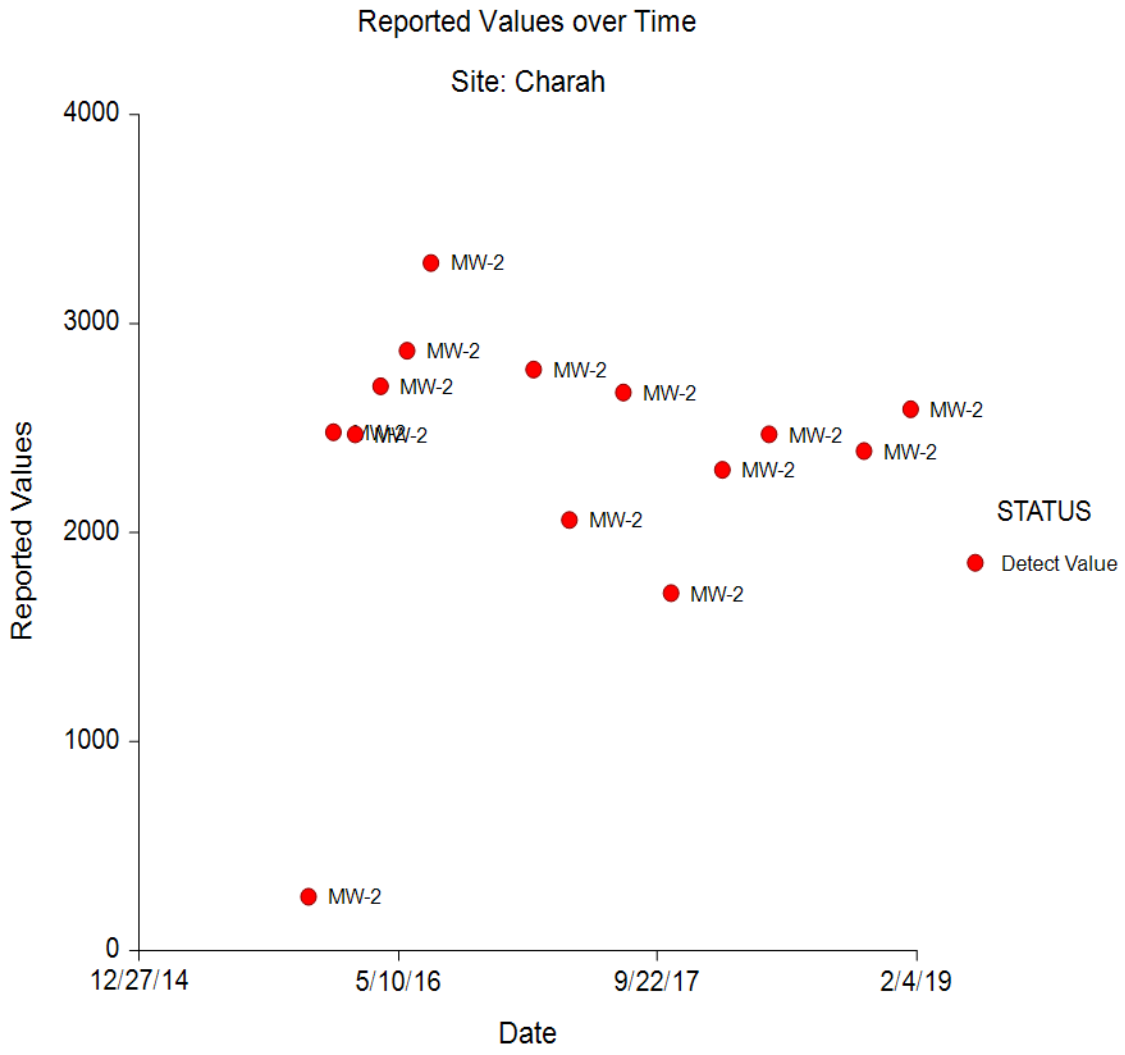


Figure 7: Lithium Concentrations (ug/L) vs. Time (MW-3)

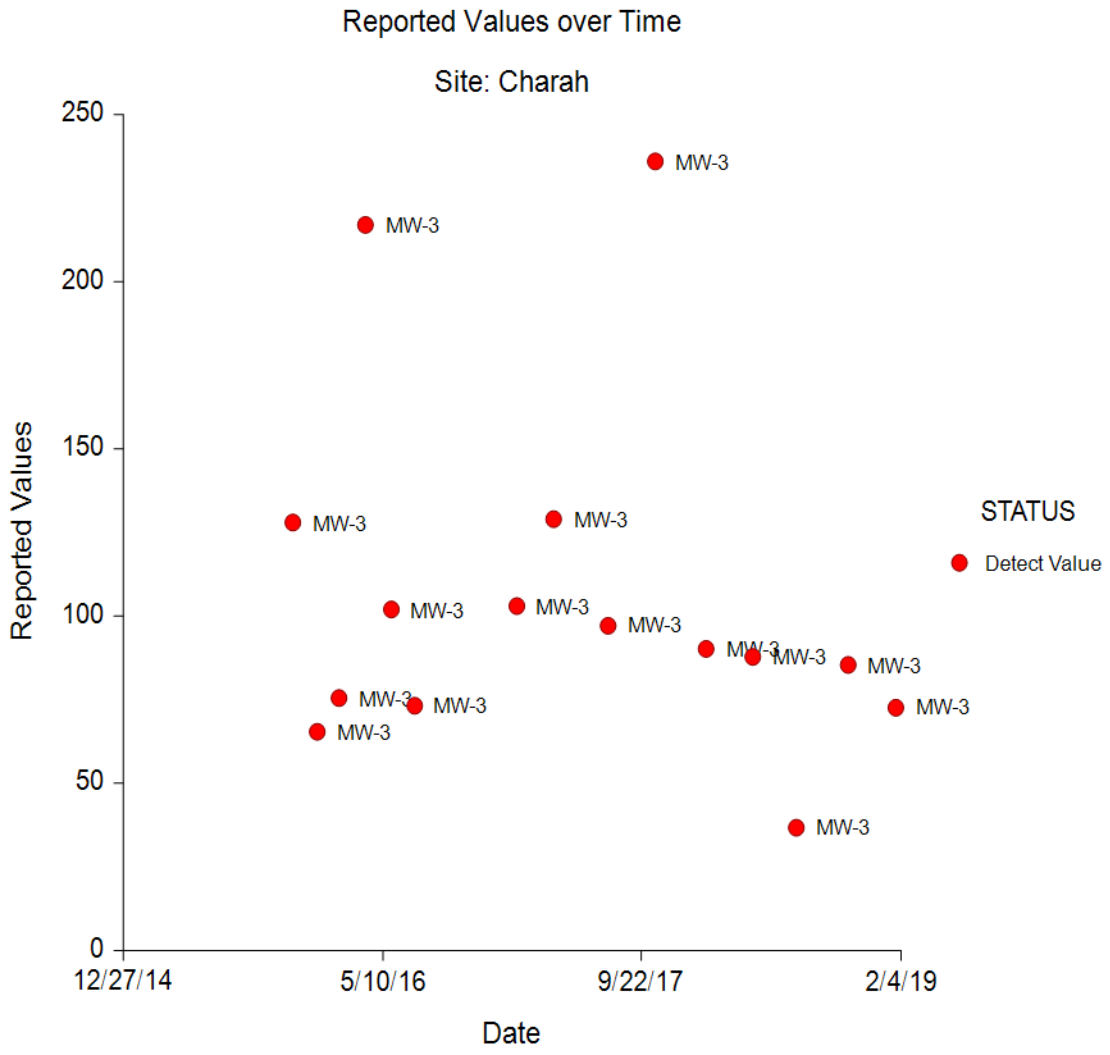


Figure 8: Copper Concentrations (ug/L) vs. Time (MW-3)

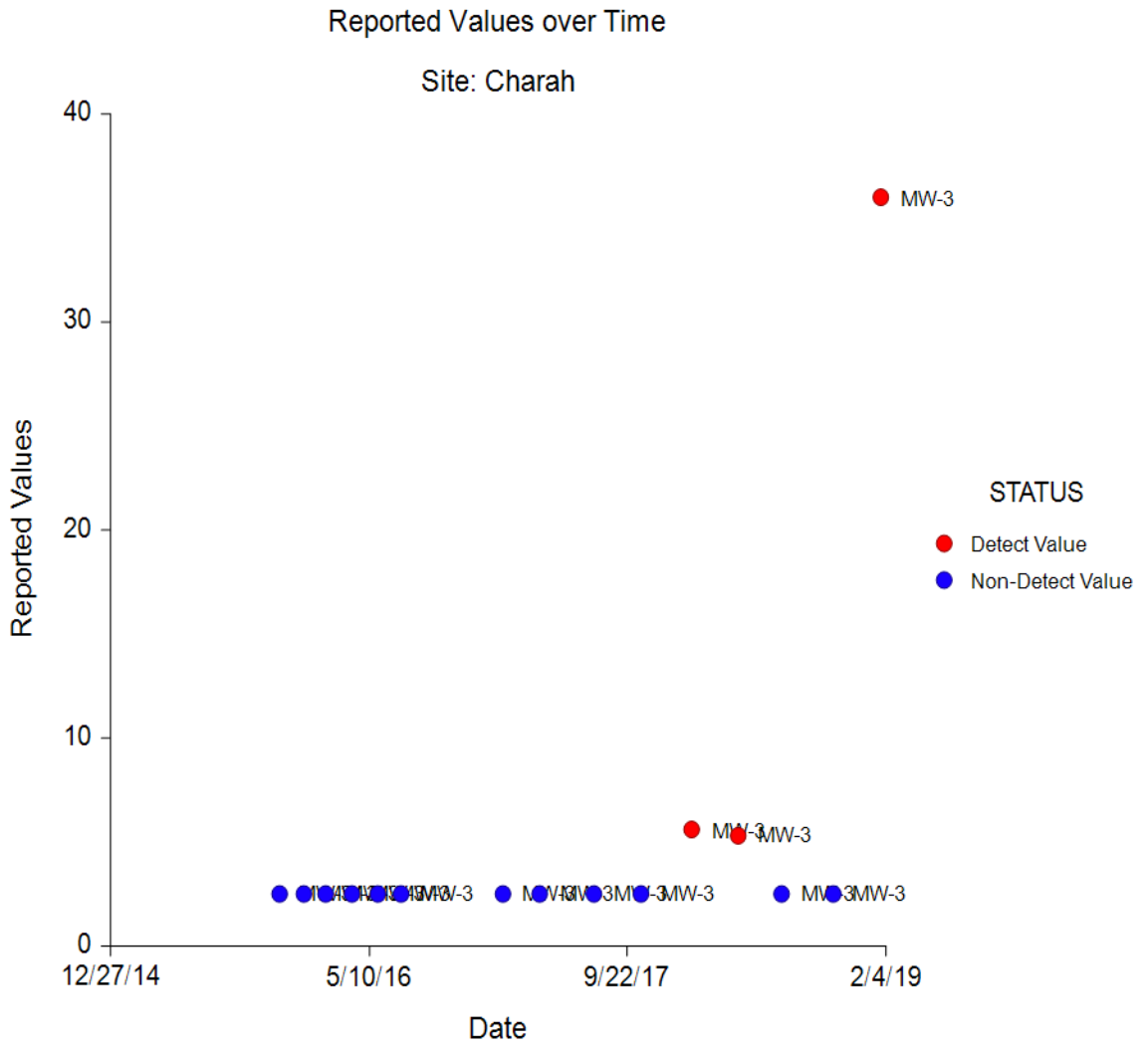


Figure 9: Boron Concentrations (ug/L) vs. Time (MW-4)

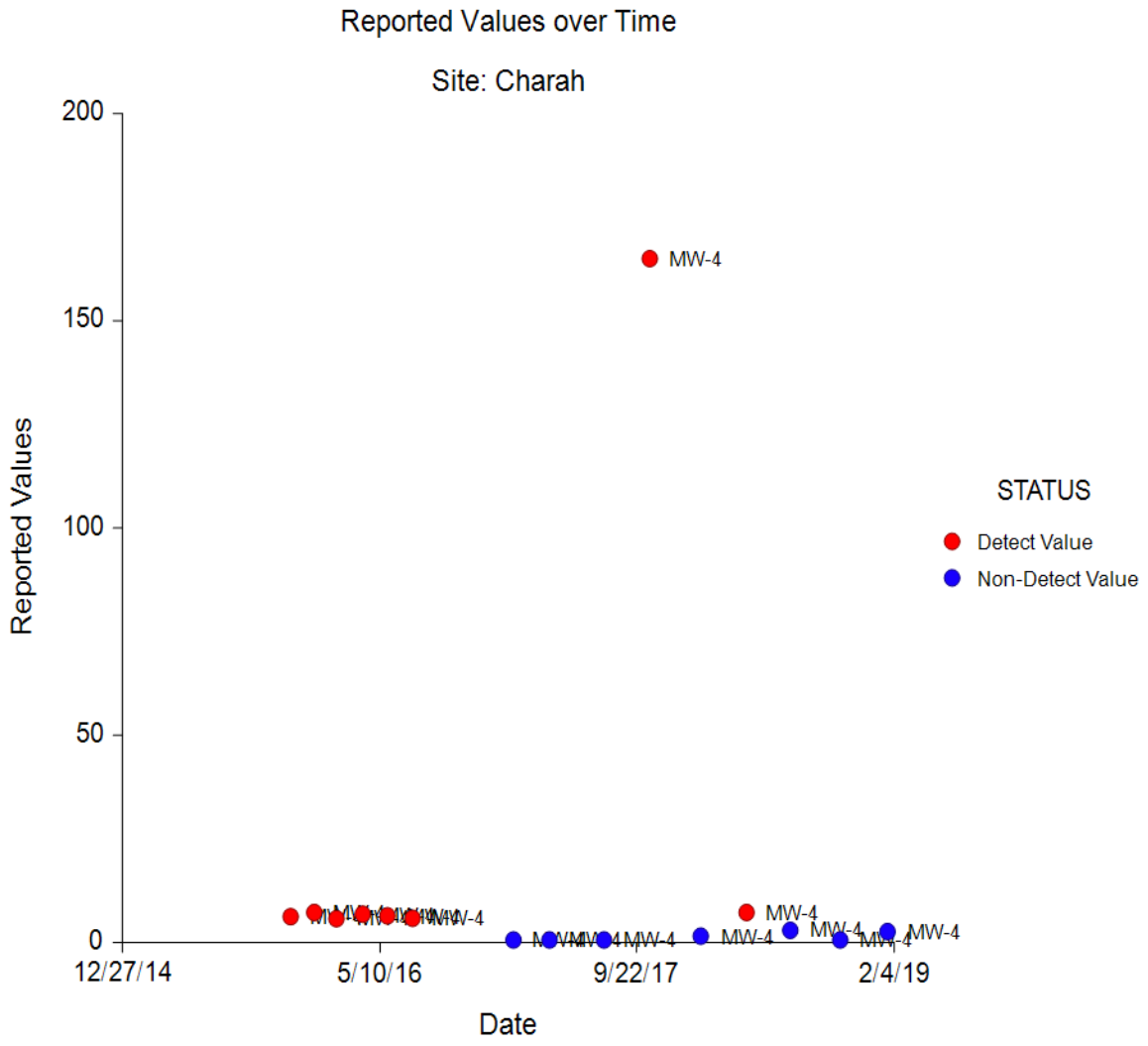


Figure 10: Radium-226 Concentrations (pCi/L) vs. Time (MW-5)

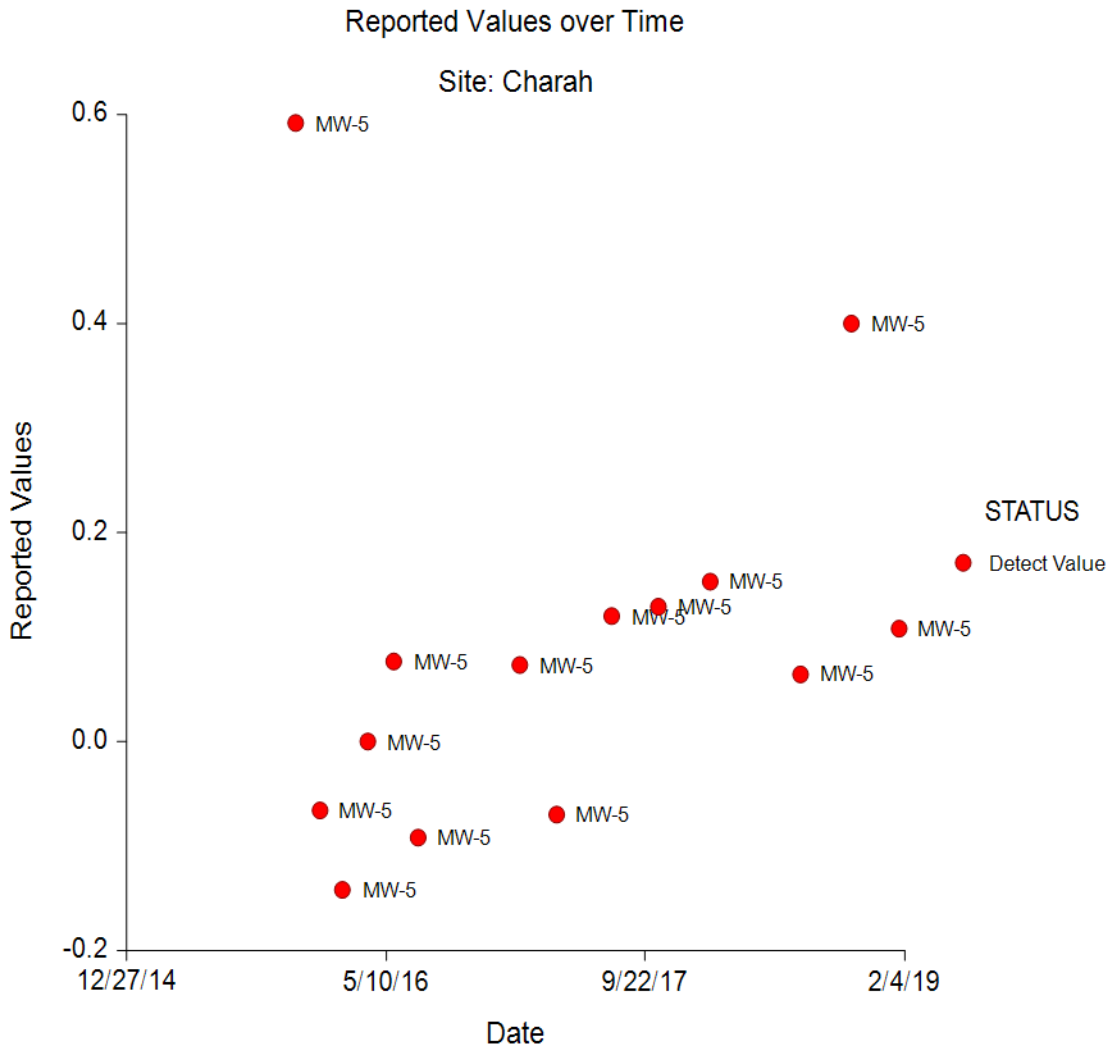


Figure 11: Boron Concentrations (ug/L) vs. Time (MW-5)

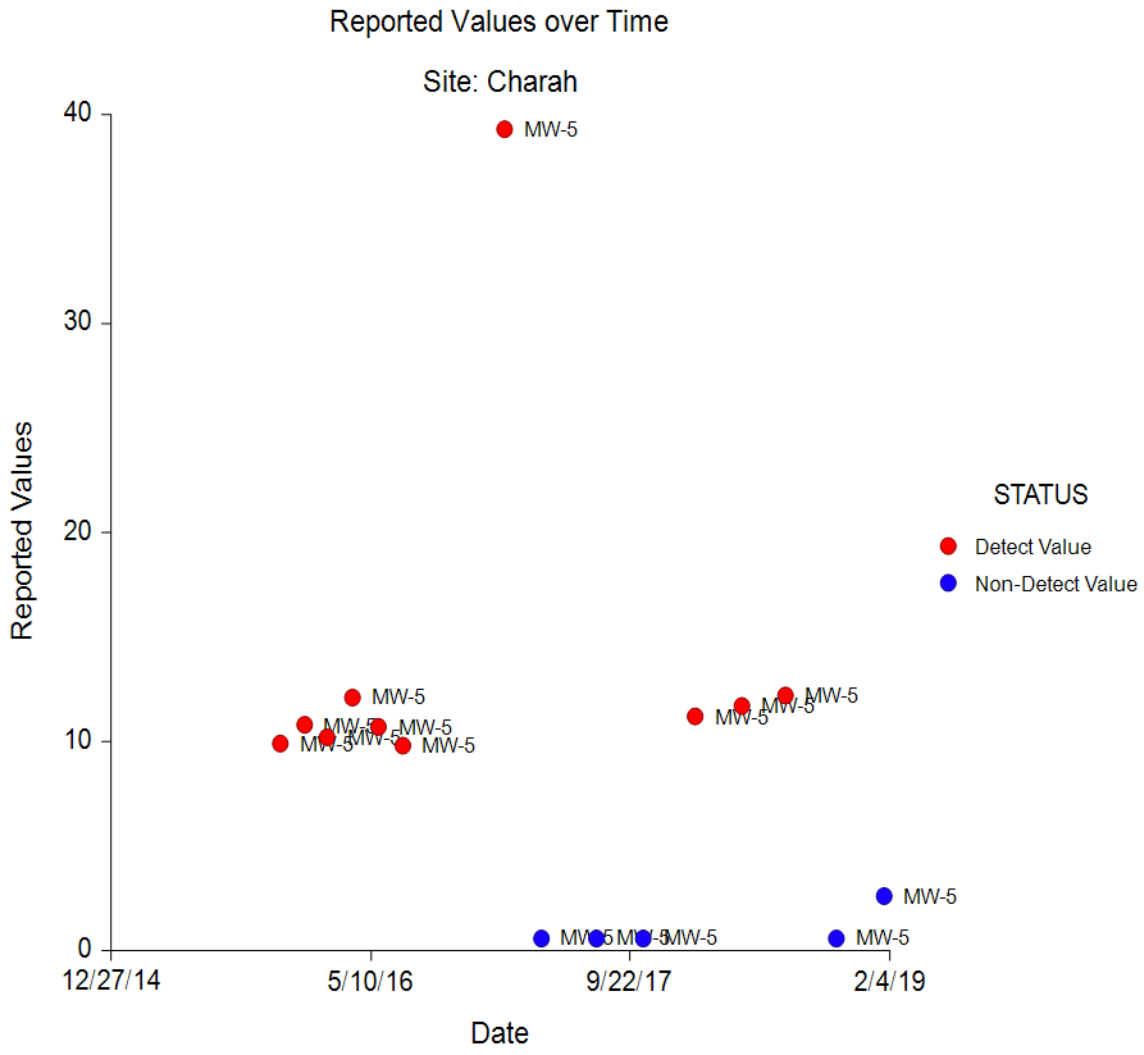


Figure 12: Total Dissolved Solids Concentrations (mg/L) vs. Time (MW-5)

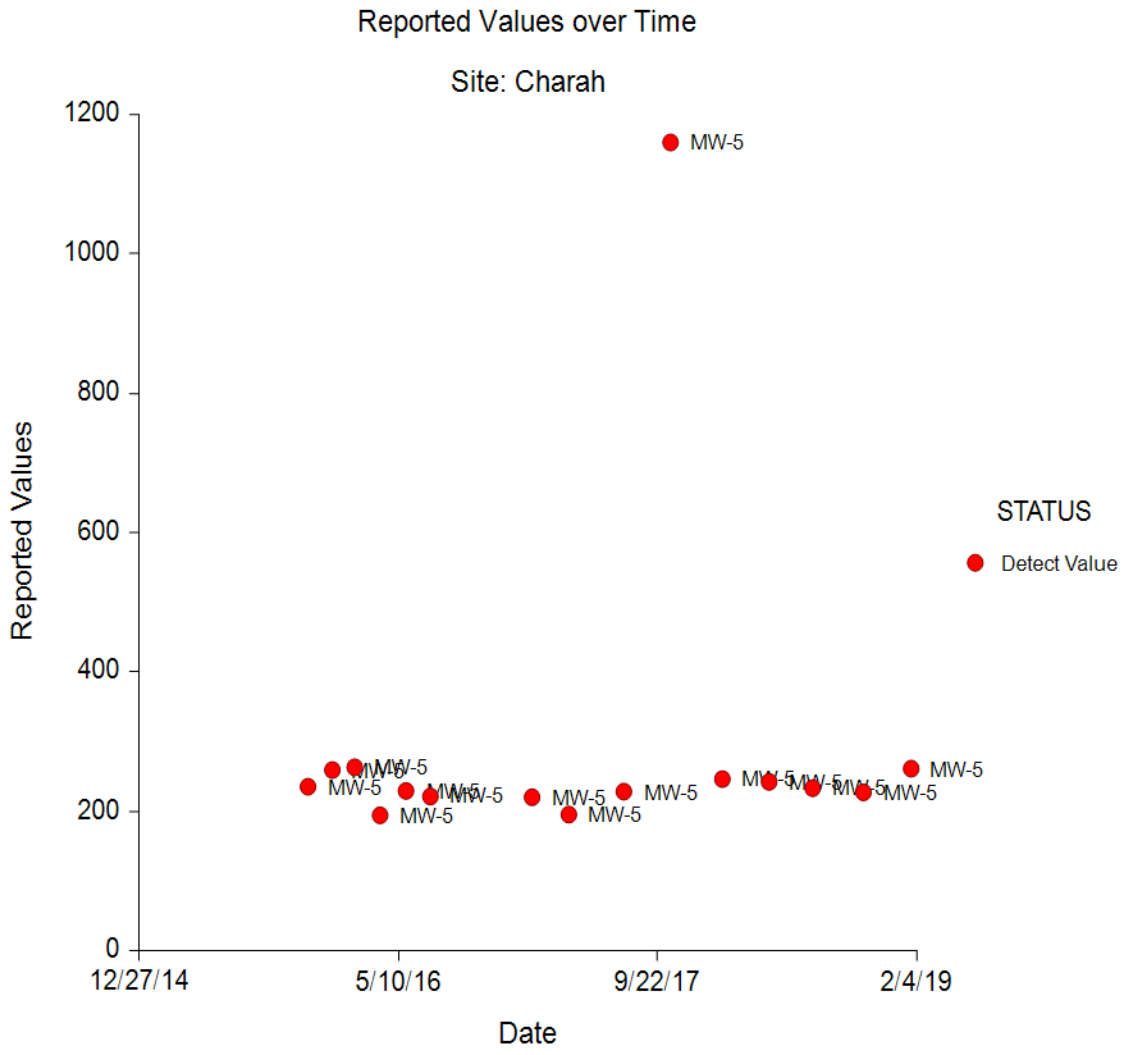


Figure 13: Chloride Concentrations (mg/L) vs. Time (MW-6)

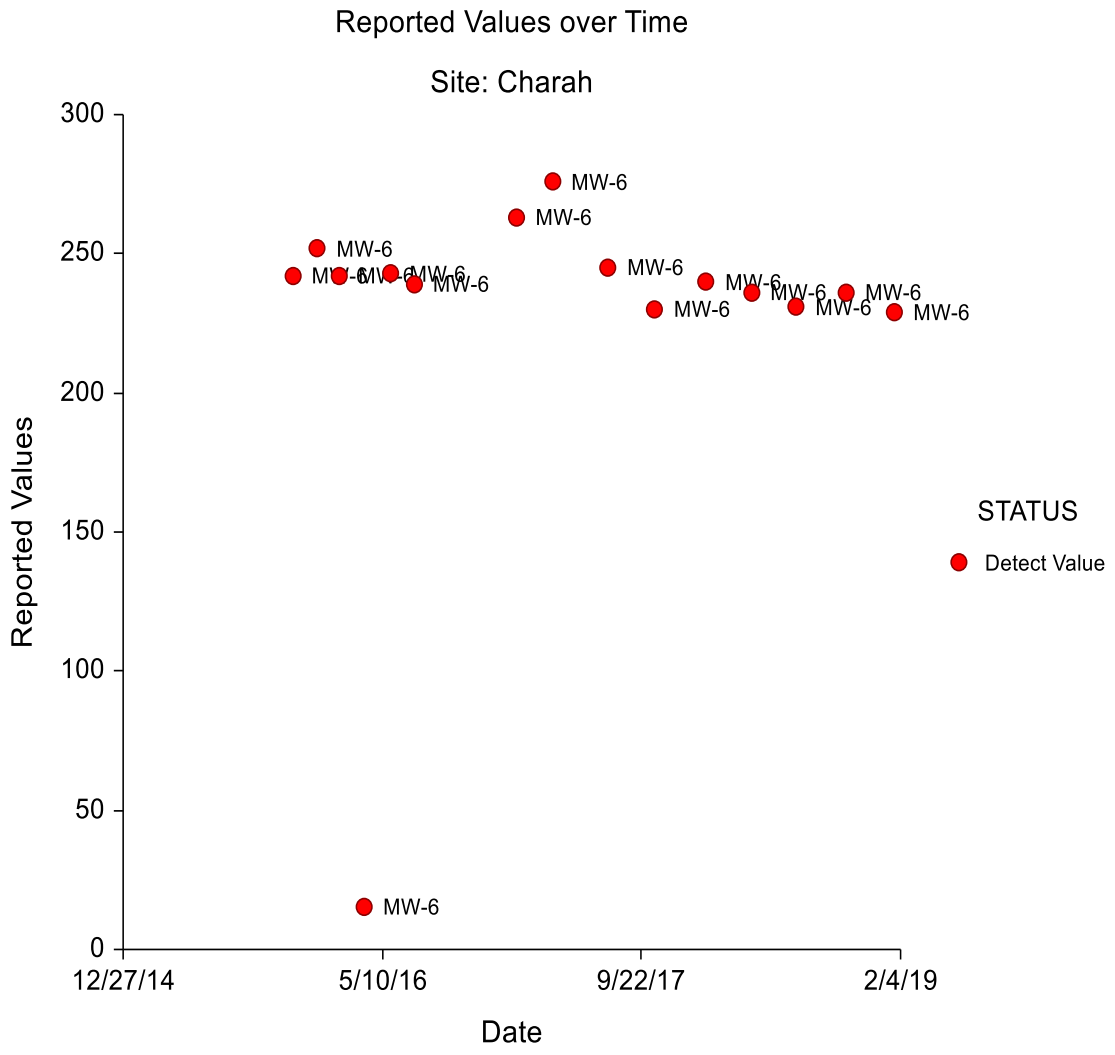


Figure 14: Total Dissolved Solids (mg/L) vs. Time (MW-6)

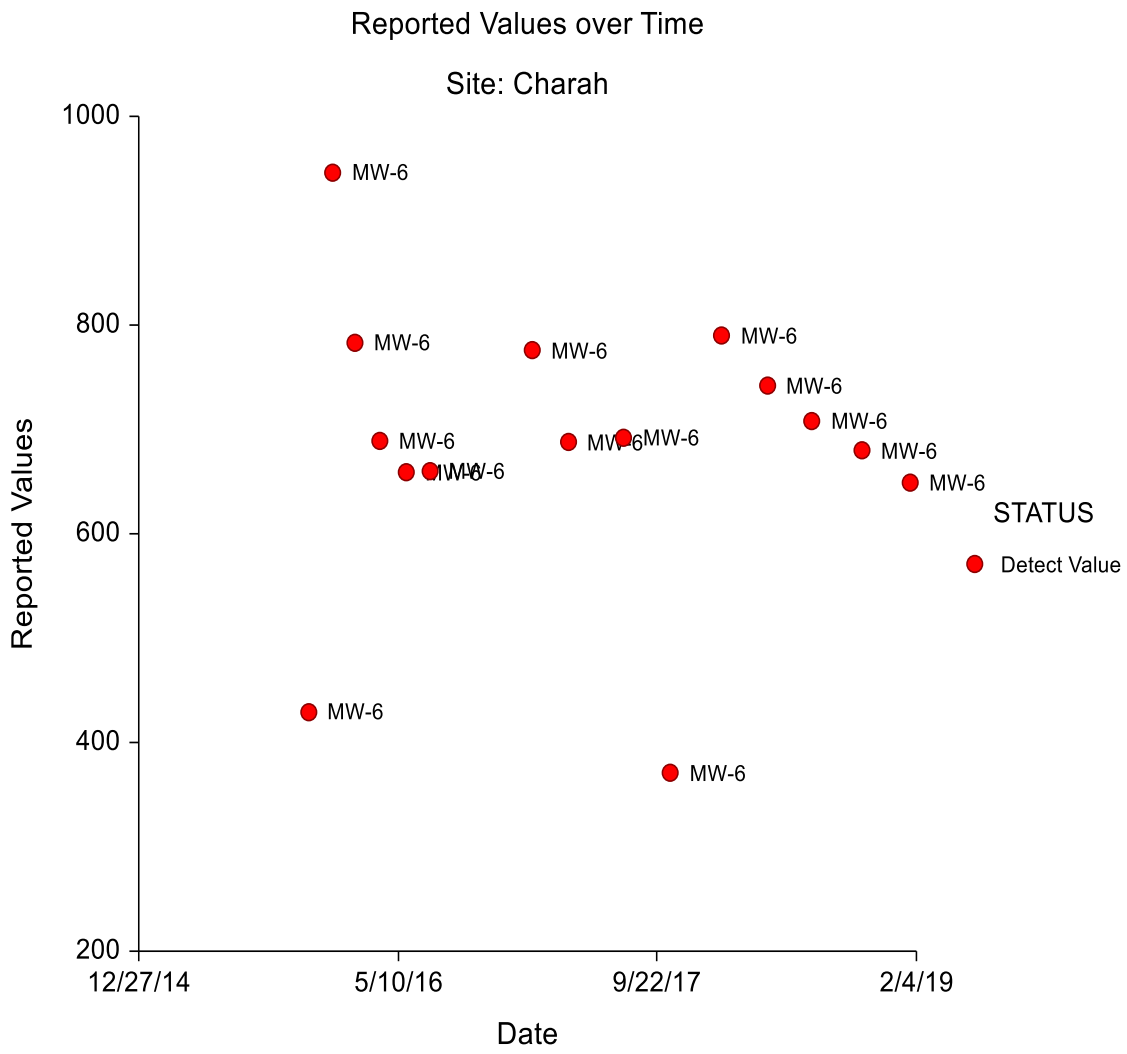


Figure 15: Fluoride Concentrations (mg/L) vs. Time (MW-7R)

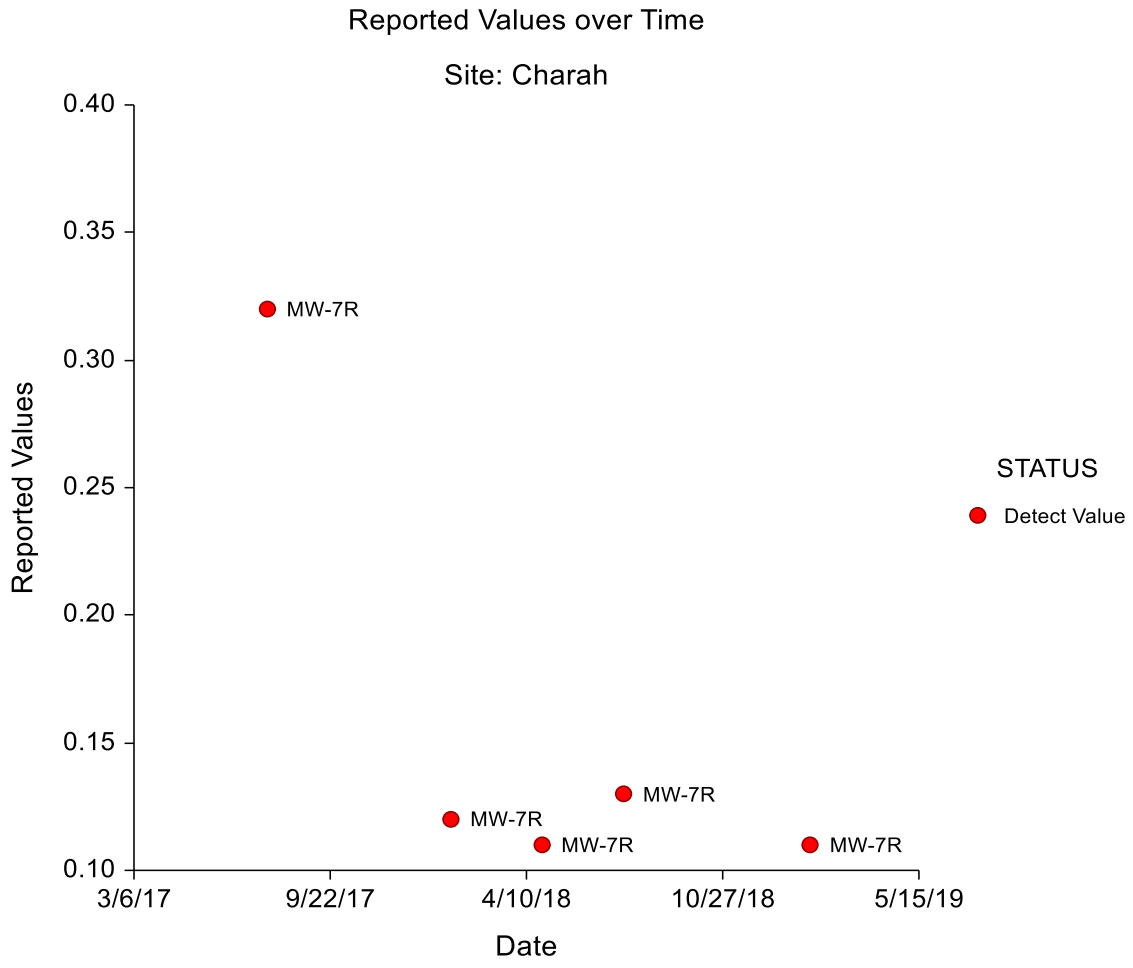


Figure 16: pH (Field) Concentrations (SU) vs. Time (MW-7R)

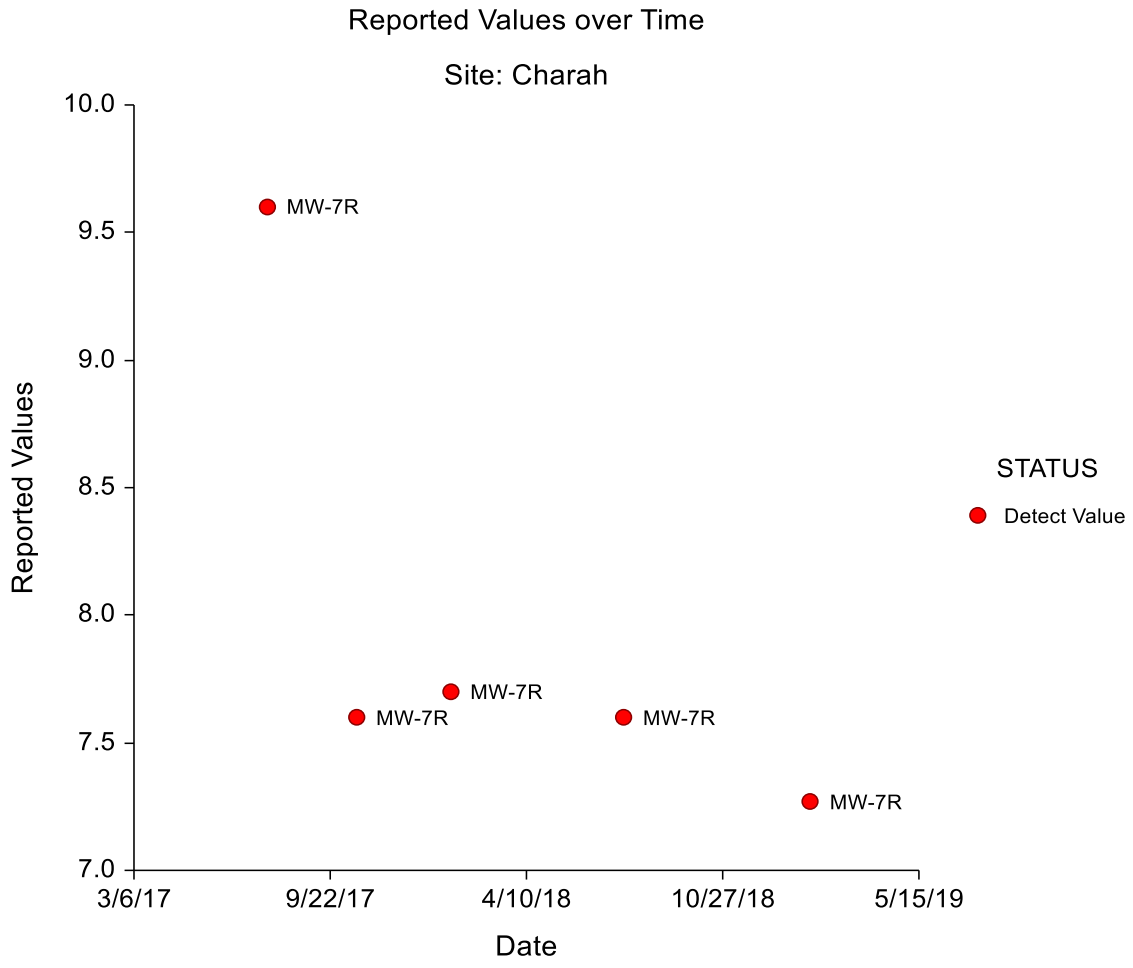


Figure 17: Sulfate Concentrations (mg/L) vs. Time (MW-7R)

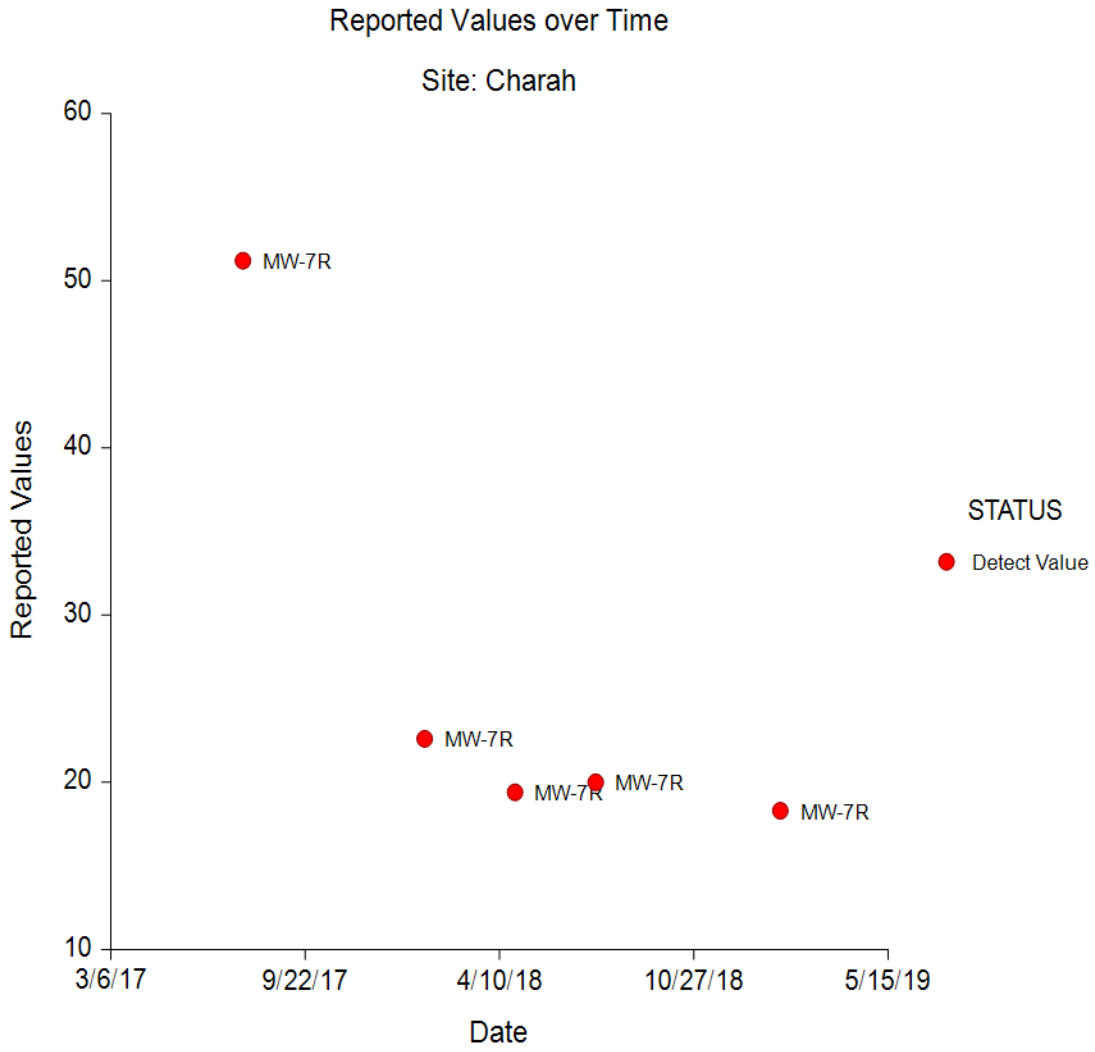
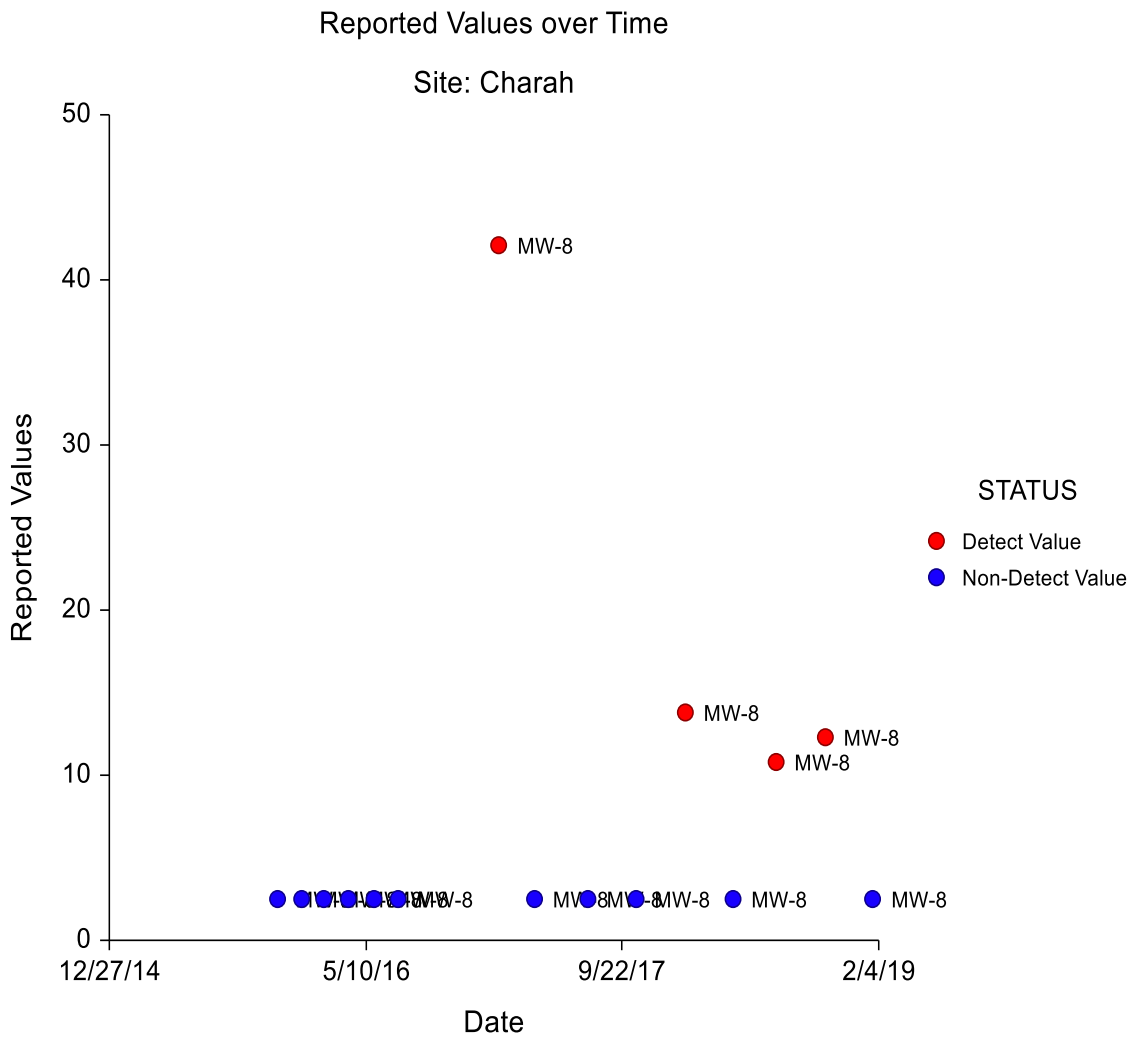


Figure 18: Nickel Concentrations (ug/L) vs. Time (MW-8)



7 References

[1] Singh, A. and Ashok Singh. ProUCL 5.1.002 Technical Guide Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations. EPA/600/R07/041, 2015.

[2] NCSS 9 Statistical Software (2013). NCSS, LLC. Kaysville, Utah, USA, ncss.com/software/ncss.

[3] R Core Team (2018). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

[4] IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.

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B

Attachment B – 2019 Second Semi-Annual Detection Monitoring Report

DENR USE ONLY: ☐ Paper Report ☐ Electronic Data - Email CD (data loaded: Yes / No) Doc/Event #:

NC DENR
Division of Waste Management - Solid Waste

Environmental Monitoring Reporting Form

Notice: This form and any information attached to it are "Public Records" as defined in NC General Statute 132-1. As such, these documents are available for inspection and examination by any person upon request (NC General Statute 132-6).

Instructions:

- **Prepare one form for each individually monitored unit.**
- **Please type or print legibly.**
- Attach a notification table with values that attain or exceed NC 2L groundwater standards or NC 2B surface water standards. The notification must include a preliminary analysis of the cause and significance of each value. (e.g. naturally occurring, off-site source, pre-existing condition, etc.).
- Attach a notification table of any groundwater or surface water values that equal or exceed the reporting limits.
- Attach a notification table of any methane gas values that attain or exceed explosive gas levels. This includes any structures on or nearby the facility (NCAC 13B .1629 (4)(a)(i).
- Send the original signed and sealed form, any tables, and Electronic Data Deliverable to: Compliance Unit, NCDENR-DWM, Solid Waste Section, 1646 Mail Service Center, Raleigh, NC 27699-1646.

Solid Waste Monitoring Data Submittal Information

Name of entity submitting data (laboratory, consultant, facility owner):

Green Meadow - Charah Solutions, Inc.

Contact for questions about data formatting. Include data preparer's name, telephone number and E-mail address:

Name: Mark Filardi, L.G. Phone: 704-338-6700

E-mail: mark.filardi@hdrinc.com

Facility name:	Facility Address:	Facility Permit #	NC Landfill Rule: (.0500 or .1600)	Actual sampling dates (e.g., October 20-24, 2006)
Charah, LLC Brickhaven No. 2 Mine Tract "A"	1271 Moncure-Flatwood Road Chatham County Moncure, NC	1910-STRUT-2015	CAMA	July 8-12, 2019

Environmental Status: (Check all that apply)

☐ Initial/Background Monitoring ☒ Detection Monitoring ☒ Assessment Monitoring ☐ Corrective Action

Type of data submitted: (Check all that apply)

☒ Groundwater monitoring data from monitoring wells
☐ Groundwater monitoring data from private water supply wells
☒ Leachate monitoring data
☒ Surface water monitoring data
☐ Methane gas monitoring data
☐ Corrective action data (specify) _____
☐ Other(specify) _____

Notification attached?

☐ No. No groundwater or surface water standards were exceeded.
☒ Yes, a notification of values exceeding a groundwater or surface water standard is attached. It includes a list of groundwater and surface water monitoring points, dates, analytical values, NC 2L groundwater standard, NC 2B surface water standard or NC Solid Waste GWPS and preliminary analysis of the cause and significance of any concentration.
☐ Yes, a notification of values exceeding an explosive methane gas limit is attached. It includes the methane monitoring points, dates, sample values and explosive methane gas limits.

Certification

To the best of my knowledge, the information reported and statements made on this data submittal and attachments are true and correct. Furthermore, I have attached complete notification of any sampling values meeting or exceeding groundwater standards or explosive gas levels, and a preliminary analysis of the cause and significance of concentrations exceeding groundwater standards. I am aware that there are significant penalties for making any false statement, representation, or certification including the possibility of a fine and imprisonment.

Mark Filardi, L.G.	Senior Geologist	704-338-6700
Facility Representative Name (Print)	Title	(Area Code) Telephone Number

Signature — 12/9/2019 (Date)

Affix NC Licensed Professional Geologist Seal

NORTH CAROLINA LICENSED SEAL 1886 GEOLOGIST MARK FILARDI

HDR Engineering, Inc. of the Carolinas, 440 S. Church St., Ste. 1000, Charlotte, NC 28202

Facility Representative Address

F0116

NC PE Firm License Number (if applicable effective May 1, 2009)

Revised 6/2009

2019 Second Semi-Annual Detection Monitoring Report

Brickhaven No.2 Mine Tract “A” Structural Fill

Charah Solutions, Inc.

Moncure, Chatham County, North Carolina
December 10, 2019

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List of Select Acronyms

µg/L	micrograms per liter
CAMA	North Carolina Coal Ash Management Act of 2014
CCP	Coal Combustion Products
DEC	Duke Energy Carolinas
DEP	Duke Energy Progress
DO	Dissolved Oxygen
EDD	Electronic Data Deliverable
EPA	United States Environmental Protection Agency
ID	Inner Diameter
KM	Kaplan-Meier Method
NCDENR	North Carolina Department of Environment and Natural Resources
NCDEQ	North Carolina Department of Environmental Quality
NCGPS	North Carolina groundwater protection standard
N	Standard Penetration Resistance
ND	Non-detects
NPPL	Non-parametric Prediction Limit
NTU	Nephelometric turbidity units
MCL	Maximum Contaminant Levels
MDL	Method Detection Limit
MLE	Maximum Likelihood Estimate
msl	mean sea level
OD	Outer Diameter
ORP	Oxidation-Reduction Potential
PL	Predictive Limit
PPL	Parametric Prediction Limit
RCRA	Resource Conservation and Recovery Act
ROS	Regression on Order Statistics
SSI	Statistically Significant Increase
UPL	Upper Prediction Limit
USCS	Unified Soil Classification System

1 Introduction

1.1 Purpose

The purpose of this *2019 Second Semi-Annual Detection Monitoring Report* is to summarize semi-annual detection monitoring at the Brickhaven No.2 Mine Tract "A" Structural Fill site in Moncure, Chatham County, North Carolina. The report includes results from the July 8-12, 2019 semi-annual detection monitoring event, as well as the statistical results calculated for this monitoring event.

The next semi-annual monitoring event will take place in January 2020.

1.2 Regulatory Compliance

Operating under Facility Permit #1910-STRUT-2015, Charah is required to monitor groundwater and surface water quality at designated locations. Per the Water Quality Monitoring Plan (Buxton, 2015a), groundwater samples are collected from 11 monitoring wells (MW-1 through MW-8, BG-1, and BG-2) and two surface water locations (SW-1 and SW-2). Groundwater samples are analyzed for constituents listed in North Carolina Department of Environmental Quality (NCDEQ) Solid Waste Appendix I and II, 40 CFR 257 Appendix III, and 40 CFR 257 Appendix IV. If sampling results indicate impacts to groundwater or surface water, Charah must notify NCDEQ within 14 days. If no impacts are observed, Charah must submit a report of the sampling results to NCDEQ with 120 days of the sampling event.

Groundwater monitoring and sampling at the site is governed by the following:

- North Carolina - Coal Ash Management Act (CAMA) of 2014 (Senate Bill 729).
- Water Quality Monitoring Plan, Brickhaven No.2 Mine Tract "A" Structural Fill, approved March 2015 (Buxton, 2015a).
- North Carolina Department of Environment and Natural Resources (NCDENR)[1] Permit No. 1910-STRUC-2015, issued June 5, 2015.
- NCDENR Solid Waste Section Guidelines for Groundwater, Soil, and Surface Water Sampling, April 2008 including Groundwater Rules .1600.
- NCDENR Division of Water Management memorandum concerning electronic document submittal for routine groundwater and surface water monitoring, November 5, 2014.
- U.S. Environmental Protection Agency (EPA) Region I, *Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells*, January 19, 2010.

Groundwater monitoring and sampling at the site is also conducted in general accordance with the U.S. EPA's "Disposal of Coal Combustion Residuals from Electric Utilities" rule (CCR Rule).

[1] On September 18, 2015, the North Carolina Department of Environment and Natural Resources (NCDENR) became the North Carolina Department of Environmental Quality (NCDEQ). Both naming conventions are used in this report, as appropriate.

1.3 Site Location and Operation

The site is located in Chatham County, approximately four miles southeast of Moncure, North Carolina (**Figure 1**). The owner of the site is Green Meadow, LLC (Green Meadow). Charah Solutions, Inc. (Charah) is responsible for the operation and maintenance of the site. The mine property is approximately 301 acres in total; of which 145 acres is permitted for structural fill placement of coal combustion products (CCP).

The property located within the structural fill area was previously owned by General Shale Brick, Inc., which operated the site and an adjacent property as a clay mine beginning in 1985 for their off-site brick manufacturing facility. Mined clay was stockpiled and then transported approximately 3.5 miles south to Brickhaven, North Carolina for brick manufacturing.

The area immediately surrounding the site primarily consists of rural residential (approximately 2,500 feet east, 1,000 feet southeast, and 1,000 feet southwest), commercial, industrial, wooded and agricultural property. According to information obtained from the Chatham County GIS website (October 2015), municipal water is available to the surrounding area.

Charah began CCP placement in the first composite liner containment system (Cell 1, Sub Cell 1A) on October 23, 2015. CCP placement has occurred in Cell 1, Cell 2, Cell 6A and Cell 6B. Charah has placed just over 7.3 million tons of CCP material in the structural fill at the time of this report. CCP materials (including fly ash, bottom ash, boiler slag, and/or flue gas desulfurization materials) were initially brought to the site by truck through October 2015 until transportation was changed to rail in January 2016. The CCP originated at the Duke Energy Carolinas (DEC) Riverbend Steam Station and Duke Energy Progress (DEP) L.V. Sutton Energy Complex (Sutton Plant) sites.

Leachate (i.e., product generated from the liquids present in the fill at the time of placement and/or stormwater that infiltrates the fill) is managed on-site through the collection, storage, and disposal of the resultant liquid. Green Meadow has approved pump and haul permits to dispose of leachate at the City of Sanford's Big Buffalo Creek Wastewater Treatment Plant and the Town of Spring Lake's South Harnett Regional Wastewater Treatment Plant.

1.4 Groundwater Monitoring System

The groundwater monitoring system was designed to provide background groundwater quality data prior to the placement of CCP in the structural fill and early detection of potential CCP constituents subsequent to CCP placement to be protective of human health and the environment. The groundwater monitoring system is comprised of ten (10) wells: eight wells are located downgradient/cross-gradient (MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-7R and MW-8) and two wells are considered to represent background groundwater quality (BG-1 and BG-2). Well construction details are presented in **Table 1**.

Background monitoring well BG-1 was installed in July of 2015 near the entrance of the site along Moncure-Flatwood Road. This location was selected to provide groundwater quality data in an area of the site presumed to not be impacted by historic or current usage of the site. Upon statistical analysis of groundwater quality data collected pre- and post-CCP placement,

concentrations of target analytes in well BG-1 appear to be anonymously low when compared to pre-CCP conditions elsewhere on-site. With approval from NCDEQ, Charah installed a second background well (BG-2) southwest of the structural fill in December 2018 to evaluate spatial variability of inorganic concentrations across the site.

Well MW-7R was installed in April of 2017 as a replacement for monitoring well MW-7, as documented and approved in the May 25, 2017 memorandum to the NCDEQ Solid Waste Section. Well MW-7 will temporarily remain onsite for water level gauging purposes only.

Table 1: Well Construction, Survey, and Groundwater Elevations

Well ID	Northing	Easting	Pad Elev. (ft.)	TOC Elev. (ft.)	TD (ft. BGS)	TD (ft. BTOC)	Screen Length (ft.)	Screened Interval (ft. BGS)	DTW (ft. BTOC)	GW Elevation (ft.)	Lithologic Unit
BG-1	670898.50	1996348.25	225.64	228.19	40.50	43.05	15	26-41	9.56	218.63	Layered Rock/PWR*
BG-2	669278.99	1990476.10	191.41	194.23	23.29	26.11	10	13-23	12.91	181.32	Layered Rock/PWR*
MW-1	674737.98	1993417.69	277.28	280.08	72.50	75.30	15	57-72	57.64	222.44	Layered Rock/PWR*
MW-2	673677.07	1994537.54	229.27	231.76	47.66	50.15	15	30-45	37.31	194.45	Layered Rock/PWR*
MW-3	672474.63	1994834.76	220.00	222.56	40.80	43.36	15	25-40	25.70	196.86	PWR
MW-4	671326.48	1994974.40	214.49	217.13	22.70	25.34	10	13-23	12.13	205.00	Residuum/PWR
MW-5	671081.19	1993779.03	242.72	244.86	44.00	46.14	10	34-44	20.75	224.11	PWR
MW-6	671267.60	1992793.34	228.63	231.10	27.00	29.47	15	12-27	7.00	223.951	Residuum/PWR
MW-7	672306.28	1992642.35	229.53	231.71	15.00	17.18	10	5-15	15.89	215.82	Residuum/PWR
MW-7R	672221.96	1992702.98	239.99	242.22	36.00	39.94	10	26-36	20.48	219.46	Residuum/PWR
MW-8	673304.83	1992200.37	233.41	236.47	46.00	49.06	15	31-46	37.56	198.91	PWR

Notes:

1. Top-of-casing, ground surface elevations and horizontal locations at MW-4 (PZM-1), MW-5 (PZM-22) and MW-7 (PZM-27) surveyed by Lawrence Surveying of Monroe, NC.
2. Top-of-casing, ground surface elevations and horizontal locations at BG-1, MW-1, MW-3, MW-6, MW-8 and MW-7R surveyed by McAdams of Durham, NC.
3. Top-of-casing, ground surface elevations and horizontal location at monitoring well MW-2 surveyed by McAdams of Durham, NC.
4. Top-of-casing, ground surface elevations and horizontal location at monitoring well BG-2 surveyed by McAdams of Durham, NC.
5. TD=total depth; BGS=below ground surface; TOC=top of casing; DTW = Depth-to-Water; BTOC = below top-of-casing; GW = groundwater.
6. Depth to water measurements obtained on July 8, 2019, to the nearest 0.01 foot with a water level meter.
7. Well locations and elevations based on NAD 83 horizontal datum and NGVD88 vertical datum.
8. * = interpreted lithologic unit based on relative drilling hardness and geologic judgment during well installation.

1.5 Site Topography and Geographical Setting

Based on review of the 1993 USGS topographic quadrangle (**Figure 2**) and GIS mapping, the topography of the site and immediately surrounding area can be characterized by moderately rolling hills, which are dissected by dendritic creeks. Prior to mining by General Shale, a topographic ridge was present within the site, extending from the northwestern corner of the present-day structural fill toward the southeast. Thus, historic drainage was to the north/northwest/west and to the northeast/east/southeast away from the ridge, as shown on **Figure 3**.

1.6 Geologic and Hydrogeologic Setting

1.6.1 Regional Geology

The site is located within the Piedmont physiographical province of North Carolina, which is a northeast-southwest trending region extending from New York to Alabama.

According to the 1985 North Carolina Geologic Map prepared by the North Carolina Geological Survey, the site is located in the Triassic Basin Belt of the Piedmont physiographic province. The basement rocks of the Triassic Basin Belt include conglomerate, sandstone, mudstone, limestone, coal, and shale. The majority of the subject property is located within the Sanford Formation which contains conglomerate, fanglomerate, sandstone, and mudstone. The far western portion of the site is located in the Cummock Formation which contains sandstone, mudstone, gray and black coal, and carbonaceous shale. The Triassic Basin is bounded by felsic metavolcanic rock within the Carolina Slate Belt approximately 6.5 miles to the northwest; and is contacted by metamorphosed granite and biotite gneiss and schist of the Raleigh Belt along a normal fault approximately 2.5 miles to the southeast. The Triassic Basin formations have been intruded by north northwest-south southeast trending igneous diabase dikes during the Jurassic Period (~144 to 208 Ma), and contain northeast-southwest trending normal faults. However, none of these faults were indicated to exist at the subject site on the 1985 geologic map (NCDENR, 1985).

In the Piedmont, the bedrock is typically overlain by a mantle of weathered rock (residuum/saprolite), which has an average thickness of approximately 25 feet. The residuum/saprolite consists of varying amounts of unconsolidated clays, silts, and sands, with lesser amounts of rock fragments. Due to the range of the parent rock composition and the variable susceptibility to weathering of each rock type, the residuum/saprolite range widely in color, texture, and thickness. Generally, the residuum/saprolite is thickest near inter-stream divides (ridges) and thins toward stream beds. In profile, the residuum/saprolite normally grades from clayey soils near the land surface to sandier, partially weathered rock above competent bedrock (Buxton, 2014).

1.6.2 Site Geology

The geology of the site can be subdivided into six units which include fill, flood plain, soil horizon, residuum, partially weathered rock, and layered rock. These units generally grade downward from a soil horizon, to residuum, to partially weathered rock and finally layered rock. Fill materials were limited to the road bed and berm located around the east and west sides of

MW-4. Flood plain sediments were only identified at MW-4 on the southeast corner of the site. The following summary of site-specific units is based on boring logs originally included in the *Design Hydrogeologic Report* (Buxton, March 2016).

FILL

Fill materials were primarily identified in the road bed and berm located around the east and west sides near MW-4 and generally consisted of mottled reddish yellow, orange, brown, and light gray sandy silty clay with quartz and brick gravel.

FLOOD PLAIN

Flood plain sediments were only located adjacent to MW-4 on the southeast corner of the site. Sediments were associated with a former adjacent intermittent tributary creek and can be generally characterized as mottled light gray fine sandy silty clay. The flood plain sediments were approximately 5 feet thick in this area and had been deposited above residuum. Based on geotechnical laboratory data, the flood plain sediments were identified as lean clay (CL) under the Unified Soil Classification System (USCS).

SOIL HORIZON

The soil horizon is characterized as mottled yellowish, brown, orange, and red silty clay and clayey silt. Root structures were common. The soil horizon at the site is formed from the continued weathering and biologic reworking of residuum, and ranges from 2 to 15 feet in thickness, when present. Based on geotechnical laboratory data, the soil horizon consisted of clayey sand (SC), elastic silt (MH), and lean clay (CL) and had a hydraulic conductivity of 2.86 x 10^{-7} cm/sec.

RESIDUUM

Residuum is characterized as mottled (black and gray) red and reddish brown sandy silty clay with infrequent quartz gravel and cobbles. Residuum is characteristically fissile, often breaking in horizontal sheets. Residuum generally retains the remnant texture, structure and mineral content of the rock from which it was formed, and ranges from 5 to 15 feet in thickness. Residuum has a Standard Penetration Resistance (N) of less than 100 blows per foot. Based on geotechnical laboratory data, the residuum consisted of lean clay (CL) with hydraulic conductivity ranging from 7.69 x 10^{-8} cm/sec to 3.69 x 10^{-9} cm/sec.

PARTIALLY WEATHERED ROCK

Partially weathered rock is characterized as mottled (light green and purple) brown, reddish gray, and weak red silty clay and weathered mudstone, which are often fissile. Partially weathered rock generally retains the remnant texture, structure, and mineral content of the rock from which it was formed, and ranges from 5 to 40 feet in thickness. Partially weathered rock has an N-value of 100 blows per foot or greater and can generally be drilled with standard hollow-stem auger drilling technology. Based on geotechnical laboratory data, partially weathered rock consisted of lean clay (CL). Hydraulic conductivity ranged from 2.433 x 10^{-4} cm/sec to 7.154 x 10^{-8} cm/sec, according to slug or recovery test data (for wells screened solely in partially weathered rock).

LAYERED ROCK

Based on rock coring activities conducted near MW-7/MW-7R and visual inspection of the layered rock exposed on the north side of the MW-4 area, layered rock at the site is primarily composed of reddish to light tan gray mudstone, cross-bedded muddy sandstone, and muddy sandy conglomerate (rounded quartz gravel and cobbles). Layered rock generally occurs as horizontally oriented and relatively thin intermittent layers (especially within the upper 15 feet of contacting layered rock) across the site, based on rock coring and the horizontal fissile nature of residuum and partially weathered rock. Layered rock contained horizontal to near vertical fracturing. Large fractures, oriented approximately N 40º to 60º E at 70 º northwest, were observed in weathered mudstone to the immediate northeast near MW-8. Rock Quality Designation (RQD) values for the MW-8 area rock core (21-inch recovery) were poor (47.6%). The occurrence of layered rock at the site was generally defined by auger refusal.

1.6.3 Regional Hydrogeology

The occurrence and movement of groundwater in the Piedmont physiographic province are within two separate but interconnected water-bearing zones that typically comprise one aquifer. A shallow water-bearing zone typically occurs within the residuum/saprolite and a deeper zone within the underlying bedrock.

Groundwater in the residuum/saprolite zone occurs in the interstitial pore spaces between the individual sediment grains. Groundwater in this zone generally flows from topographic highs to topographic lows. The occurrence and movement of groundwater in the underlying bedrock zone are controlled by joints and fractures within the bedrock. Groundwater within this deeper zone may occur under confined or semi-confined conditions, depending on the extent of fracturing at the saprolite/bedrock interface. Deeper groundwater movement is typically controlled by the distribution of openings in the bedrock and can be variable.

2 Groundwater Flow Characteristics

On July 8, 2019, groundwater depth was measured in each well. Depths-to-water ranged from 7.00 feet (MW-6) to 57.64 feet below top of casing (MW-1). Groundwater elevations ranged from 181.32 feet in well BG-2 to 224.11 feet in well MW-5 (**Table 1**). Historic groundwater elevations are shown in **Table 2**. Monitoring well locations are shown on **Figure 3**.

Table 2: Historic Groundwater Elevations

Well ID	TOC Elev.	Groundwater Elevation													
		Oct-15	*Nov-15*	*Jan-16*	*Feb-16*	*Apr-16*	*Jun-16*	*Jul-16*	*Jan-17*	*Apr-17*	*Jul-17*	*Jan-18*	*Jul-18*	*Jan-19*	*Jul-19*
BG-1	228.19	215.70	216.83	218.14	218.94	218.46	218.46	218.74	217.08	216.61	216.76	211.96	215.37	218.50	218.63
BG-2	194.23	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	183.28	181.32
MW-1	280.08	220.18	220.55	222.03	222.76	221.83	221.83	221.51	220.58	219.72	219.19	217.61	218.03	220.52	222.44
MW-2	229.97	190.20	192.90	197.19	198.82	201.17	201.17	204.62	205.42	201.63	201.58	186.33	195.65	195.61	194.45
MW-3	222.56	208.46	210.29	210.64	212.31	212.36	212.36	204.81	202.35	202.36	203.91	199.53	194.38	199.03	196.86
MW-4	217.13	206.37	206.83	206.98	211.36	208.34	208.34	205.66	203.67	203.30	204.10	202.16	203.43	204.16	205.00
MW-5	244.86	229.66	230.11	230.16	228.69	220.06	220.06	222.96	203.32	221.53	222.60	218.86	221.93	223.86	224.11
MW-6	231.1	223.99	223.97	224.53	224.75	224.13	224.13	224.07	224.54	223.31	223.58	222.14	222.21	224.89	223.95
MW-7	231.71	222.36	222.53	216.11	215.31	215.66	215.65	216.21	215.42	215.59	216.09	215.03	215.97	215.40	215.82
MW-7R	242.22	NG	NG	NG	NG	NG	NG	NG	NG	NG	220.92	217.54	220.30	219.82	219.46
MW-8	236.47	200.58	201.35	200.60	200.55	199.49	199.49	199.82	199.31	199.11	198.98	198.75	198.45	201.85	198.91

Note:
1. NG – Not Gauged; MW-7R installed April 2017 and BG-2 installed December 2018.

2.1.1 Groundwater Flow Direction

Groundwater at the site flows away from the historic north to south trending topographic ridge that was present prior to mine development by General Shale (**Figure 4**). Groundwater elevations and general flow directions remain consistent with previous background and detection monitoring events.

2.1.2 Hydraulic Conductivity

Horizontal hydraulic conductivity of aquifer materials adjacent to the well screen were estimated through in-situ slug testing during the *Design Hydrogeologic Report* (Buxton, 2016). Results are provided in **Table 3**.

Table 3: Hydraulic Conductivity

Well ID	Screen Length (ft)	Screened Interval (ft)	Estimated Effective Porosity (%)	Hydraulic Conductivity (K, cm/sec)	Lithologic Unit
BG-1	15	26-41	0.075	7.76E-05	Layered Rock/PWR*
BG-2	10	13-23	NA	NA	Layered Rock/PWR*
MW-1	15	57-72	0.075	4.11E-04	Layered Rock/PWR*
MW-2	15	30-45	0.05	3.41E-06	Layered Rock/PWR*
MW-3	15	25-40	0.05	4.08E-07	PWR
MW-4	10	13-23	0.14	1.41E-04	Residuum/PWR
MW-5	10	34-44	0.075	8.01E-06	PWR
MW-6	15	12-27	0.15	1.10E-04	Residuum/PWR
MW-7	10	5-15	0.15	1.26E-06	Residuum/PWR
MW-8	15	26-36	0.075	1.29E-04	PWR

Notes:
1. Hydraulic conductivity values determined by Buxton Environmental, Inc. on September 10, 2015, by conducting rising head slug tests; and solved utilizing the Bouwer-Rice (unconfined slug test) solution with AQTESOLV for Windows Version 4.50 software by Hydrosolv, Inc. (1996-2007).
2. Effective porosity values from geotechnical testing and the literature (McWhorter and Sunada, 1977; Sinhal and Gupta, 2010) where geotechnical data was not available.
3. MW-7R and BG-2 were installed after the Hydrogeologic Report was submitted; MW-7 was utilized for evaluation in lieu of data from MW-7R.
4. * = interpreted lithologic unit based on relative drilling hardness during well installation.
5. NA=Not Analyzed

2.1.3 Horizontal Hydraulic Gradients

Horizontal hydraulic gradient is calculated by taking the difference in hydraulic head over the length of the flow path between two wells of similar construction and (generally) perpendicular to flow. Given that the historic ridge runs approximately north-south through the structural fill and that no monitoring wells have been installed through the liner system of the fill, horizontal hydraulic gradient was calculated between wells MW-5 and MW-4 and MW-1 to MW-2, recognizing that MW-1 to MW-2 is not truly perpendicular to flow, as shown on **Figure 4**. Hydraulic gradients at the site during this sampling event are depicted in **Table 4.**

Table 4: Horizontal Hydraulic Gradients (i, dh/dl)

Upgradient Well	Downgradient Well	Upgradient Groundwater Elevation (ft)	Downgradient Groundwater Elevation (ft)	Linear Flow Distance (ft)	Hydraulic Gradient
MW-1	MW-2	222.44	194.45	1,543	0.018
MW-5	MW-4	224.11	205.00	1,220	0.016

Notes:
1. Horizontal hydraulic gradients calculated by dividing the difference in hydraulic head between a well pair by the length of the flow path between the well pair. (*i*= dh/dl)
2. All well pairs assumed to be screened in same surficial aquifer unit
3. Horizontal flow path distance calculated by

$$\sqrt{(Easting_1 - Easting_2)^2 + (Northing_1 - Northing_2)^2}$$

4. Top-of-casing elevation and horizontal location for well MW-5 surveyed by Lawrence Surveying of Monroe, NC.
5. Top-of-casing elevations and horizontal locations for wells MW-1 and MW-3 surveyed by McAdams of Durham, NC.
6. Top-of-casing elevation and horizontal location for well MW-2 surveyed by Gregory C. Bewley.
7. Groundwater elevations calculated for depth-to-water measurements recorded on July 8, 2019.

2.1.4 Groundwater Flow Velocity

The average linear velocity, or seepage velocity, of groundwater between wells at the site was calculated using Darcy's Law, as follows:

$$V_S = \frac{Ki}{P_e}$$

Where:

V_s = seepage velocity
K = horizontal hydraulic conductivity
i = horizontal hydraulic gradient
P_e = effective porosity

Seepage velocities for groundwater were calculated using horizontal hydraulic gradients, as referenced above, average horizontal hydraulic conductivity and estimated effective porosity values from geotechnical testing and from the literature where geotechnical data was not available (Buxton, 2014; Sinhal and Gupta, 2010).

Seepage velocity varies on a well-by-well basis and was calculated between the MW-1/MW-2 and MW-5/MW-4 well pairs, representing the two well pairs that are roughly perpendicular to the direction of groundwater flow. Seepage velocity was calculated at 11.2 feet per year (between MW-1 and MW-2) and 5.1 feet per year (between MW-5 and MW-4) for this sampling event. Historical seepage velocities are shown in **Table 5**.

Table 5: Historical Seepage Velocity

	Seepage Velocity (ft/yr)							
Well Pair	2015 Dec	2016 May	2017 Jan	2017 Jul	2018 Jan	2018 Jul	2019 Jan	2019 Jul
MW-1/MW-2	62.8	6.78	6.1	7.1	12.5	9.0	10.0	11.2
MW-4/MW-5	15.6	4.59	0.1	4.9	4.4	4.9	5.2	5.1

3 Sampling Procedures

3.1 Groundwater Sampling Procedures

HDR collected groundwater samples from the monitoring well network between July 8 and 11, 2019. Purging was conducted via low-flow methods and was considered complete when the water table and field parameters had stabilized in accordance with the targets specified below.

- Turbidity (10% for values greater than 5 NTU (if three turbidity values are less than 5 NTU, the values are considered stabilized)
- DO (10% for values greater than 0.5 mg/L, if three DO values are less than 0.5 mg/L, the values are considered stabilized)
- Specific conductance (3%)
- Temperature (3%)
- pH (± 0.1 unit)
- ORP (± 10 millivolts)

In cases where water level in the well would not stabilize, the well was pumped dry and groundwater samples were collected with disposable bailers upon recovery of adequate volume for sampling. Field data sheets are provided in **Appendix A**.

All non-disposable equipment was decontaminated after each use by washing in a Liqunox® detergent solution followed by a tap-water rinse. Purge water was discharged to the ground surface adjacent to each well.

Samples were shipped under Chain of Custody (COC) procedures to Pace Analytical Services, LLC (Pace) for analysis. Sample handling and custody were performed according to the EPA Guidance for Field Samplers.

3.2 Surface Water Sampling Procedures

Surface water samples were collected from two locations outside of the structural fill boundary to evaluate potential groundwater to surface water interaction. Surface water sample SW-1 was collected approximately 500 feet south of the MW-4 outside of the property boundary along an unnamed tributary of Gulf Creek. Surface water sample SW-2 was collected south and adjacent to the rail spur west of the structural fill along an unnamed tributary of Shaddox Creek. Prior to sample collection, field parameters (temperature, specific conductance, DO, pH, turbidity, and ORP) were measured with a water quality meter and recorded on field data sheets (**Appendix A**). Surface water sampling locations are shown on **Figure 3**.

3.3 Leachate Sampling Procedures

One leachate sample (Leachate) was collected from the on-site storage holding tanks. The leachate sample is used to evaluate potential on-site leachate impacts. The leachate sample location is shown on **Figures 3**

4 Water Quality

Groundwater samples were collected from 8 of 11 monitoring wells (MW-1, MW-4 through MW-8, BG-1, and BG-2) and two surface water locations (SW-1 and SW-2). Groundwater samples were not collected from MW-2 and MW-3 due to the wells being purged dry and not recharging. MW-7 is no longer sampled since it was replaced by MW-7R. Groundwater samples are analyzed for constituents listed in NCDEQ Solid Waste Appendix I and II, 40 CFR 257 Appendix III, and 40 CFR 257 Appendix IV.

4.1 Background Site Conditions

Two groundwater sampling events were conducted prior to CCP placement (August and October 2015). The background sampling events consisted of sample collection and analysis from nine monitoring wells (MW-1 through MW-8 and BG-1) and two surface water sample locations (SW-1 and SW-2).

During these initial background monitoring events, chloride, pH, TDS, and vanadium were detected at concentrations that exceeded their North Carolina 2L Groundwater Protection Standards (2L Standard) or Interim Maximum Allowable Concentration (IMAC) in groundwater samples collected from background monitoring well BG-1. Antimony, barium, chloride, chromium, cobalt, pH, TDS, and vanadium were detected at concentrations that exceeded their respective 2L Standards or IMACs in other monitoring wells prior to ash placement. Additional target analytes were detected in the samples from well BG-1 and other wells; however, these concentrations did not exceed applicable standards.

Copper and cobalt concentrations that exceeded their respective NC Surface Water & Wetland Standards (2B Standards) were reported in surface water samples collected during the initial background monitoring events, prior to CCP placement. Additionally, all EPA Appendix III constituents were detected in the surface water samples collected prior to CCP material placement, but at concentrations below their respective 2B Standards (if applicable).

During the first monitoring event (August 2015), bromodichloromethane and dibromochloromethane were detected at concentrations above their respective 2L Standards in groundwater samples collected from MW-2, MW-3, and MW-7. Volatile organic compounds (VOCs), including trihalomethanes, are not present naturally at the site. These detections are attributed to the use of municipal water during previous well development activities. VOCs were not detected above laboratory method detection limits (MDLs) in any subsequent (2nd through 8th) background sampling events.

A detailed discussion of background groundwater conditions can be found in the *2016 Background Sampling Report* (HDR, 2016b). Additional discussion of the statistical results can be found in **Section 5** of this report for a better understanding of predictive limits for the background well locations (BG-1 and BG-2), as well as interwell interactions.

4.2 Groundwater Analytical Results

Concentrations of the following constituents have exceeded 2L Standards or IMACs in one or more wells: chloride, pH, TDS, antimony, barium, chromium, cobalt, nickel, and vanadium. The antimony MDL (3.0 µg/L) is greater than the 2L Standard (1.0 µg/L). Antimony was detected in one sample (MW-7R), in which it exceeded the 2L Standard. EPA Appendix I VOCs were not detected above laboratory method detection limits. Analytical results are presented in **Table 6**. Concentration versus time plots generated for three constituents (barium, chloride, and TDS) with the most frequent detections and/or exceedances are included in **Appendix B**.

The presence of naturally occurring inorganic constituents above regulatory criteria is common in North Carolina due to various geologic conditions. The presence of naturally occurring metals (i.e., weathering of crystalline parent material) is discussed in more detail in the *Initial Background Groundwater & Surface Water Monitoring Event* (Buxton, 2015c). The laboratory report for the current sampling event is provided in **Appendix C**. Electronic data deliverables (EDDs) are provided in **Appendix D**.

Table 6: Analytical Results - July 2019

Analyte	CAS Number	Pre-ash concentration range	2L Standard / IMAC	BTV (1Q2019)	Groundwater Analysis										Quality Control				Surface Water Analysis			Leachate Analysis
					BG-1	BG-2	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7R	MW-8	Amb. Blank	Equip. Blank	Trip Blank	DUP (MW-8)	SW-1	SW-2	2B Standard	LEACHATE
EPA APPENDIX III																						
Boron (µg/l)	7440-42-8	*6.01 - 53.10*	*700*	*9.26*	<2.60	<5.10	<2.60	DRY	DRY	<2.60	<12.80	<2.60	<12.80	<12.80	<2.60	<2.60	NT	<12.80	<12.80	40.5	*NE*	3,250
Calcium (µg/l)	7440-70-2	*16,900 - 185,000*	*NE*	*89,600*	27,900	**111,000**	**216,000**	DRY	DRY	69,400	14,300	37,800	**102,000**	**94,600**	<24.20	<24.20	NT	**98,000**	11,400	35,400	*NE*	310,000
Chloride (µg/l)	16887-00-6	*2,220, - 1,166,000*	*250,000*	*355,000*	228,000	234,000	**855,000**	DRY	DRY	**467,000**	22,300	208,000	275,000	309,000	<0.60	<0.60	NT	312,000	7,800	50,200	*250,000*	18,300
Fluoride (µg/l)	16984-48-8	*<20 - 590*	*2,000*	*189*	180	**190**	**170**	DRY	DRY	**340**	**600**	**380**	120	<50	<50	<50	NT	<50	250	160	*1,800*	220
pH (standard units)	pH	*6.17 - 7.70*	*6.5-8.5*	*6.05 - 7.07*	6.30	6.93	6.50	DRY	DRY	6.23	6.25	6.15	**7.29**	7.01	NT	NT	NT	7.01	7.01	7.78	*6.0-9.0*	7.78
Sulfate (µg/l)	14808-79-8	*3,700 - 199,000*	*250,000*	*64,700*	20,600	**102,000**	7,200	DRY	DRY	11,200	3,500	25,800	16,800	7,500	<500	<1000	NT	7,500	21,600	47,000	*250,000*	592,000
Total Dissolved Solids (µg/l)	TDS	*296,000 - 2,770,000*	*500,000*	*2,630,000*	638,000	952,000	1,800,000	DRY	DRY	1,170,000	254,000	574,000	790,000	768,000	<25,000	<25.0	NT	792,000	1,090,000	225,000	*500,000*	1,490,000
EPA APPENDIX IV																						
Antimony (µg/l)	7440-36-0	*<3.80 - 12.00*	*1*	*3.90*	<3.0	<3.0	<3.0	DRY	DRY	<3.0	<3.0	<3.0	**13.6**	<3.0	<3.0	<3.0	NT	<3.0	<3.0	<3.0	*5.6*	<3.0
Arsenic (µg/l)	7440-38-2	*<2.50*	*10*	*5.00*	<4.7	<4.7	<4.7	DRY	DRY	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	NT	<4.7	10.6	<4.7	*10*	20.5
Barium (µg/l)	7440-39-3	*117 - 1,240*	*700*	*433*	346	108	261	DRY	DRY	319	153	47.8	395	**976**	<1.0	<1.0	NT	**992**	737	81.0	*1,000*	76.9
Beryllium (µg/l)	7440-41-7	*<0.50*	*4*	*0.500*	<1.0	<0.20	<0.20	DRY	DRY	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	NT	<0.20	1.3	<0.20	*6.5*	<0.20
Cadmium (µg/l)	7440-43-9	*<0.50*	*2*	*0.500*	<0.40	<0.40	<0.40	DRY	DRY	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	NT	<0.40	<0.40	<0.40	*2*	<0.40
Chromium (µg/l)	7440-47-3	*<2.50 - 33.90*	*10*	*2.50*	<5.0	<5.0	<5.0	DRY	DRY	<1.0	<1.0	<1.0	**1,940**	<1.0	<1.0	<1.0	NT	<1.0	16.3	<1.0	*50*	<1.0
Cobalt (µg/l)	7440-48-4	*<2.50 - 7.00*	*1*	*2.50*	<5.0	<5.0	<5.0	DRY	DRY	<1.10	<1.10	<1.10	**20.4**	<1.10	<1.10	<1.10	NT	<1.10	13.8	<1.10	*3*	<1.10
Fluoride (µg/l)	16984-48-8	*<20 - 590*	*2,000*	*189*	180	**190**	170	DRY	DRY	**340**	**600**	**380**	120	<50	<50	<50	NT	<50	250	160	*1,800*	220
Lead (µg/l)	7439-92-1	*<2.50 - 6.30*	*15*	*2.50*	<1.60	<1.60	<1.60	DRY	DRY	<1.60	<1.60	<1.60	**6.8**	<1.60	<1.60	<1.60	NT	<1.60	46.3	<1.60	*25*	<1.60
Lithium (µg/l)	7439-93-2	*7.50 - 70.40*	*NE*	*42.7*	17.1	14.9	35.6	DRY	DRY	26.8	11.6	22.7	31.7	21.1	<0.42	<0.42	NT	21.8	13.2	<0.42	*NE*	51.2
Mercury (µg/l)	7439-97-6	*<0.10*	*1*	*0.100*	<0.1	<0.1	<0.1	DRY	DRY	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NT	<0.1	<0.1	<0.1	*0.012*	<0.1
Molybdenum (µg/l)	7439-98-7	*<2.50 - 20.60*	*NE*	*6.80*	**10.8**	**11.3**	**14.5**	DRY	DRY	**18.7**	<0.9	**8.3**	**49.5**	5.2	<0.9	<0.9	NT	5.4	<0.9	<0.9	*160*	248
Selenium (µg/l)	7782-49-2	*<5.00*	*20*	*5.00*	<4.7	<4.7	<4.7	DRY	DRY	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	<4.7	NT	<4.7	<4.7	<4.7	*5*	<4.7
Thallium (µg/l)	7440-28-0	*<5.00*	*0.28*	*13.7*	<0.06	<0.12	<0.06	DRY	DRY	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	NT	<0.06	0.19	<0.06	*0.24*	<0.72
Radium 226 (pCi/l)	13982-63-3	*0.0774 - 0.820*	*NE*	*0.800*	0	0.247	**1.03**	DRY	DRY	0.76	-0.0968	0.681	0.316	0.105	0.459	-0.0338	NT	0.28	2.08	1.04	*NE*	0.458
Radium 228 (pCi/l)	15262-20-1	*0.0230 - 1.56*	*NE*	*1.29*	0.823	0.205	**1.45**	DRY	DRY	0.556	0.987	0.685	0.686	0.535	0.403	0.557	NT	0.649	1.96	0.658	*NE*	0.517
Combined Radium (pCi/l)	7440-14-4	*0.304 - 2.93*	*NE**	*2.09*	0.823	0.452	**2.48**	DRY	DRY	1.32	0.987	1.37	1.00	0.64	0.862	0.557	NT	0.929	4.04	1.7	*NE*	0.975
EPA APPENDIX I METALS																						
Copper (µg/l)	7440-50-8	*<2.50 - 16.40*	*1,000*	*2.50*	<2.10	<2.10	<2.10	DRY	DRY	<2.10	**5.6**	**5.5**	**79.3**	<2.10	<2.10	<2.10	NT	<2.10	22.5	<2.10	*7*	<2.10
Nickel (µg/l)	7440-02-0	*<2.50 - 18.20*	*100*	*2.50*	<0.9	<0.9	<0.9	DRY	DRY	**5.1**	<0.9	<0.9	**880**	<0.9	<0.9	<0.9	NT	<0.9	12	<0.9	*88*	9.1
Silver (µg/l)	7440-22-4	*<2.50*	*20*	*2.50*	<2.50	<2.50	<2.50	DRY	DRY	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	NT	<2.50	<2.50	<2.50	*0.06*	<2.50
Vanadium (µg/l)	7440-62-2	*<2.50 - 9.90*	*0.3*	*5.50*	<1.30	<1.30	<1.30	DRY	DRY	<1.30	<1.30	<1.30	**18.8**	<1.30	<1.30	<1.30	NT	<1.30	78.1	<1.30	*NE*	<1.30
Zinc (µg/l)	7440-66-6	*<5.00 -106*	*1,000*	*10.0*	<3.90	<3.90	<3.90	DRY	DRY	<3.90	**11.4**	<3.90	**53.4**	<3.90	<3.90	<3.90	NT	<3.90	83.5	<3.90	*50*	<3.90
EPA APPENDIX I VOCs																						
Acetone (µg/l)	67-64-1	*<10.00*	*6,000*	*10.0*	<6.20	<6.20	<6.20	DRY	DRY	<6.20	<6.20	<6.20	<6.20	<6.20	<6.20	<6.20	<6.20	<6.20	<6.20	<6.20	*2,000*	<6.20
Bromodichloromethane (µg/l)	75-27-4	*<0.18*	*0.6*	*0.260*	<0.26	<0.26	<0.26	DRY	DRY	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	*NE*	<0.26
Bromoform (µg/l)	75-25-2	*<0.26*	*4*	*0.620*	<0.62	<0.62	<0.62	DRY	DRY	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	*4.3*	<0.62
Chloroform (µg/l)	67-66-3	*<0.14 - 1.80*	*70*	*2.30*	<2.30	<2.30	<2.30	DRY	DRY	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30	*5.6*	<2.30
Dibromochloromethane (µg/l)	124-48-1	*<0.21*	*0.4*	*0.41*	<0.41	<0.41	<0.41	DRY	DRY	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	*NE*	<0.41
Carbon Disulfide (µg/l)	75-15-0	*<1.20*	*700*	*1.20*	<0.40	<0.40	<0.40	DRY	DRY	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	*NE*	<0.40
Dibromomethane (µg/l)	74-95-3	*<0.21*	*70*	*0.460*	<0.46	<0.46	<0.46	DRY	DRY	<0.46	<0.46	<0.46	<0.46	<0.46	<0.46	<0.46	<0.46	<0.46	<0.46	<0.46	*47*	<0.46
1,4-Dichlorobenzene (µg/l)	106-46-7	*<0.33*	*6*	*0.330*	<0.26	<0.26	<0.26	DRY	DRY	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	*63*	<0.26

Notes:

* = no established 2L Standard. 5 (pCi/l) is the Federal Standard

†= potential SSIs as they are non-detected constituents that had detected values

BTV = background threshold value calculated for January 2019

NE = not established

NT = not tested

VOCs = volatile organic compounds

µg/l = micrograms per liter

pCi/l - picocuries per liter

Shaded = concentration reported above established 2L Standard, IMAC, or 2B Standard

Bold/Underlined = concentration exceeded BTV

2L Standard = North Carolina Groundwater Protection Standard (T15A NCAC 02L .0202)

IMAC = Interim Allowable Maximum Concentration

2B Standard = North Carolina Surface Water and Wetland Standards (15A NCAC 02B) for Gulf Creek (SW-1) a Shaddox Creek (SW-2) which are both Class WS-IV Waters or are National Criteria per EPA

pH was field tested

Groundwater, surface water, and leachate samples collected from January 21-25, 2019 and analyzed for above parameters by Pace Analytical Services, LLC

Pre-ash concentration range = range of concentrations taken from MW-1 thru MW-8 and BG-1 during the October 2015 sampling event

4.3 Surface Water Analytical Results

Surface water samples were compared to the North Carolina Water Quality Standards for Surface Waters established under T15A NCAC 02B (2B Standards) or the EPA National Criteria Standard (utilized by the North Carolina Division of Water Quality as default standards for parameters not listed in 15A NCAC 02B). Concentrations of the following constituents have exceeded 2B Standards at sampling location SW-1: TDS, arsenic, lead and zinc. Though silver was not detected, the silver MDL (2.50 µg/L) is greater than the 2B Standard (0.06 µg/L). No exceedances of target analytes were reported in the surface water sample collected from the SW-2 location.

Standards have not been established under T15A NCAC 02B for the following constituents detected: boron, calcium, cobalt, lithium, radium 226, radium 228, vanadium, bromodichloromethane, dibromochloromethane, and carbon disulfide. Laboratory results are presented in **Table 6**.

4.4 Leachate Analytical Results

One sample of leachate generated on-site was collected and analyzed this event. In general, results have shown a declining trend for EPA Appendix III, Appendix IV, and Appendix I Metal analytes when compared to results from previous events. The July 2019 Leachate sample had slightly higher concentrations in detected analytes than the previous January 2019 sampling event, but are within historical ranges, except for sulfate and TDS which showed historical highs. Leachate sampling is required by the Permit to Operate and is disposed of in compliance with the Clean Water Act at either the City of Sanford's Big Buffalo Creek Wastewater Treatment Plant or the Town of Spring Lake's South Harnett Regional Wastewater Treatment Plant.

5 Statistics

5.1 Methodology

Background groundwater quality was evaluated to establish statistically-derived background concentrations for the site. Groundwater quality in downgradient wells were then compared to background concentrations to determine if a statistically significant increase (SSI) over background has occurred, as required by Section .1600 rules of the North Carolina Solid Waste Management Rules 15A NCAC 13B.

Sampling results used to establish background threshold values (BTVs) were obtained during sixteen monitoring events performed between October 2015 and January 2019. BTVs were not updated during this sampling event. Therefore, July 2019 sampling results were not used in the statistical analysis of BTVs. Downgradient sampling results from two detection monitoring rounds in January 2019 and July 2019 were used to evaluate for SSIs. Software packages ProUCL, NCSS, R and SPSS were used in the production of the statistics (ProUCL is offered by the USEPA; R is a free software environment; NCSS and SPSS are licensed software packages).

Groundwater samples collected as part of the monitoring program were analyzed for EPA Appendix III and Appendix IV constituents, Appendix I Metals, and Appendix I Volatile Organic Compounds (VOCs). Only non-filtered sample results were utilized for the statistical analysis of monitored constituents.

5.1.1 Statistical Analysis

The background sample size (i.e., quantity of qualifying samples) was evaluated per constituent. Descriptive statistics were calculated for the background data set including non-detect (ND) values and excluding ND values. When NDs were included in the data set, the method detection limit (MDL) was substituted as the ND value for simple descriptive statistics. The analysis was performed with NDs removed to better understand the central tendency and range of the detected values. Note that for the trend analyses in **Section 5.1.4** and for the establishment of statistically-derived background concentration levels in Section 5.2, imputation methods using the maximum likelihood method (MLE) for NDs, regression on order statistics (ROS) or Kaplan-Meier (KM) methods, where appropriate, were used.

Following the calculation of descriptive statistics, the statistical analysis for the background data set was performed to evaluate for outliers, data distributions, and trends for Appendix III and IV constituents, Appendix I Metals, and Appendix I VOCs, where data quantity and quality permit. A total of seventeen samples (sixteen monitoring events from BG-1 and one monitoring event from BG-2) were included for the descriptive analysis of the background monitoring well results for the monitored constituents. The first sampling event conducted in August 2015 was not included in the analysis as data obtained during this event were not consistent with data from subsequent rounds; sample analyses for the August 2015 event were performed by a different laboratory, possibly accounting for the disparity in results.

For downgradient monitoring results, the data analysis included the calculation of descriptive statistics for Appendix III and IV constituents, Appendix I Metals, and Appendix I VOCs (for the data sets including and excluding ND values), followed by an evaluation of outliers and trends. A total of seventeen monitoring events performed between November 2015 and July 2019 were included for the descriptive analysis of the downgradient monitoring well results for the monitored constituents.

5.1.2 Outliers

Outliers are values that are not representative of the population from which they are sampled. The background and downgradient data sets were screened for outliers using the Dixon's outlier test, which is suitable for data sets containing less than 25 samples. The outlier test was conducted using a significance of one percent. For constituents that had NDs, the NDs were removed prior to testing for outliers.

Statistical outliers were identified in the background data set evaluated for three Appendix III constituents (calcium, sulfate, and total dissolved solids) and one Appendix IV constituent (barium). The constituent concentrations identified as statistical outliers were sampled from the newly installed background well BG-2, except for total dissolved solids.

Statistical outliers were identified intermittently for numerous Appendix III and Appendix IV constituents and Appendix I Metals, in the data sets evaluated for downgradient monitoring wells throughout the monitoring period.

The statistical outliers were investigated as possible data entry or measurement errors. The values were all within one order of magnitude of other observations and deemed correct. Given the variable nature of groundwater samples, the small sample sizes and that it is common for groundwater quality samples to have very low or very high concentrations over time, statistical outliers are expected but do not necessarily signify that the outliers are from different distributions. As additional background samples are collected over time, outlier test results may change and earlier observations thought to be outliers may no longer be outliers.

5.1.3 Data Distribution

Groundwater data was fitted to known distribution models using Goodness-of-Fit (GOF) tests incorporated into ProUCL. For data sets comprised of 50 or fewer samples, ProUCL's GOF module incorporates the Shapiro-Wilk GOF test to determine normal or lognormal distribution and Anderson-Darling to determine gamma distribution. Normal, lognormal and gamma distributions are parametric distributions. If a data set could not be fit with any of these three parametric distributions, it was considered to follow a nonparametric distribution.

Note that ProUCL does not provide GOF results for data sets with less than three detected values due to insufficient data. For purposes of estimating background concentrations, these data sets were treated under non-parametric distribution assumptions with the maximum detected value chosen to represent the background concentrations.

5.1.4 Trends

Background constituent concentrations in groundwater should demonstrate stationary conditions through time, free of trends. Constituents were analyzed for trends within the data set using a maximum likelihood estimate (MLE) regression for constituents which followed parametric distributions and Mann-Kendall tests for those that were treated under nonparametric distributional assumptions. The MLE regression can be applied to data sets that can be fitted to a specific distribution model, and that contain NDs with multiple MDLs. The Mann-Kendall test is suitable for data series with no discernable distributions and only one MDL value for NDs.

Constituents treated under nonparametric data assumptions (either tested as nonparametric or having more than 50 percent NDs) and with multiple MDLs or with less than three detected values were not assessed for trends.

The background well regression analysis showed a potential increasing trend for one Appendix III constituent (fluoride) and a potential decreasing trend for two Appendix III constituents (boron and chloride) and one Appendix IV constituent (barium). There were no increasing or decreasing trends identified for other constituents with sufficient data quantity and quality for testing with the MLE analysis or Mann-Kendall test. Although statistical trends were identified for boron, barium, chloride, and fluoride, the results can be misleading due to the short duration of the sampling program.

Trends were also evaluated for constituents in each downgradient well using the same methods as described above for the background data set. Trends were identified for select constituents at select monitoring well locations and should be monitored as additional downgradient groundwater data are collected at the site (**Section 4.2**).

5.1.5 Spatial Variability

Spatial variability refers to identifying whether or not there are statistically identifiable differences in mean concentrations or variance levels across the well field (i.e., the pooled background data). The results from background wells BG-1 and BG-2 were assessed to determine if it is appropriate to pool the data to calculate background concentrations. Results of sampling from well BG-2 were compared to the BTVs established in 2018 with the BG-1 well concentrations. The majority of the concentrations in BG-2 were below the former BTVs, therefore no evidence of spatial variability was identified. The constituents in BG-2 will be monitored as additional background groundwater data are collected at the site.

5.2 Evaluation for SSIs over Background

Based on the statistical evaluations performed, BTVs were calculated for the detection monitoring program at the site for Appendix III and IV constituents and Appendix I metals. Note that UPLs were not calculated for Appendix I VOCs as all of these constituents were 100 percent non-detects. For constituents that have all ND background values, the maximum MDL is chosen to represent background and the double quantification rule (DQR) is used to evaluate whether or not there is an SSI. The BTV provided for detection monitoring constituents is the statistically-derived background concentration (i.e., upper prediction limit [UPL]), the maximum

detected value or the maximum MDL depending on the level of censorship in each of the background samples.

Downgradient sampling results from the first detection monitoring round in January 2019 and the second detection monitoring round in July 2019 were used to test for SSIs. Downgradient concentrations were compared to BTVs. For constituents that have all ND background values, the DQR is applied; that is, an SSI is registered for the well-constituent pair if the downgradient concentrations exhibit detects in two consecutive sampling events. The downgradient sampling results collected in April 2019 were used to assess if an SSI occurred for detected constituents with all ND background values in the first detection monitoring round. For the second detection monitoring round, constituents under the DQR were flagged if they exhibited detect results. If the downgradient concentrations for these constituents remain as detects in the consecutive sampling event, then they will be considered SSIs.

5.3 Statistical Summary

BTVs were calculated using wells BG-1 and BG-2 as the background monitoring wells. However, eight monitoring wells (MW-1 through MW-8) were installed and sampled (October 2015) prior to ash placement, thus representing pre-ash conditions at the site.

In the first detection monitoring round, SSIs were found for six Appendix III constituents (boron, calcium, chloride, fluoride, pH (field), and sulfate), eight Appendix IV constituents (barium, chromium, fluoride, lithium, molybdenum, radium-226, radium-228, and total radium), and four Appendix I metals (copper, nickel, vanadium and zinc). No SSI was registered for the two Appendix IV constituents (cobalt and lead) because, although the non-detected constituents had detect values in the January 2019 detection monitoring round, the next sampling event in April 2019 did not exhibit detects for these constituents at the specified downgradient wells. When results of the January 2019 sampling event are compared to the pre-ash sampling results from those eight wells, current downgradient groundwater constituent concentrations are generally similar to concentrations reported prior to ash placement. Of the seventeen constituents with observed SSIs, eight are within the range of pre-ash conditions.

In the second detection monitoring round, wells MW-2 and MW-3 were dry and have no samples. SSIs were found for eight constituents. Four Appendix III constituents (calcium, chloride, fluoride, and pH (field)), three Appendix IV constituents (barium, fluoride, and molybdenum), and two Appendix I metals (vanadium and zinc). Note that fluoride is listed as a constituent in both Appendix III and Appendix IV. Four Appendix IV constituents (antimony, chromium, cobalt, and lead) and two Appendix I metals (copper and nickel) were flagged as potential SSIs as they are non-detected constituents that had detected values. If the downgradient concentrations for these constituents exhibit detects in the next sampling event (October 2019), then an SSI would be registered. Of the eight constituents with observed SSIs, four are within the range of pre-ash conditions and four are outside the range of pre-ash conditions.

Depending on the data distribution of the constituent, the BTVs have been computed to allow for one to three verification samples. With verification sampling, the validity of the SSIs can be

confirmed. Additional details regarding statistical methodology and results is provided in **Appendix E**.

6 Summary and Conclusions

The 2019 Second Semi-Annual Detection Monitoring Event was conducted at the Brickhaven No. 2 Mine Tract "A" Structural Fill site from July 8-11, 2019. A summary of the findings from is provided below**.**

6.1 Groundwater

- Groundwater concentrations of chloride, pH, TDS, antimony, barium, chromium, cobalt, nickel and vanadium exceeded the 2L Standards or IMACs during the current sampling event.
- No exceedances were reported for EPA Appendix I VOCs.
- Concentrations of calcium, lithium, molybdenum, radium 226, radium 228, and combined radium were detected above the laboratory MDLs; however, standards have not been established by NCDEQ for these constituents.
- TDS concentrations increased in BG-1, BG-2, and MW-1 during this sampling event. Well MW-7R had generally increased concentrations from the previous event with exceedances in chloride, TDS, antimony, chromium, cobalt, nickel and vanadium.
- Groundwater wells MW-2 and MW-3 were dry and not sampled during this event.
- Concentrations of chloride and barium, and pH, have generally remained consistent with previous sampling events.

6.2 Surface Water

- TDS, arsenic, lead and zinc exceeded the 2B Standard in the sample collected from sampling location SW-1. SW-1 was sampled outside the property boundary and results may have off-site influences.
- Concentrations of boron, calcium, chloride, lithium, radium 226, radium 228, and vanadium were detected above the laboratory MDLs; however, standards have not been established by NCDEQ for these constituents.

6.3 Leachate

- Leachate samples collected during this sampling event generally show an increase in detected concentrations of EPA Appendix III, Appendix IV, and Appendix I Metals. Though concentrations show an increase, they are within the range of concentrations sampled from groundwater.

6.4 Statistical Analysis

- The analysis is based on an interwell analysis consisting of sixteen monitoring events of the background well BG-1 and one monitoring event of the background well BG-2 (nine more than the required eight). Subsequent sampling events could provide greater refinement and confidence of statistical significance.
- Statistical outliers were identified in the background data set evaluated for barium, calcium, sulfate, and TDS. Intermittent statistical outliers for Appendix III and Appendix IV constituents and Appendix I Metals, in the data sets evaluated for downgradient monitoring wells, were noted throughout the monitoring period. As the sample size is

very small from a statistical perspective, the variability in the concentrations of these constituents will change as additional samples are obtained.

- Groundwater quality in wells were compared to background concentrations to determine if a statistically significant increase (SSI) over background has occurred:
    - In the detection monitoring round in January 2019, seventeen SSIs were found: boron, calcium, chloride, fluoride, pH (field), sulfate, barium, chromium, lithium, molybdenum, radium-226, radium-228, total radium, copper, nickel, vanadium and zinc.
        - When results of the January 2019 sampling event are compared to the pre-ash sampling results, eight of the seventeen are within the range of pre-ash conditions.
    - In the detection monitoring round in July 2019, eight SSIs were found: calcium, chloride, fluoride, pH (field), barium, molybdenum, vanadium, and zinc. Wells MW-2 and MW-3 were dry and have no samples.
        - When results of the July 2019 sampling event are compared to the pre-ash sampling results, four of the eight constituents are within the range of pre-ash conditions.
- From the July 2019 evaluation, four Appendix IV constituents (antimony, chromium, cobalt, and lead) and two Appendix I metals (copper and nickel) were flagged as potential SSIs as they are non-detected constituents that had detected values.
- HDR believes that the presence of SSIs is the result of low background concentrations that may not represent data collected prior to CCP placement (August and October 2015 sampling events) and is influenced by natural and seasonal variations at the site. In general, the SSIs reported during this sampling event are either consistent with those evaluated in the Alternate Source Demonstration (ASD) dated March 29, 2019 or are potential SSIs to be verified during the next sampling event.

7 Recommendations

Based on the findings, HDR makes the following recommendations:

- Continue to sample semi-annually in accordance with permit requirements.
- Discontinue sampling for EPA Appendix I VOCs. VOCs have only been detected in MW-2 (October 2015), an ambient blank (July 2016), and an equipment blank (July 2016). VOCs are not typically associated with CCP and continued analysis of VOCs is unlikely to provided new information.
- Evaluate the validity of SSIs by further assessing sampling protocols/performance, spatial variability, and seasonality of constituent concentrations as additional sampling rounds are conducted.
- HDR recommends that the site proceed to Assessment Monitoring and follow the Proposed Assessment Plan submitted to NCDEQ on August 16, 2019.

8 References

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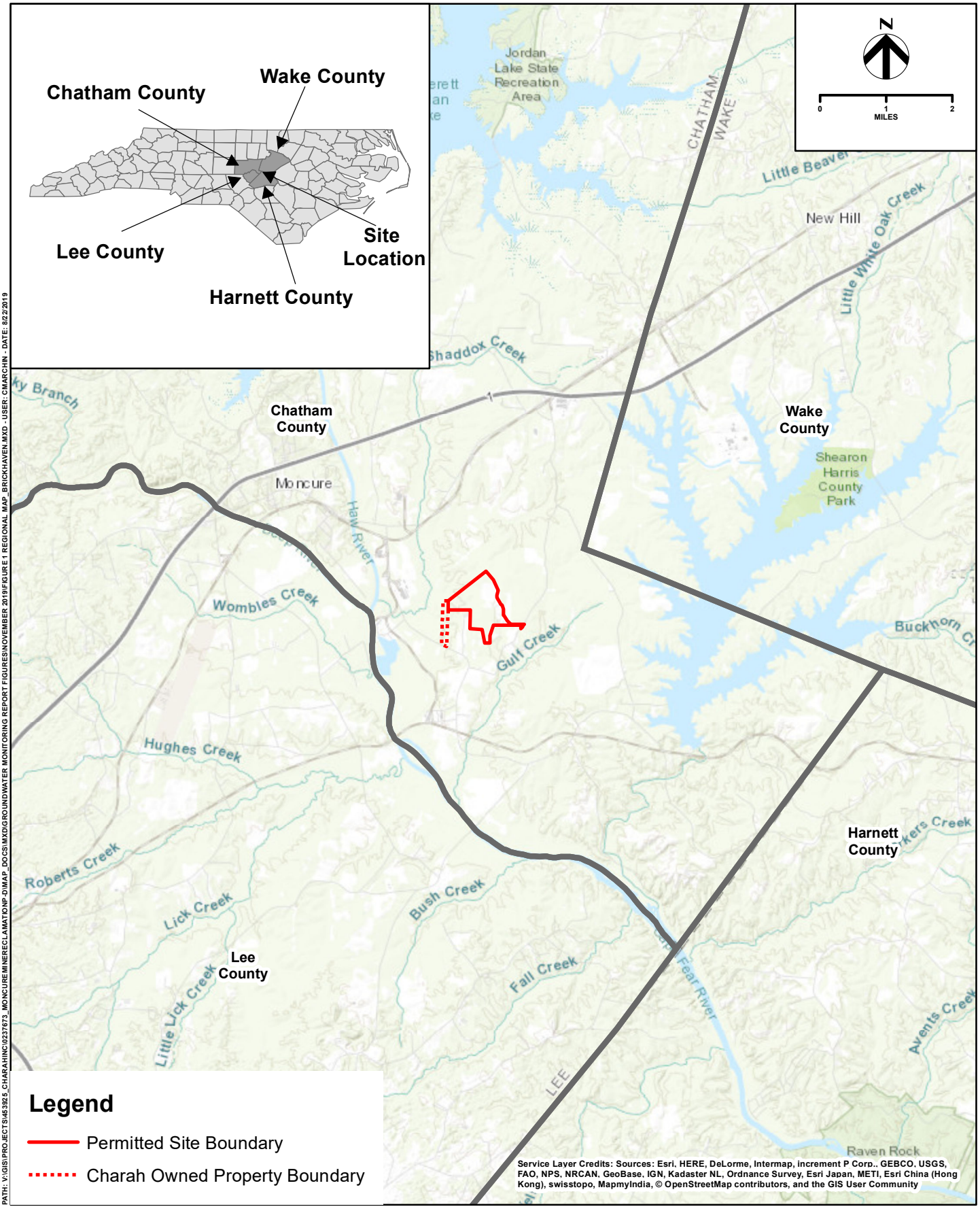
Singhal, B. B.S. and R. P. Gupta. 2010*. Applied Hydrogeology of Fractured Rocks: Springer, 2nd Edition*, 408p. (Table 8-1, p. 140)United States Geological Survey. 2004. *Arsenic, Nitrate, and Chloride in Groundwater, Oakland County, Michigan.*

Figures



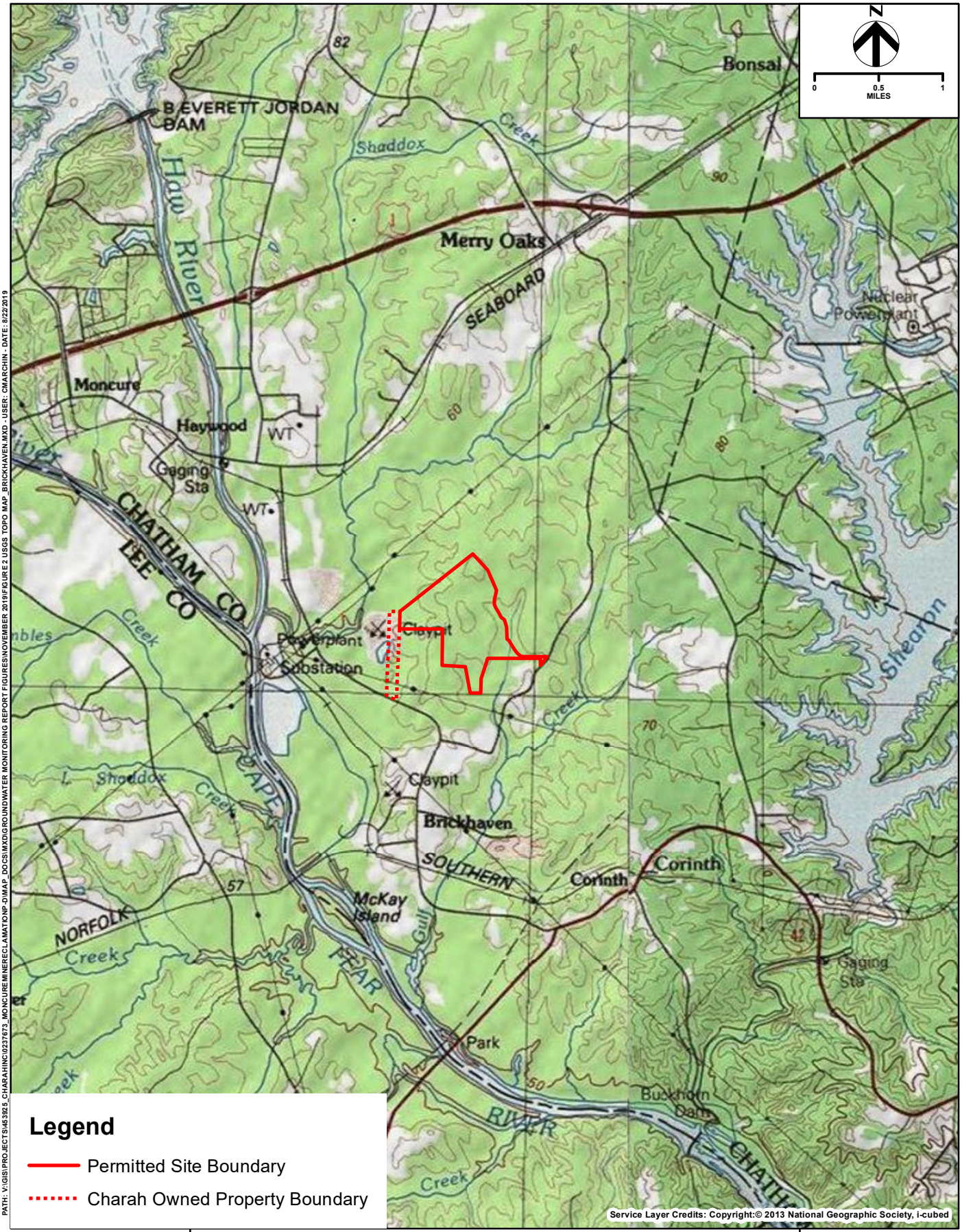
PATH: V:\GIS\PROJECTS\463925_CHARAH\NC\0237673_MONCURE\MINERECLAMATIONP-DIMAP_DOCS\MXD\GROUNDWATER MONITORING REPORT FIGURES\NOVEMBER 2019\FIGURE 1 REGIONAL MAP_BRICKHAVEN.MXD - USER: CMARCHIN - DATE: 8/22/2019

REGIONAL SITE LOCATION MAP
CHARAH SOLUTIONS, INC
MONCURE, NORTH CAROLINA

BRICKHAVEN NO. 2 MINE TRACT "A"

DATE
NOVEMBER 2019

FIGURE
1



PATH: V:\GIS\PROJECTS\463925_CHARAHINC\0237673_MONCUREMINERECLAMATIONP-D\MAP_DOCS\MXD\GROUNDWATER MONITORING REPORT FIGURES\NOVEMBER 2019\FIGURE 2 USGS TOPO MAP_BRICKHAVEN.MXD - USER: CMARCHIN - DATE: 8/22/2019

SITE LOCATION MAP
CHARAH SOLUTIONS, INC
MONCURE, NORTH CAROLINA

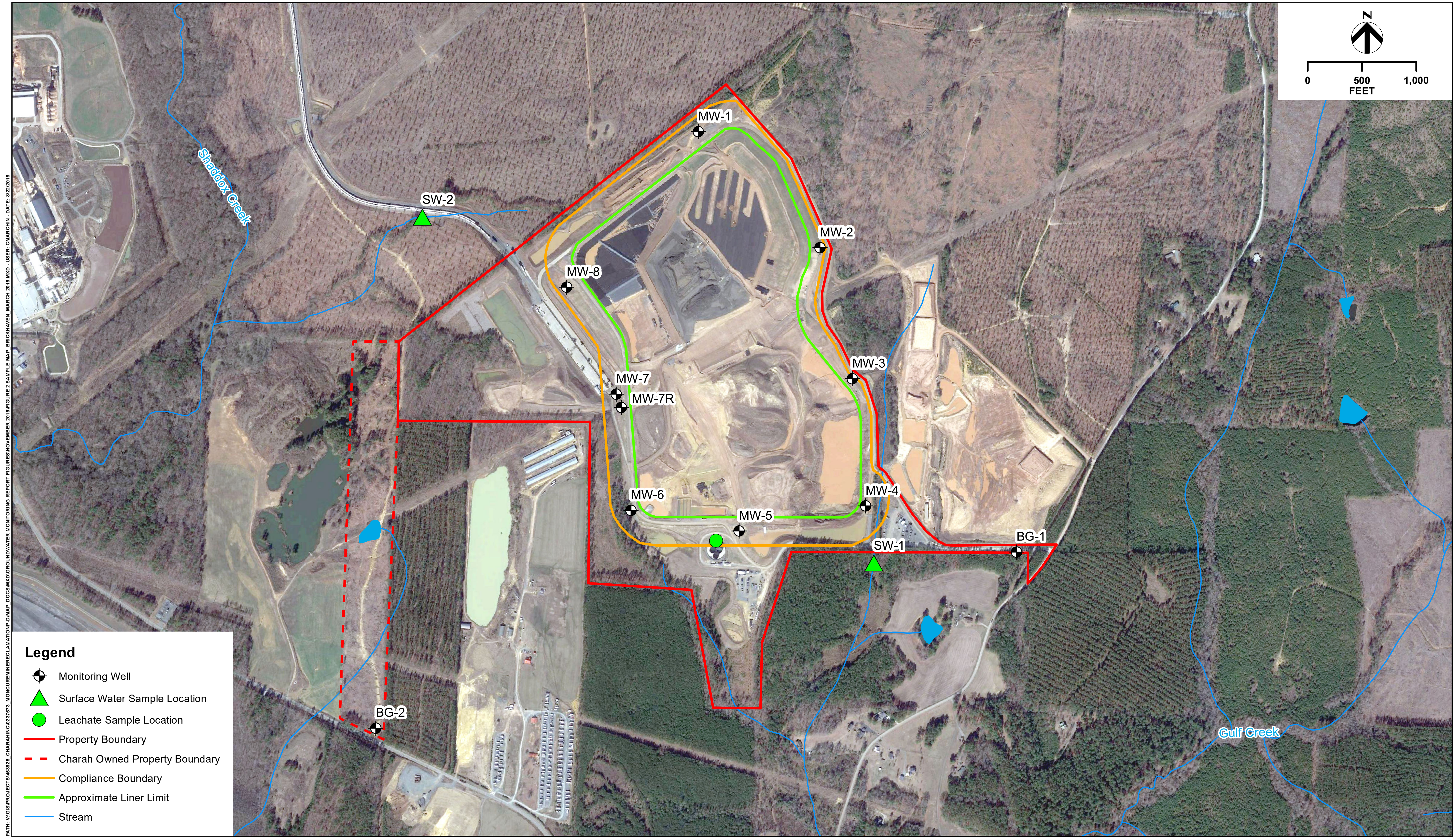
BRICKHAVEN NO. 2 MINE TRACT "A"

DATE

NOVEMBER 2019

FIGURE

2


N
0
500
1,000
FEET
Shaddox Creek
Gulf Creek
SW-1
SW-2
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-7R
MW-8
BG-1
BG-2
Legend
Monitoring Well
Surface Water Sample Location
Leachate Sample Location
Property Boundary
Charah Owned Property Boundary
Compliance Boundary
Approximate Liner Limit
Stream
PATH: V:\GIS\PROJECTS\453925_CHARAHINC\0237673_MONCUREMINERECLAMATIONP-D\MAP_DOCS\MXD\GROUNDWATER MONITORING REPORT FIGURES\NOVEMBER 2019\FIGURE 2 SAMPLE MAP_BRICKHAVEN_MARCH 2019.MXD - USER: CMARCHIN - DATE: 8/22/2019

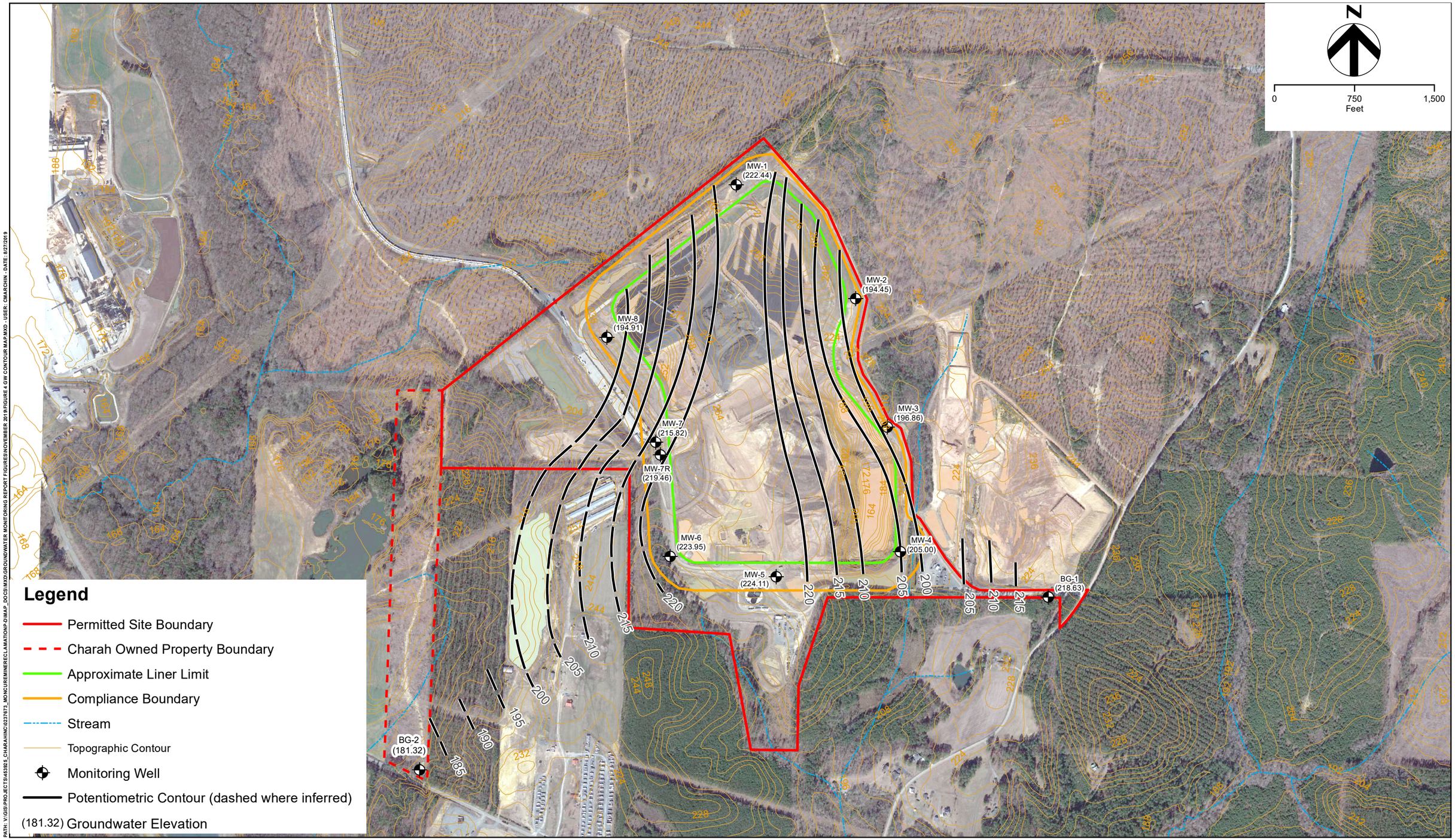
HDR

SAMPLE LOCATION MAP
CHARAH SOLUTIONS, INC.
MONCURE, NORTH CAROLINA

BRICKHAVEN NO. 2 MINE TRACT "A"

DATE
NOVEMBER 2019

FIGURE
3



PATH: V:\GIS\PROJECTS\453923_CHARAHINC\0237673_MONCURE\MINERECLAMATION\P-DMAP_DOCS\MXD\GROUNDWATER MONITORING REPORT FIGURES\NOVEMBER 2019\FIGURE 4 GW CONTOUR MAP.MXD - USER: CMARCHIN - DATE: 9/27/2019

Note:
1. Groundwater elevations derived from depth to water measurements collected on July 8, 2019.
2. Topography data for the site was obtained from NCDOT Geographic Information System (GIS) website (Dated 2007).

POTENTIOMETRIC SURFACE MAP - JULY 2019
CHARAH SOLUTIONS, INC.
MONCURE, NORTH CAROLINA

BRICKHAVEN NO. 2 MINE TRACT "A"

DATE
NOVEMBER 2019

FIGURE 4

A

Appendix A – Field Data Sheets

GROUNDWATER DEPTH

Project Name: Charah – Brickhaven Date: 8/30/2019

Project Address: Moncure, NC Project No: 237673-019

Time Started: _____ Time Finished: _____

Personnel: J. Ruffing

Well ID	Depth to Water	Total Depth
BG-1	09.56	
BG-2	12.91	
MW-1	57.64	
MW-2	37.31	
MW-3	25.70	
MW-4	12.13	
MW-5	20.75	
MW-6	7.00	
MW-7	15.89	
MW-7R	20.46	
MW-8	37.56	

Well ID	Depth to Water	Total Depth

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven

PROJECT #: 237673-019

DATE: 8 Jul 2019

SAMPLER'S INITIALS: JR

WELL ID: Leachate

WELL DIAMETER (in): 2

WELL DEPTH (ft): —

SCEENED Length (ft): —

DEPTH TO WATER (ft): —

PURGE METHOD: Low flow

SAMPLING METHOD: ~~Poly tubing~~

Sample Time: ~~1122~~ 1130

Sample Date: ~~1130~~ 7/8/19

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
1130	—	—	—	28.2	1439	2.30	7.78	8.59	-51.8

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 8 Jul 2019 **SAMPLER'S INITIALS:** JM

WELL ID: SW-1 **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** —

SCEENED Length (ft): — **DEPTH TO WATER (ft):** —

PURGE METHOD: ~~Low flow~~ **SAMPLING METHOD:** ~~Poly tubing~~

Sample Time: 1215 **Sample Date:** 7/8/19

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
1215	—	—	—	26.6	117.8	4.08	7.01	Overrange	18.0

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #: 237673-019**

DATE: 8 Jul 2019 **SAMPLER'S INITIALS:** JR

WELL ID: SW-2 **WELL DIAMETER (in):** ~~2~~ **WELL DEPTH (ft):** —

SCEENED Length (ft): — **DEPTH TO WATER (ft):** —

PURGE METHOD: ~~Low flow~~ **SAMPLING METHOD:** ~~Poly tubing~~

Sample Time: 1200 **Sample Date:** 7/8/19

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
1200	—	—	—	28.0	489	4.50	7.78	47.2	-60.0

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 10 Jul 2019 **SAMPLER'S INITIALS:** JR

WELL ID: MW1 **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** 75.30

SCEENED Length (ft): — **DEPTH TO WATER (ft):** 57.80

PURGE METHOD: Low flow **SAMPLING METHOD:** Poly tubing

Sample Time: 1705 **Sample Date:** 7/10/19

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
~~1500~~	1	57.80	300	22.4	875	0.81	6.74	429	-65.5
1505	~~2~~ 50	57.80	300	22.2	942	0.37	6.85	316	-64.7
1510	~~4~~ 4	57.80	↓	22.6	1105	0.25	6.82	153	-58.4
1520	~~5.50~~	↓	↓	22.8	1429	0.23	6.76	95.6	-55.8
1530	~~7~~	↓	↓	22.7	1938	0.26	6.66	49.9	-52.0
1540	~~8.50~~	↓	↓	22.8	2128	0.29	6.63	37.4	-50.8
1550	~~10~~	↓	↓	22.3	2269	0.31	6.60	32.0	-49.5
1600	~~11.5~~	↓	↓	22.0	2387	0.33	6.57	29.0	-48.2
1610	~~13~~	↓	↓	22.1	2495	0.33	6.58	18.4	-49.0
1615	~~14.5~~	↓	↓	22.7	2579	0.33	6.58	14.1	-49.3
1620	~~16~~	↓	↓	22.3	2614	0.34	6.57	14.1	-50.5
1625	~~17.5~~	↓	↓	22.8	2730	0.34	6.57	11.7	-51.0
1635		↓	↓	22.7	2981	0.37	6.54	12.6	-51.3
1645		↓	↓	22.4	3179	0.43	6.51	15.6	-50.1
1700		↓	↓	22.5	3314	0.48	6.50	8.30	-50.4
—	2hr purge	—	—	—	—	—	—	—	—

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 8 Jul 2014 **SAMPLER'S INITIALS:** JR

WELL ID: MW-2 **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** 50.15

SCEENED Length (ft): — **DEPTH TO WATER (ft):** 37.31

PURGE METHOD: Low flow **SAMPLING METHOD:** Poly tubing

Sample Time: — **Sample Date:** —

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
1300		37.31	—	Pumped dry	—	—	—	—	—
	well did not recover water over 4 days								

No Sample

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 8/1/2019 **SAMPLER'S INITIALS:** JR

WELL ID: MW-3 **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** 43.36

SCEENED Length (ft): — **DEPTH TO WATER (ft):** 24.94

PURGE METHOD: Low flow **SAMPLING METHOD:** Poly tubing

Sample Time: — **Sample Date:** —

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
1330	—	24.94	—						
1345	2.25	25.20	150	24.4	4225	3.41	6.90	—	-21.0
1400	4.50	28.75	150	26.6	4228	3.79	7.09	136	-24.9
1405	6.75	29.20	150	23.1	4147	4.00	7.06	134	-29.5
1410	8.9	29.80	150	24.2	4059	4.16	7.08	60.8	-30.8
Water level not stable - pump dry wait for recharge									

Dry No Sample

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 9/1/2019 **SAMPLER'S INITIALS:** JL

WELL ID: MW-4 **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** 25.34

SCEENED Length (ft): — **DEPTH TO WATER (ft):** 11.70

PURGE METHOD: Low flow **SAMPLING METHOD:** Poly tubing

Sample Time: 1055 **Sample Date:** 7/9/15

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
0840	1	13.52	250	19.1	2040	7.23	5.89	660	-4.1
0845	2.25	14.12	250	18.8	2129	5.79	6.00	~~567~~	-22.4
0900		15.67	300	18.7	2184	2.37	6.02	332	-17.3
0905		~~15.61~~	300	18.7	2225	2.29	6.10	98.1	-20.5
0915		~~15.90~~	300	18.7	2207	2.08	6.12	32.7	-19.3
0925	20	~~15.90~~	300	18.8	2181	1.79	6.10	35.7	-17.2
0930	21.5	~~15.90~~	300	18.8	2176	1.62	6.07	40.3	-15.1
0935		15.90	300	19.0	2203	1.46	6.03	24.3	-13.5
0940		15.90	300	19.1	2234	1.33	6.02	16.9	-13.1
0945		15.90	300	19.1	2241	1.28	6.03	13.6	-13.2
0950	40	15.90	300	19.1	2245	1.21	6.07	16.6	-15.6
1005	~~17.34~~	~~15.90~~	300	19.1	2235	1.13	6.13	16.3	-20.4
~~1015~~		~~17.02~~	~~150~~						
1020		16.51	150	20.6	2229	0.96	6.22	43.0	-24.7
1030		15.71	150	20.8	2227	0.93	6.24	14.1	-25.0
1040		15.65	150	21.0	2234	0.85	6.23	9.17	-26.0
		2 hr limit							

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 8 Jul 2019 **SAMPLER'S INITIALS:** JR

WELL ID: MW-5 **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** 46.14

SCEENED Length (ft): — **DEPTH TO WATER (ft):** 20.75

PURGE METHOD: Low flow **SAMPLING METHOD:** Poly tubing

Sample Time: 1450 **Sample Date:** 7/9/19

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
1455	4	25.78	250	22.8	4.5	6.45	6.79	—	-34.1
—	—	—	change pump motor			—	—	—	—
1525	5	24.50	250	23.0	425.4	1.24	6.47	60.8	-17.7
1530	6.25	26.20	250	23.2	409.2	1.25	6.46	>1000	-18.0
1545	13.00	27.71	250	25.8	371.8	20.9	6.67	660	-23.9
can't stabilize water level — pump dry - wait for recharge									
7/9 1450	—	—	—	24.7	4738	2.41	6.25	122	-24.0

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 9 Jul 2019 **SAMPLER'S INITIALS:** JR

WELL ID: MW-6 **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** —

SCEENED Length (ft): — **DEPTH TO WATER (ft):** 6.50

PURGE METHOD: Low flow **SAMPLING METHOD:** Poly tubing

Sample Time: 1315 **Sample Date:** 7/9/19

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or ~~<5NTU~~ <10	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
1150	1	8.30	250	21.6	1104	1.69	6.13	933	-0.6
1155	2.25	8.60		21.6	1086	0.79	6.13	934	-16.7
1220	8.50	8.90		21.4	1076	0.22	6.11	121	-21.4
1225	9.75	8.90		21.7	1076	0.21	6.11	100	-20.7
1235	11.25	8.90		21.6	1072	0.30	6.13	48.0	-21.1
1240	12.50	8.92		22.1	1075	0.30	6.14	35.1	-22.2
1250	15.00	8.94		21.5	1072	0.10	6.13	22.5	-21.5
1300	17.25	8.95		22.0	1074	0.11	6.14	10.4	-22.1
1305	18.50	8.94		21.7	1075	0.11	6.15	8.05	-22.8
—	Stable	—							

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 10 Jul 2019 **SAMPLER'S INITIALS:** JR

WELL ID: 7R **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** 39.94

SCEENED Length (ft): — **DEPTH TO WATER (ft):** 19.95

PURGE METHOD: Low flow **SAMPLING METHOD:** Poly tubing

Sample Time: 0950 **Sample Date:** 7/10/19

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
0745	0	21.49	300	20.1	1523	5.03	7.22	>1000	-23.6
2755	3	24.20		21.2	1533	4.60	7.39	>1000	-46.5
0815		29.15	100	22.2	1542	4.36	7.57	93.2	-54.0
0825		29.50	100	23.6	1541	3.79	7.55	55.9	-54.1
0830		29.60	100	23.6	1548	4.34	7.51	123	-54.7
0845		29.70	100	25.5	1539	3.93	7.51	70.7	-54.1
0900		36.07	— draw down to stabilize W/L						
0915	~~30~~	35.88	~100	25.1	1543	3.64	7.61	505	-67.9
0920		35.84	100	28.4	1547	2.49	7.51	233	-74.4
0945	60	35.84	100	31.5	1545	1.51	7.29	233	-73.1
	—	2 hr	purge	—	—	—	—		

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 10 Jul 19 **SAMPLER'S INITIALS:** JR

WELL ID: MW-8 / Dup **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** ~~37.46~~ 44.06

SCEENED Length (ft): — **DEPTH TO WATER (ft):** 37.46

PURGE METHOD: Low flow **SAMPLING METHOD:** Poly tubing

Sample Time: 1325 Dup 1220 **Sample Date:** 7/10/19

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or ~~<5NTU~~ <10	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
1120	1	38.06	200	24.1	2411	4.33	7.01	233	-86.9
1130	3	38.18		25.3	2390	3.07	6.99	359	-80.9
1140	5	38.21		25.8	2326	2.73	6.99	221	-85.5
1150	7	38.28		26.8	2070	1.96	7.02	149	-80.6
1200	9	38.30		27.0	1987	1.69	7.01	99.0	-75.6
1210	11	38.31		25.6	1861	1.53	6.97	66.3	-69.5
1220	13	38.34		26.7	1758	~~#~~1.20	7.00	39.2	-74.4
1230	15	38.35		27.8	1647	0.98	7.02	29.8	-79.9
1240	17	38.35		26.7	1641	0.92	6.97	21.8	-79.0
1250	19	38.35		26.6	1595	0.83	6.96	56.8	-70.7
1300	21	38.35		26.2	1557	0.80	6.95	62.8	-63.7
1310	23	38.35		27.8	1534	0.60	7.01	22.7	-63.4
~~#~~1320	—	2Lr purge							

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 11 Jul 2019 **SAMPLER'S INITIALS:** SR

WELL ID: BG-1 **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** 43.05

SCEENED Length (ft): — **DEPTH TO WATER (ft):** 11.02

PURGE METHOD: Low flow **SAMPLING METHOD:** Poly tubing

Sample Time: 1300 **Sample Date:** 7/11/19

Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

PURGE MEASUREMENTS

Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
1050	1	11.02	300	22.3	1081	0.52	6.41	195	-44.0
1110	7	11.28	300	21.4	1087	0.31	6.41	172	-60.2
1120	10	12.15	200	23.2	1104	0.17	6.36	80.7	-48.5
1130	12	11.71	200	23.0	1104	0.16	6.37	62.5	-59.6
1200	18	11.50	200	22.4	1118	0.14	6.32	33.3	-48.4
1210	20	11.50	200	23.4	1120	0.13	6.34	28.1	-50.4
1220	22	11.49	200	23.1	1118	0.14	6.29	23.6	-44.3
1230	24	11.49	200	22.6	1118	0.16	6.30	18.0	-48.8
1240	26	11.25	200	23.8	1114	0.16	6.32	16.9	-47.7
1250	28	11.10	200	23.6	1117	0.16	6.30	14.4	-46.6
—	2 hr	purge	—	—	—	—	—	—	—

MONITORING WELL SAMPLING LOG

SITE NAME/LOCATION: Charah Brickhaven **PROJECT #:** 237673-019

DATE: 11 Jul 2019 **SAMPLER'S INITIALS:** JC

WELL ID: BG-2 **WELL DIAMETER (in):** 2 **WELL DEPTH (ft):** —

SCEENED Length (ft): — **DEPTH TO WATER (ft):** 12.91

PURGE METHOD: Low flow **SAMPLING METHOD:** Poly tubing

Sample Time: ~~0944~~ 0950 **Sample Date:** 7/11/19

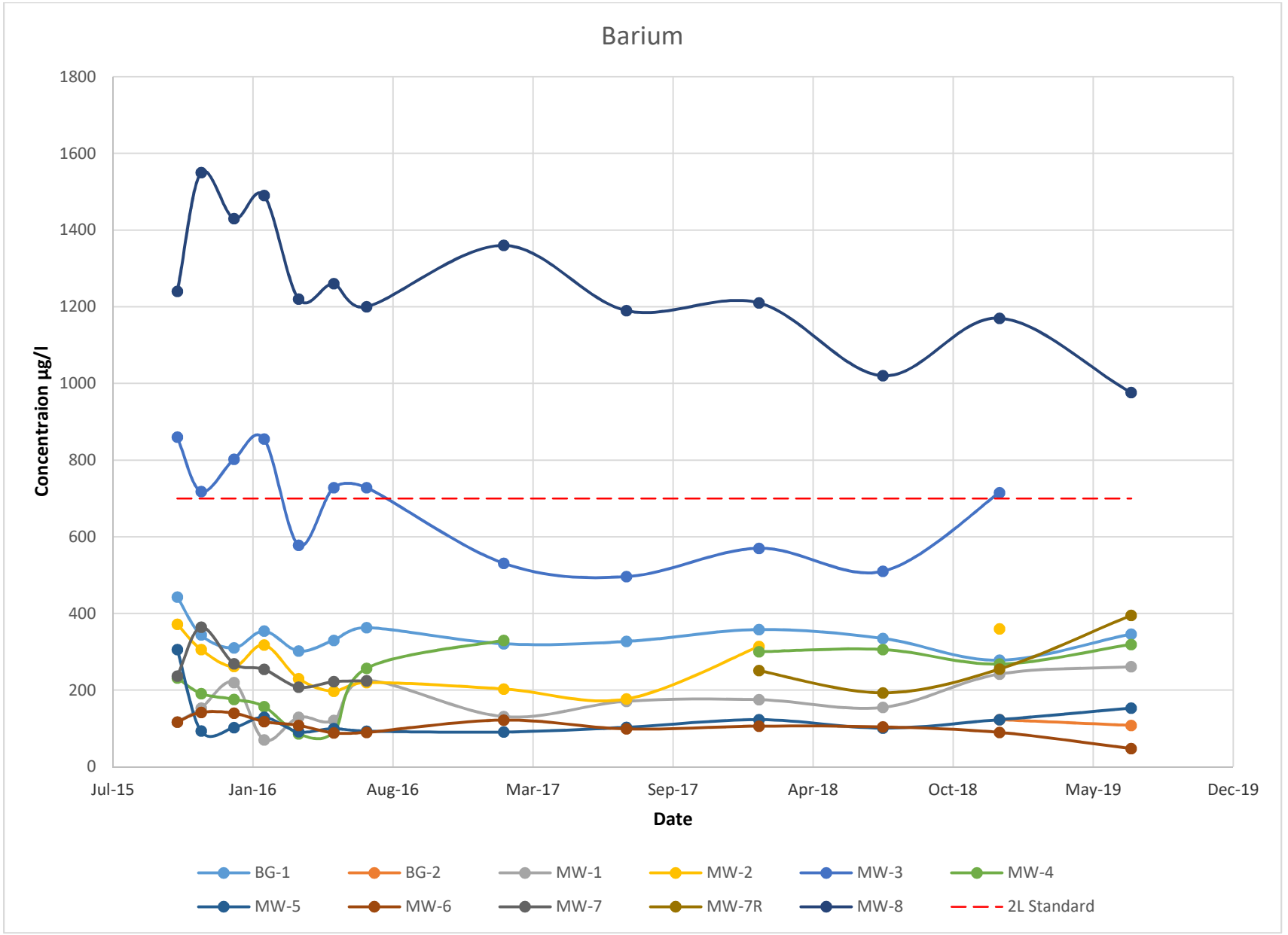
Stabilization Requirements		
SC - 3%	pH ± 0.1	ORP ± 10mV
DO - 10% or <0.5mg/L	Turb. 10% or <5NTU	

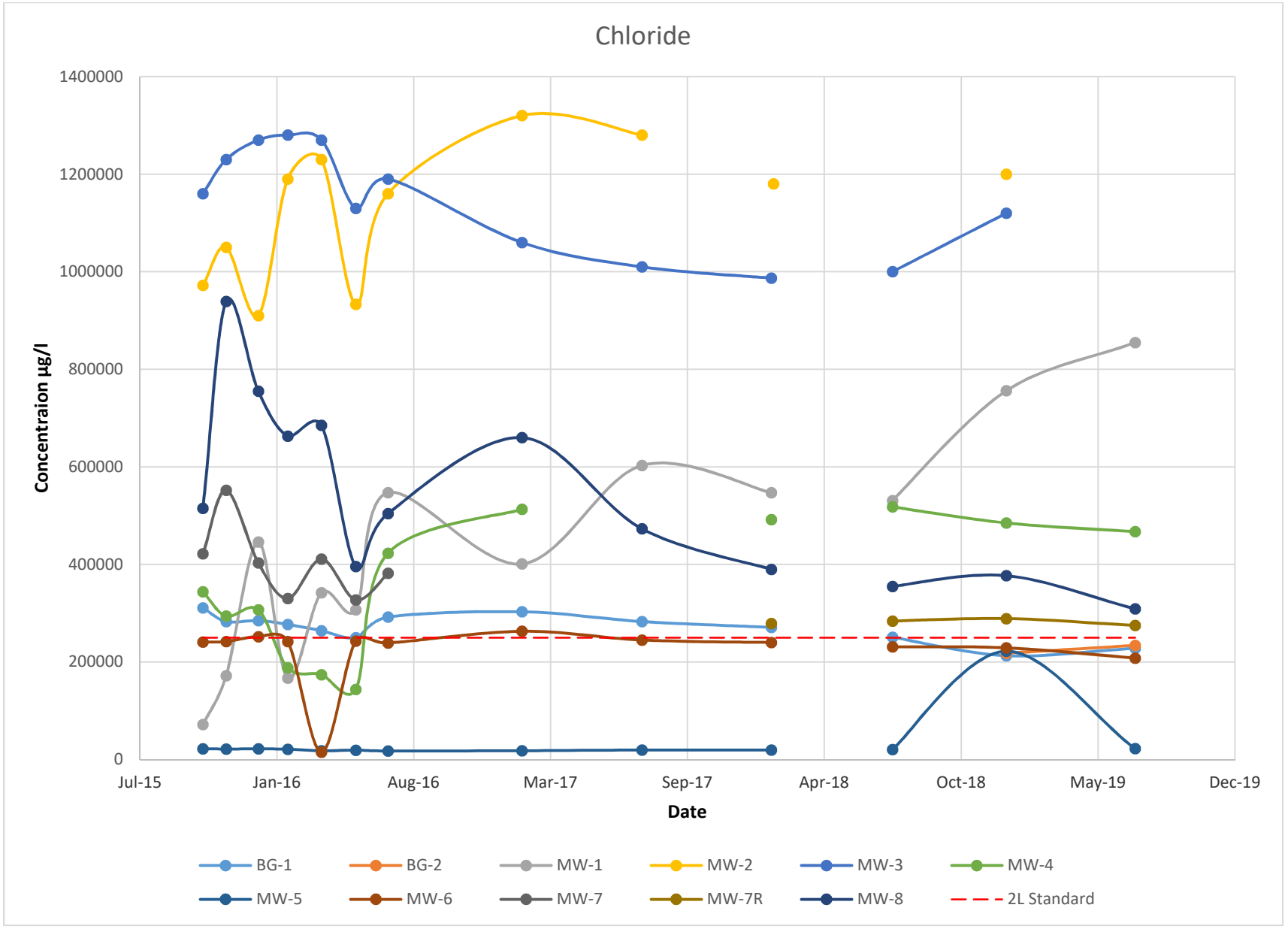
PURGE MEASUREMENTS

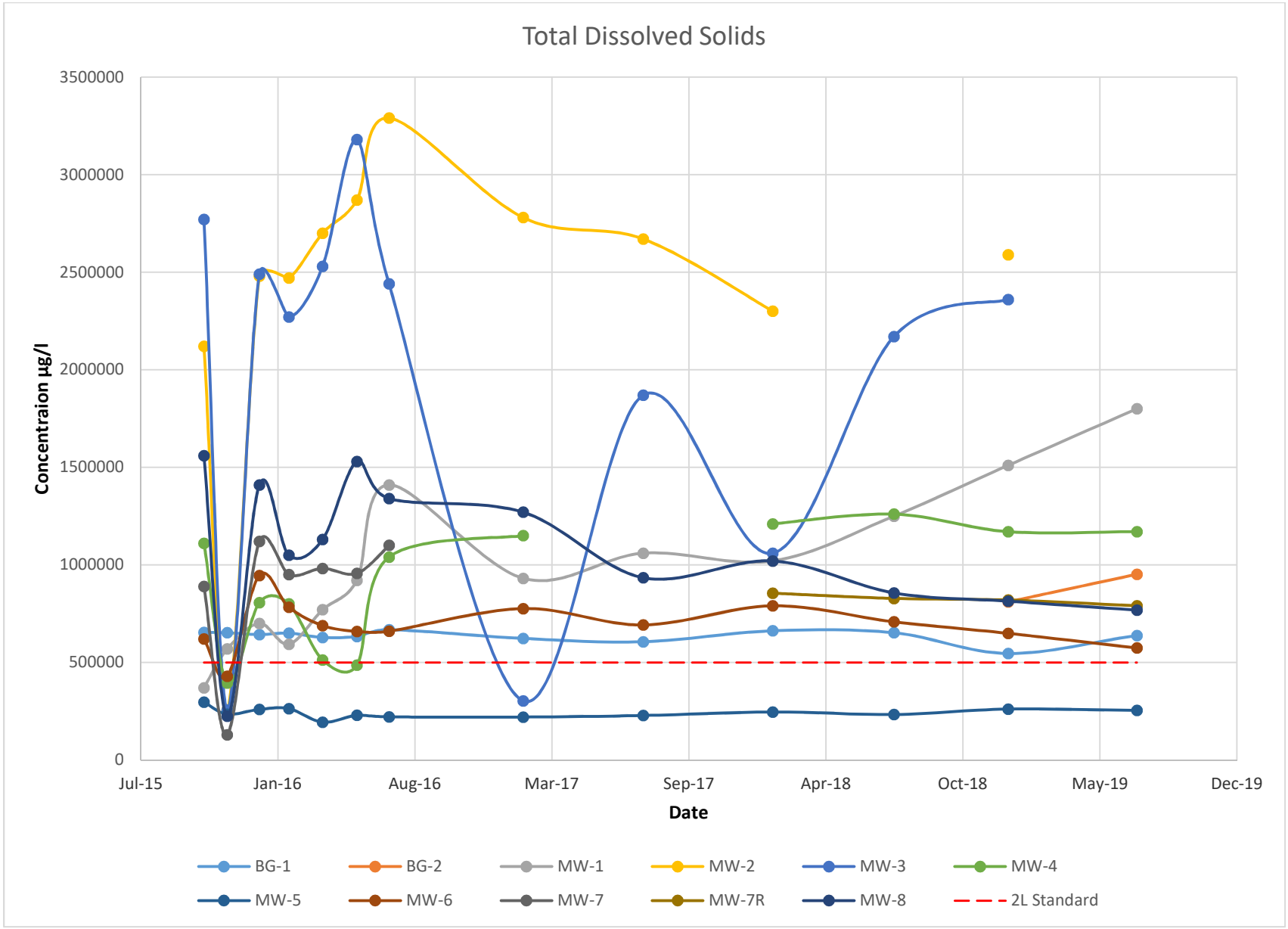
Time	Liters Purged	Depth to Water (BTOC ft)	Flow Rate (mL/min)	Temp (C)	SC (µS/cm)	DO (mg/L)	pH	Turbidity (NTU)	ORP (mV)
0750	1	~~13.58~~ 13.85	~~13.58~~ 200	18.2	2529	0.93	6.95	>1000	-25.9
0800	3	13.85		18.7	2162	0.27	6.92	954	-49.5
0810	5	13.85		19.1	1904	0.17	6.91	525	-52.9
0820	7	13.85		19.0	1784	0.13	6.90	228	-55.5
0830	9	14.20		19.0	1714	0.18	6.89	77.2	-57.4
0840	11	14.25		19.1	1707	0.19	6.89	58.2	-57.8
0850	13	14.35		19.0	1688	0.20	6.89	55.7	-58.3
0900	15	14.35		19.1	1671	0.22	6.89	40.5	-59.5
0910	17	14.35		19.1	1664	0.23	6.90	25.9	-60.8
0920	19	14.35		19.1	1657	0.23	6.89	34.4	-61.3
0930	21	14.35		19.4	1651	0.25	6.90	29.6	-63.1
0940	23	14.35		19.8	1650	0.25	6.91	24.1	-66.0
0950	25	14.35		20.2	1653	0.26	6.93	25.2	-71.0
—	2 hr purge								

B

Appendix B – Concentration vs. Time Plots


Barium
1800
1600
1400
1200
1000
800
600
400
200
0
Concentraion µg/l
Jul-15
Jan-16
Aug-16
Mar-17
Sep-17
Apr-18
Oct-18
May-19
Dec-19
Date
BG-1
BG-2
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-7R
MW-8
2L Standard


Chloride
1400000
1200000
1000000
800000
600000
400000
200000
0
Concentraion µg/l
Jul-15
Jan-16
Aug-16
Mar-17
Sep-17
Apr-18
Oct-18
May-19
Dec-19
Date
BG-1
BG-2
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-7R
MW-8
2L Standard


Total Dissolved Solids
3500000
3000000
2500000
2000000
1500000
1000000
500000
0
Concentraion µg/l
Jul-15
Jan-16
Aug-16
Mar-17
Sep-17
Apr-18
Oct-18
May-19
Dec-19
Date
BG-1
BG-2
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-7R
MW-8
2L Standard

C

Appendix C – Laboratory Reports, Chains of Custody, & Quality Control Data

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

August 02, 2019

Mark Filardi
HDR
440 S. Church St
Suite 900
Charlotte, NC 28202

RE: Project: Charah GW
Pace Project No.: 92436599

Dear Mark Filardi:
Enclosed are the analytical results for sample(s) received by the laboratory on July 12, 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,

Kevin Herring
kevin.herring@pacelabs.com
1(704)875-9092
HORIZON Database Administrator

Enclosures

cc: Mike Plummer, HDR
Jacob Ruffing

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

CERTIFICATIONS

Project: Charah GW
Pace Project No.: 92436599

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

Charlotte Certification IDs

9800 Kincey Ave. Ste 100, Huntersville, NC 28078
Louisiana/NELAP Certification # LA170028
North Carolina Drinking Water Certification #: 37706
North Carolina Field Services Certification #: 5342
North Carolina Wastewater Certification #: 12
South Carolina Certification #: 99006001
Florida/NELAP Certification #: E87627
Kentucky UST Certification #: 84
Virginia/VELAP Certification #: 460221

Asheville Certification IDs

2225 Riverside Drive, Asheville, NC 28804
Florida/NELAP Certification #: E87648
Massachusetts Certification #: M-NC030
North Carolina Drinking Water Certification #: 37712
North Carolina Wastewater Certification #: 40
South Carolina Certification #: 99030001
Virginia/VELAP Certification #: 460222

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

SAMPLE SUMMARY

Project: Charah GW
Pace Project No.: 92436599

Lab ID	Sample ID	Matrix	Date Collected	Date Received
92436599001	**BG-1**	Water	07/11/19 13:00	07/12/19 12:00
92436599002	**BG-2**	Water	07/11/19 09:50	07/12/19 12:00
92436599003	**MW-1**	Water	07/10/19 17:05	07/12/19 12:00
92436599004	**MW-4**	Water	07/09/19 10:55	07/12/19 12:00
92436599005	**MW-5**	Water	07/09/19 14:50	07/12/19 12:00
92436599006	**MW-6**	Water	07/09/19 13:15	07/12/19 12:00
92436599007	**MW-7R**	Water	07/10/19 09:50	07/12/19 12:00
92436599008	**MW-8**	Water	07/10/19 13:25	07/12/19 12:00
92436599009	**DUP**	Water	07/10/19 12:20	07/12/19 12:00
92436599010	**LEACHATE**	Water	07/08/19 11:30	07/12/19 12:00
92436599011	**EQUIPMENT BLANK**	Water	07/11/19 13:30	07/12/19 12:00
92436599012	**AMBIENT BLANK**	Water	07/09/19 15:20	07/12/19 12:00
92436599013	**SW-2**	Water	07/08/19 12:15	07/12/19 12:00
92436599014	**SW-1**	Water	07/08/19 12:00	07/12/19 12:00
92436599015	**TRIP BLANK**	Water	07/08/19 11:00	07/12/19 12:00

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
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(704)875-9092

SAMPLE ANALYTE COUNT

Project: Charah GW
Pace Project No.: 92436599

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
92436599001	**BG-1**	EPA 6010D	SH1	16	PASI-A
		EPA 6020B	JOR	3	PASI-A
		EPA 7470A	JMW1	1	PASI-A
		EPA 8260D	SAS	48	PASI-C
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	MJP	1	PASI-A
		EPA 300.0 Rev 2.1 1993	BRJ	3	PASI-A
92436599002	**BG-2**	EPA 6010D	SH1	16	PASI-A
		EPA 6020B	JOR	3	PASI-A
		EPA 7470A	JMW1	1	PASI-A
		EPA 8260D	SAS	48	PASI-C
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	MJP	1	PASI-A
		EPA 300.0 Rev 2.1 1993	BRJ	3	PASI-A
92436599003	**MW-1**	EPA 6010D	DS, SH1	16	PASI-A
		EPA 6020B	JOR	3	PASI-A
		EPA 7470A	JMW1	1	PASI-A
		EPA 8260D	SAS	48	PASI-C
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	MJP	1	PASI-A
		EPA 300.0 Rev 2.1 1993	BRJ	3	PASI-A
92436599004	**MW-4**	EPA 6010D	DS, SH1	16	PASI-A
		EPA 6020B	JOR	3	PASI-A
		EPA 7470A	JMW1	1	PASI-A
		EPA 8260D	SAS	48	PASI-C
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	JP1	1	PASI-A
		EPA 300.0 Rev 2.1 1993	BRJ	3	PASI-A
92436599005	**MW-5**	EPA 6010D	DS, SH1	16	PASI-A

Pace Analytical Services, LLC
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SAMPLE ANALYTE COUNT

Project: Charah GW
Pace Project No.: 92436599

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
		EPA 6020B	JOR	3	PASI-A
		EPA 7470A	JMW1	1	PASI-A
		EPA 8260D	SAS	48	PASI-C
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	JP1	1	PASI-A
		EPA 300.0 Rev 2.1 1993	BRJ	3	PASI-A
92436599006	**MW-6**	EPA 6010D	DS, SH1	16	PASI-A
		EPA 6020B	JOR	3	PASI-A
		EPA 7470A	JMW1	1	PASI-A
		EPA 8260D	SAS	48	PASI-C
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	JP1	1	PASI-A
		EPA 300.0 Rev 2.1 1993	BRJ	3	PASI-A
92436599007	**MW-7R**	EPA 6010D	DS, SH1	16	PASI-A
		EPA 6020B	JOR	3	PASI-A
		EPA 7470A	JMW1	1	PASI-A
		EPA 8260D	SAS	48	PASI-C
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	MJP	1	PASI-A
		EPA 300.0 Rev 2.1 1993	BRJ	3	PASI-A
92436599008	**MW-8**	EPA 6010D	DS, SH1	16	PASI-A
		EPA 6020B	JOR	3	PASI-A
		EPA 7470A	JMW1	1	PASI-A
		EPA 8260D	SAS	48	PASI-C
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	MJP	1	PASI-A
		EPA 300.0 Rev 2.1 1993	BRJ	3	PASI-A
92436599009	**DUP**	EPA 6010D	DS, SH1	16	PASI-A
		EPA 6020B	JOR	3	PASI-A

Pace Analytical Services, LLC
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(704)875-9092

SAMPLE ANALYTE COUNT

Project: Charah GW
Pace Project No.: 92436599

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
		EPA 7470A	JMW1	1	PASI-A
		EPA 8260D	SAS	48	PASI-C
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	MJP	1	PASI-A
		EPA 300.0 Rev 2.1 1993	BRJ	3	PASI-A
92436599010	**LEACHATE**	EPA 6010D	DS, SH1	16	PASI-A
		EPA 6020B	JOR	3	PASI-A
		EPA 7470A	JMW1	1	PASI-A
		EPA 8260D	SAS	48	PASI-C
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	JP1	1	PASI-A
		EPA 300.0 Rev 2.1 1993	BRJ	3	PASI-A
92436599011	**EQUIPMENT BLANK**	EPA 6010D	DS, SH1	16	PASI-A
		EPA 6020B	JOR	3	PASI-A
		EPA 7470A	JMW1	1	PASI-A
		EPA 8260D	SAS	48	PASI-C
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	MJP	1	PASI-A
		EPA 300.0 Rev 2.1 1993	BRJ	3	PASI-A
92436599012	**AMBIENT BLANK**	EPA 6010D	DS, SH1	16	PASI-A
		EPA 6020B	JOR	3	PASI-A
		EPA 7470A	JMW1	1	PASI-A
		EPA 8260D	SAS	48	PASI-C
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	JP1	1	PASI-A
		EPA 300.0 Rev 2.1 1993	BRJ	3	PASI-A
92436599013	**SW-2**	EPA 6010D	DS, SH1	16	PASI-A
		EPA 6020B	JOR	3	PASI-A
		EPA 7470A	JMW1	1	PASI-A

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SAMPLE ANALYTE COUNT

Project: Charah GW
Pace Project No.: 92436599

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
		EPA 8260D	SAS	48	PASI-C
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	JP1	1	PASI-A
		EPA 300.0 Rev 2.1 1993	BRJ	3	PASI-A
92436599014	**SW-1**	EPA 6010D	DS, SH1	16	PASI-A
		EPA 6020B	JOR	3	PASI-A
		EPA 7470A	JMW1	1	PASI-A
		EPA 8260D	SAS	48	PASI-C
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		Total Radium Calculation	CMC	1	PASI-PA
		SM 2540C-2011	MJP	1	PASI-A
		EPA 300.0 Rev 2.1 1993	BRJ	3	PASI-A
92436599015	**TRIP BLANK**	EPA 8260D	SAS	48	PASI-C

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SUMMARY OF DETECTION

Project: Charah GW
Pace Project No.: 92436599

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92436599001	**BG-1**					
EPA 6010D	Barium	346	ug/L	5.0	07/18/19 03:23	
EPA 6010D	Calcium	27900	ug/L	100	07/18/19 03:23	
EPA 6010D	Molybdenum	10.8	ug/L	5.0	07/18/19 03:23	
EPA 6020B	Lithium	17.1	ug/L	2.5	07/17/19 00:44	
EPA 903.1	Radium-226	0.000 ± 0.525 (0.940) C:NA T:86%	pCi/L		07/26/19 13:48	
EPA 904.0	Radium-228	0.823 ± 0.435 (0.787) C:81% T:76%	pCi/L		07/25/19 12:48	
Total Radium Calculation	Total Radium	0.823 ± 0.960 (1.73)	pCi/L		07/30/19 13:54	
SM 2540C-2011	Total Dissolved Solids	638	mg/L	50.0	07/16/19 14:30	
EPA 300.0 Rev 2.1 1993	Chloride	228	mg/L	5.0	07/14/19 00:49	
EPA 300.0 Rev 2.1 1993	Fluoride	0.18	mg/L	0.10	07/13/19 19:35	
EPA 300.0 Rev 2.1 1993	Sulfate	20.6	mg/L	1.0	07/13/19 19:35	
92436599002	**BG-2**					
EPA 6010D	Barium	108	ug/L	5.0	07/18/19 03:26	
EPA 6010D	Calcium	111000	ug/L	500	07/19/19 02:09	
EPA 6010D	Molybdenum	11.3	ug/L	5.0	07/18/19 03:26	
EPA 6020B	Lithium	14.9	ug/L	5.0	07/17/19 01:20	
EPA 903.1	Radium-226	0.247 ± 0.625 (1.03) C:NA T:87%	pCi/L		07/26/19 13:48	
EPA 904.0	Radium-228	0.205 ± 0.329 (0.715) C:81% T:83%	pCi/L		07/25/19 12:48	
Total Radium Calculation	Total Radium	0.452 ± 0.954 (1.75)	pCi/L		07/30/19 13:54	
SM 2540C-2011	Total Dissolved Solids	952	mg/L	50.0	07/16/19 14:31	
EPA 300.0 Rev 2.1 1993	Chloride	234	mg/L	5.0	07/14/19 01:03	
EPA 300.0 Rev 2.1 1993	Fluoride	0.19	mg/L	0.10	07/13/19 19:50	
EPA 300.0 Rev 2.1 1993	Sulfate	102	mg/L	5.0	07/14/19 01:03	
92436599003	**MW-1**					
EPA 6010D	Barium	261	ug/L	5.0	07/18/19 15:57	
EPA 6010D	Calcium	216000	ug/L	500	07/18/19 15:48	
EPA 6010D	Molybdenum	14.5	ug/L	5.0	07/18/19 03:36	
EPA 6020B	Lithium	35.6	ug/L	2.5	07/17/19 01:28	
EPA 903.1	Radium-226	1.03 ± 0.736 (0.964) C:NA T:86%	pCi/L		07/26/19 13:48	

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SUMMARY OF DETECTION

Project: Charah GW
Pace Project No.: 92436599

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92436599003	**MW-1**					
EPA 904.0	Radium-228	1.45 ± 0.478 (0.661) C:81% T:89%	pCi/L		07/25/19 12:48	
Total Radium Calculation	Total Radium	2.48 ± 1.21 (1.63)	pCi/L		07/30/19 13:54	
SM 2540C-2011	Total Dissolved Solids	1800	mg/L	50.0	07/16/19 14:15	
EPA 300.0 Rev 2.1 1993	Chloride	855	mg/L	18.0	07/14/19 01:18	M6
EPA 300.0 Rev 2.1 1993	Fluoride	0.17	mg/L	0.10	07/13/19 20:04	
EPA 300.0 Rev 2.1 1993	Sulfate	7.2	mg/L	1.0	07/13/19 20:04	
92436599004	**MW-4**					
EPA 6010D	Barium	319	ug/L	5.0	07/18/19 16:00	
EPA 6010D	Calcium	69400	ug/L	100	07/18/19 03:39	
EPA 6010D	Molybdenum	18.7	ug/L	5.0	07/18/19 03:39	
EPA 6010D	Nickel	5.1	ug/L	5.0	07/18/19 03:39	
EPA 6020B	Lithium	26.8	ug/L	2.5	07/17/19 01:36	
EPA 903.1	Radium-226	0.760 ± 0.551 (0.714) C:NA T:94%	pCi/L		07/26/19 13:48	
EPA 904.0	Radium-228	0.556 ± 0.380 (0.734) C:82% T:79%	pCi/L		07/25/19 12:49	
Total Radium Calculation	Total Radium	1.32 ± 0.931 (1.45)	pCi/L		07/30/19 13:54	
SM 2540C-2011	Total Dissolved Solids	1170	mg/L	50.0	07/13/19 00:39	
EPA 300.0 Rev 2.1 1993	Chloride	467	mg/L	10.0	07/14/19 02:02	
EPA 300.0 Rev 2.1 1993	Fluoride	0.34	mg/L	0.10	07/13/19 20:49	
EPA 300.0 Rev 2.1 1993	Sulfate	11.2	mg/L	1.0	07/13/19 20:49	
92436599005	**MW-5**					
EPA 6010D	Barium	153	ug/L	5.0	07/18/19 16:03	
EPA 6010D	Calcium	14300	ug/L	100	07/18/19 03:42	
EPA 6010D	Copper	5.6	ug/L	5.0	07/18/19 03:42	
EPA 6010D	Zinc	11.4	ug/L	10.0	07/18/19 03:42	
EPA 6020B	Lithium	11.6	ug/L	2.5	07/17/19 01:44	
EPA 903.1	Radium-226	-0.0968 ± 0.718 (1.28) C:NA T:77%	pCi/L		07/26/19 13:48	
EPA 904.0	Radium-228	0.987 ± 0.440 (0.737) C:80% T:80%	pCi/L		07/25/19 12:49	
Total Radium Calculation	Total Radium	0.987 ± 1.16 (2.02)	pCi/L		07/30/19 13:54	
SM 2540C-2011	Total Dissolved Solids	254	mg/L	25.0	07/13/19 00:39	

REPORT OF LABORATORY ANALYSIS

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SUMMARY OF DETECTION

Project: Charah GW
Pace Project No.: 92436599

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92436599005	**MW-5**					
EPA 300.0 Rev 2.1 1993	Chloride	22.3	mg/L	1.0	07/13/19 21:04	
EPA 300.0 Rev 2.1 1993	Fluoride	0.60	mg/L	0.10	07/13/19 21:04	
EPA 300.0 Rev 2.1 1993	Sulfate	3.5	mg/L	1.0	07/13/19 21:04	
92436599006	**MW-6**					
EPA 6010D	Barium	47.8	ug/L	5.0	07/18/19 16:06	
EPA 6010D	Calcium	37800	ug/L	100	07/18/19 03:45	
EPA 6010D	Copper	5.5	ug/L	5.0	07/18/19 03:45	
EPA 6010D	Molybdenum	8.3	ug/L	5.0	07/18/19 03:45	
EPA 6020B	Lithium	22.7	ug/L	2.5	07/17/19 01:52	
EPA 903.1	Radium-226	0.681 ± 0.785 (1.17) C:NA T:87%	pCi/L		07/26/19 13:48	
EPA 904.0	Radium-228	0.685 ± 0.444 (0.850) C:80% T:80%	pCi/L		07/25/19 15:54	
Total Radium Calculation	Total Radium	1.37 ± 1.23 (2.02)	pCi/L		07/30/19 13:54	
SM 2540C-2011	Total Dissolved Solids	574	mg/L	50.0	07/13/19 00:39	
EPA 300.0 Rev 2.1 1993	Chloride	208	mg/L	4.0	07/14/19 02:17	
EPA 300.0 Rev 2.1 1993	Fluoride	0.38	mg/L	0.10	07/13/19 21:49	
EPA 300.0 Rev 2.1 1993	Sulfate	25.8	mg/L	1.0	07/13/19 21:49	
92436599007	**MW-7R**					
EPA 6010D	Antimony	13.6	ug/L	5.0	07/18/19 03:58	
EPA 6010D	Barium	395	ug/L	5.0	07/18/19 16:21	
EPA 6010D	Calcium	102000	ug/L	500	07/18/19 16:18	
EPA 6010D	Chromium	1940	ug/L	5.0	07/18/19 03:58	
EPA 6010D	Cobalt	20.4	ug/L	5.0	07/18/19 03:58	
EPA 6010D	Copper	79.3	ug/L	5.0	07/18/19 03:58	
EPA 6010D	Lead	6.8	ug/L	5.0	07/18/19 03:58	
EPA 6010D	Molybdenum	49.5	ug/L	5.0	07/18/19 03:58	
EPA 6010D	Nickel	880	ug/L	5.0	07/18/19 03:58	
EPA 6010D	Vanadium	18.8	ug/L	5.0	07/18/19 03:58	
EPA 6010D	Zinc	53.4	ug/L	10.0	07/18/19 03:58	
EPA 6020B	Lithium	31.7	ug/L	2.5	07/17/19 02:00	
EPA 903.1	Radium-226	0.316 ± 0.650 (1.05) C:NA T:81%	pCi/L		07/26/19 14:06	
EPA 904.0	Radium-228	0.686 ± 0.424 (0.803) C:78% T:86%	pCi/L		07/25/19 15:55	
Total Radium Calculation	Total Radium	1.00 ± 1.07 (1.85)	pCi/L		07/30/19 13:54	
SM 2540C-2011	Total Dissolved Solids	790	mg/L	50.0	07/16/19 14:15	

REPORT OF LABORATORY ANALYSIS

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SUMMARY OF DETECTION

Project: Charah GW
Pace Project No.: 92436599

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92436599007	**MW-7R**					
EPA 300.0 Rev 2.1 1993	Chloride	275	mg/L	6.0	07/14/19 02:32	
EPA 300.0 Rev 2.1 1993	Fluoride	0.12	mg/L	0.10	07/13/19 22:05	
EPA 300.0 Rev 2.1 1993	Sulfate	16.8	mg/L	1.0	07/13/19 22:05	
92436599008	**MW-8**					
EPA 6010D	Barium	976	ug/L	5.0	07/18/19 16:33	
EPA 6010D	Calcium	94600	ug/L	500	07/18/19 16:24	
EPA 6010D	Molybdenum	5.2	ug/L	5.0	07/18/19 04:01	
EPA 6020B	Lithium	21.1	ug/L	2.5	07/17/19 02:08	
EPA 903.1	Radium-226	0.105 ± 0.507 (0.871) C:NA T:91%	pCi/L		07/26/19 14:06	
EPA 904.0	Radium-228	0.535 ± 0.389 (0.762) C:81% T:85%	pCi/L		07/25/19 15:55	
Total Radium Calculation	Total Radium	0.640 ± 0.896 (1.63)	pCi/L		07/30/19 13:54	
SM 2540C-2011	Total Dissolved Solids	768	mg/L	50.0	07/16/19 14:15	
EPA 300.0 Rev 2.1 1993	Chloride	309	mg/L	7.0	07/14/19 02:47	
EPA 300.0 Rev 2.1 1993	Sulfate	7.5	mg/L	1.0	07/13/19 22:20	
92436599009	**DUP**					
EPA 6010D	Barium	992	ug/L	5.0	07/18/19 16:39	
EPA 6010D	Calcium	98000	ug/L	500	07/18/19 16:36	
EPA 6010D	Molybdenum	5.4	ug/L	5.0	07/18/19 04:04	
EPA 6020B	Lithium	21.8	ug/L	2.5	07/17/19 02:15	
EPA 903.1	Radium-226	0.280 ± 0.650 (1.05) C:NA T:91%	pCi/L		07/26/19 14:06	
EPA 904.0	Radium-228	0.649 ± 0.430 (0.826) C:82% T:77%	pCi/L		07/25/19 15:55	
Total Radium Calculation	Total Radium	0.929 ± 1.08 (1.88)	pCi/L		07/30/19 13:54	
SM 2540C-2011	Total Dissolved Solids	792	mg/L	50.0	07/16/19 14:18	
EPA 300.0 Rev 2.1 1993	Chloride	312	mg/L	7.0	07/14/19 03:01	
EPA 300.0 Rev 2.1 1993	Sulfate	7.5	mg/L	1.0	07/13/19 22:35	
92436599010	**LEACHATE**					
EPA 6010D	Arsenic	20.5	ug/L	10.0	07/18/19 16:45	
EPA 6010D	Barium	76.9	ug/L	5.0	07/18/19 16:45	
EPA 6010D	Calcium	310000	ug/L	500	07/18/19 16:42	
EPA 6010D	Molybdenum	248	ug/L	5.0	07/18/19 04:13	
EPA 6010D	Nickel	9.1	ug/L	5.0	07/18/19 04:13	
EPA 6020B	Boron	3250	ug/L	300	07/17/19 02:23	

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SUMMARY OF DETECTION

Project: Charah GW
Pace Project No.: 92436599

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92436599010	**LEACHATE**					
EPA 6020B	Lithium	51.2	ug/L	30.0	07/17/19 02:23	
EPA 903.1	Radium-226	0.458 ± 0.554 (0.832) C:NA T:96%	pCi/L		07/26/19 14:06	
EPA 904.0	Radium-228	0.517 ± 0.391 (0.771) C:79% T:84%	pCi/L		07/25/19 15:55	
Total Radium Calculation	Total Radium	0.975 ± 0.945 (1.60)	pCi/L		07/30/19 13:54	
SM 2540C-2011	Total Dissolved Solids	1490	mg/L	50.0	07/13/19 00:38	D6
EPA 300.0 Rev 2.1 1993	Chloride	18.3	mg/L	1.0	07/13/19 22:50	
EPA 300.0 Rev 2.1 1993	Fluoride	0.22	mg/L	0.10	07/13/19 22:50	
EPA 300.0 Rev 2.1 1993	Sulfate	592	mg/L	13.0	07/14/19 04:01	
92436599011	**EQUIPMENT BLANK**					
EPA 903.1	Radium-226	-0.0338 ± 0.672 (1.20) C:NA T:82%	pCi/L		07/26/19 14:06	
EPA 904.0	Radium-228	0.557 ± 0.396 (0.772) C:78% T:85%	pCi/L		07/25/19 15:55	
Total Radium Calculation	Total Radium	0.557 ± 1.07 (1.97)	pCi/L		07/30/19 13:55	
92436599012	**AMBIENT BLANK**					
EPA 903.1	Radium-226	0.459 ± 0.374 (0.454) C:NA T:93%	pCi/L		07/26/19 14:06	
EPA 904.0	Radium-228	0.403 ± 0.387 (0.795) C:79% T:83%	pCi/L		07/25/19 15:55	
Total Radium Calculation	Total Radium	0.862 ± 0.761 (1.25)	pCi/L		07/30/19 13:55	
92436599013	**SW-2**					
EPA 6010D	Barium	81.0	ug/L	5.0	07/18/19 16:54	
EPA 6010D	Calcium	35400	ug/L	100	07/18/19 04:23	
EPA 6020B	Boron	40.5	ug/L	25.0	07/17/19 02:51	
EPA 903.1	Radium-226	1.04 ± 0.655 (0.745) C:NA T:73%	pCi/L		07/26/19 14:06	

REPORT OF LABORATORY ANALYSIS

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SUMMARY OF DETECTION

Project: Charah GW
Pace Project No.: 92436599

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
92436599013	**SW-2**					
EPA 904.0	Radium-228	0.658 ± 0.466 (0.908) C:79% T:71%	pCi/L		07/25/19 15:55	
Total Radium Calculation	Total Radium	1.70 ± 1.12 (1.65)	pCi/L		07/30/19 13:55	
SM 2540C-2011	Total Dissolved Solids	225	mg/L	25.0	07/13/19 00:38	
EPA 300.0 Rev 2.1 1993	Chloride	50.2	mg/L	1.0	07/13/19 21:19	M1
EPA 300.0 Rev 2.1 1993	Fluoride	0.16	mg/L	0.10	07/13/19 21:19	
EPA 300.0 Rev 2.1 1993	Sulfate	47.0	mg/L	1.0	07/13/19 21:19	
92436599014	**SW-1**					
EPA 6010D	Arsenic	10.6	ug/L	10.0	07/18/19 16:57	
EPA 6010D	Barium	737	ug/L	5.0	07/18/19 16:57	
EPA 6010D	Beryllium	1.3	ug/L	1.0	07/18/19 16:57	
EPA 6010D	Calcium	11400	ug/L	100	07/18/19 04:26	
EPA 6010D	Chromium	16.3	ug/L	5.0	07/18/19 04:26	
EPA 6010D	Cobalt	13.8	ug/L	5.0	07/18/19 04:26	
EPA 6010D	Copper	22.5	ug/L	5.0	07/18/19 04:26	
EPA 6010D	Lead	46.3	ug/L	5.0	07/18/19 04:26	
EPA 6010D	Nickel	12.0	ug/L	5.0	07/18/19 04:26	
EPA 6010D	Vanadium	78.1	ug/L	5.0	07/18/19 04:26	
EPA 6010D	Zinc	83.5	ug/L	10.0	07/18/19 04:26	
EPA 6020B	Lithium	13.2	ug/L	12.5	07/17/19 22:37	
EPA 6020B	Thallium	0.19	ug/L	0.10	07/17/19 02:55	
EPA 903.1	Radium-226	2.08 ± 1.05 (0.352) C:NA T:86%	pCi/L		07/26/19 14:06	
EPA 904.0	Radium-228	1.96 ± 0.838 (1.38) C:81% T:57%	pCi/L		07/25/19 15:55	
Total Radium Calculation	Total Radium	4.04 ± 1.89 (1.73)	pCi/L		07/30/19 13:55	
SM 2540C-2011	Total Dissolved Solids	1090	mg/L	25.0	07/13/19 00:38	
EPA 300.0 Rev 2.1 1993	Chloride	7.8	mg/L	1.0	07/13/19 22:32	
EPA 300.0 Rev 2.1 1993	Fluoride	0.25	mg/L	0.10	07/13/19 22:32	
EPA 300.0 Rev 2.1 1993	Sulfate	21.6	mg/L	1.0	07/13/19 22:32	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: BG-1 **Lab ID: 92436599001** Collected: 07/11/19 13:00 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:23	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 03:23	7440-38-2	
Barium	**346**	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:23	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 03:23	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 03:23	7440-43-9	
Calcium	**27900**	ug/L	100	1	07/17/19 16:36	07/18/19 03:23	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:23	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:23	7440-48-4	
Copper	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:23	7440-50-8	
Lead	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:23	7439-92-1	
Molybdenum	**10.8**	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:23	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:23	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 03:23	7782-49-2	
Silver	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:23	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:23	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 03:23	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	07/15/19 22:55	07/17/19 00:44	7440-42-8	
Lithium	**17.1**	ug/L	2.5	1	07/15/19 22:55	07/17/19 00:44	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/15/19 22:55	07/17/19 00:44	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	07/15/19 09:44	07/16/19 10:34	7439-97-6	
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
Acetone	ND	ug/L	25.0	1		07/13/19 14:51	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/13/19 14:51	107-13-1	
Benzene	ND	ug/L	1.0	1		07/13/19 14:51	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/13/19 14:51	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/13/19 14:51	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/13/19 14:51	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/13/19 14:51	74-83-9	v2
2-Butanone (MEK)	ND	ug/L	5.0	1		07/13/19 14:51	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/13/19 14:51	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/13/19 14:51	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/13/19 14:51	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/13/19 14:51	75-00-3	
Chloroform	ND	ug/L	5.0	1		07/13/19 14:51	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/13/19 14:51	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/13/19 14:51	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/13/19 14:51	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 14:51	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 14:51	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/13/19 14:51	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/13/19 14:51	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: BG-1 **Lab ID: 92436599001** Collected: 07/11/19 13:00 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/13/19 14:51	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/13/19 14:51	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 14:51	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 14:51	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/13/19 14:51	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 14:51	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 14:51	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/13/19 14:51	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/13/19 14:51	591-78-6	
Iodomethane	ND	ug/L	20.0	1		07/13/19 14:51	74-88-4	v1
Methylene Chloride	ND	ug/L	5.0	1		07/13/19 14:51	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/13/19 14:51	108-10-1	
Styrene	ND	ug/L	1.0	1		07/13/19 14:51	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 14:51	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 14:51	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/13/19 14:51	127-18-4	
Toluene	ND	ug/L	1.0	1		07/13/19 14:51	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/13/19 14:51	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/13/19 14:51	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/13/19 14:51	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/13/19 14:51	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/13/19 14:51	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/13/19 14:51	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/13/19 14:51	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/13/19 14:51	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	97	%	70-130	1		07/13/19 14:51	460-00-4	
1,2-Dichloroethane-d4 (S)	105	%	70-130	1		07/13/19 14:51	17060-07-0	
Toluene-d8 (S)	97	%	70-130	1		07/13/19 14:51	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**638**	mg/L	50.0	1		07/16/19 14:30		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**228**	mg/L	5.0	5		07/14/19 00:49	16887-00-6	
Fluoride	**0.18**	mg/L	0.10	1		07/13/19 19:35	16984-48-8	
Sulfate	**20.6**	mg/L	1.0	1		07/13/19 19:35	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: BG-2 **Lab ID: 92436599002** Collected: 07/11/19 09:50 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:26	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 03:26	7440-38-2	
Barium	**108**	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:26	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 03:26	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 03:26	7440-43-9	
Calcium	**111000**	ug/L	500	5	07/17/19 16:36	07/19/19 02:09	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:26	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:26	7440-48-4	
Copper	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:26	7440-50-8	
Lead	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:26	7439-92-1	
Molybdenum	**11.3**	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:26	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:26	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 03:26	7782-49-2	
Silver	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:26	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:26	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 03:26	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	50.0	2	07/15/19 22:55	07/17/19 01:20	7440-42-8	D3
Lithium	**14.9**	ug/L	5.0	2	07/15/19 22:55	07/17/19 01:20	7439-93-2	
Thallium	ND	ug/L	0.20	2	07/15/19 22:55	07/17/19 01:20	7440-28-0	D3
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	07/15/19 09:44	07/16/19 10:36	7439-97-6	
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
Acetone	ND	ug/L	25.0	1		07/13/19 15:09	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/13/19 15:09	107-13-1	
Benzene	ND	ug/L	1.0	1		07/13/19 15:09	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/13/19 15:09	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/13/19 15:09	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/13/19 15:09	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/13/19 15:09	74-83-9	v2
2-Butanone (MEK)	ND	ug/L	5.0	1		07/13/19 15:09	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/13/19 15:09	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/13/19 15:09	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/13/19 15:09	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/13/19 15:09	75-00-3	
Chloroform	ND	ug/L	5.0	1		07/13/19 15:09	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/13/19 15:09	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/13/19 15:09	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/13/19 15:09	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 15:09	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 15:09	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/13/19 15:09	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/13/19 15:09	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: BG-2 **Lab ID: 92436599002** Collected: 07/11/19 09:50 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/13/19 15:09	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/13/19 15:09	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 15:09	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 15:09	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/13/19 15:09	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 15:09	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 15:09	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/13/19 15:09	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/13/19 15:09	591-78-6	
Iodomethane	ND	ug/L	20.0	1		07/13/19 15:09	74-88-4	v1
Methylene Chloride	ND	ug/L	5.0	1		07/13/19 15:09	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/13/19 15:09	108-10-1	
Styrene	ND	ug/L	1.0	1		07/13/19 15:09	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 15:09	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 15:09	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/13/19 15:09	127-18-4	
Toluene	ND	ug/L	1.0	1		07/13/19 15:09	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/13/19 15:09	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/13/19 15:09	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/13/19 15:09	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/13/19 15:09	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/13/19 15:09	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/13/19 15:09	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/13/19 15:09	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/13/19 15:09	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	99	%	70-130	1		07/13/19 15:09	460-00-4	
1,2-Dichloroethane-d4 (S)	106	%	70-130	1		07/13/19 15:09	17060-07-0	
Toluene-d8 (S)	97	%	70-130	1		07/13/19 15:09	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**952**	mg/L	50.0	1		07/16/19 14:31		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**234**	mg/L	5.0	5		07/14/19 01:03	16887-00-6	
Fluoride	**0.19**	mg/L	0.10	1		07/13/19 19:50	16984-48-8	
Sulfate	**102**	mg/L	5.0	5		07/14/19 01:03	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: MW-1 **Lab ID: 92436599003** Collected: 07/10/19 17:05 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:36	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 03:36	7440-38-2	
Barium	**261**	ug/L	5.0	1	07/17/19 16:36	07/18/19 15:57	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 15:57	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 03:36	7440-43-9	
Calcium	**216000**	ug/L	500	5	07/17/19 16:36	07/18/19 15:48	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:36	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:36	7440-48-4	
Copper	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:36	7440-50-8	
Lead	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:36	7439-92-1	
Molybdenum	**14.5**	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:36	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:36	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 03:36	7782-49-2	
Silver	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:36	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:36	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 03:36	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	07/15/19 22:55	07/17/19 01:28	7440-42-8	
Lithium	**35.6**	ug/L	2.5	1	07/15/19 22:55	07/17/19 01:28	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/15/19 22:55	07/17/19 01:28	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	07/15/19 09:44	07/16/19 10:38	7439-97-6	
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
Acetone	ND	ug/L	25.0	1		07/13/19 15:27	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/13/19 15:27	107-13-1	
Benzene	ND	ug/L	1.0	1		07/13/19 15:27	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/13/19 15:27	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/13/19 15:27	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/13/19 15:27	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/13/19 15:27	74-83-9	v2
2-Butanone (MEK)	ND	ug/L	5.0	1		07/13/19 15:27	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/13/19 15:27	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/13/19 15:27	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/13/19 15:27	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/13/19 15:27	75-00-3	
Chloroform	ND	ug/L	5.0	1		07/13/19 15:27	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/13/19 15:27	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/13/19 15:27	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/13/19 15:27	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 15:27	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 15:27	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/13/19 15:27	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/13/19 15:27	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: MW-1 **Lab ID: 92436599003** Collected: 07/10/19 17:05 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/13/19 15:27	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/13/19 15:27	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 15:27	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 15:27	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/13/19 15:27	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 15:27	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 15:27	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/13/19 15:27	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/13/19 15:27	591-78-6	
Iodomethane	ND	ug/L	20.0	1		07/13/19 15:27	74-88-4	v1
Methylene Chloride	ND	ug/L	5.0	1		07/13/19 15:27	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/13/19 15:27	108-10-1	
Styrene	ND	ug/L	1.0	1		07/13/19 15:27	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 15:27	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 15:27	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/13/19 15:27	127-18-4	
Toluene	ND	ug/L	1.0	1		07/13/19 15:27	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/13/19 15:27	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/13/19 15:27	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/13/19 15:27	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/13/19 15:27	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/13/19 15:27	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/13/19 15:27	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/13/19 15:27	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/13/19 15:27	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	97	%	70-130	1		07/13/19 15:27	460-00-4	
1,2-Dichloroethane-d4 (S)	105	%	70-130	1		07/13/19 15:27	17060-07-0	
Toluene-d8 (S)	97	%	70-130	1		07/13/19 15:27	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**1800**	mg/L	50.0	1		07/16/19 14:15		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**855**	mg/L	18.0	18		07/14/19 01:18	16887-00-6	M6
Fluoride	**0.17**	mg/L	0.10	1		07/13/19 20:04	16984-48-8	
Sulfate	**7.2**	mg/L	1.0	1		07/13/19 20:04	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: MW-4 **Lab ID: 92436599004** Collected: 07/09/19 10:55 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:39	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 03:39	7440-38-2	
Barium	**319**	ug/L	5.0	1	07/17/19 16:36	07/18/19 16:00	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 16:00	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 03:39	7440-43-9	
Calcium	**69400**	ug/L	100	1	07/17/19 16:36	07/18/19 03:39	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:39	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:39	7440-48-4	
Copper	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:39	7440-50-8	
Lead	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:39	7439-92-1	
Molybdenum	**18.7**	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:39	7439-98-7	
Nickel	**5.1**	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:39	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 03:39	7782-49-2	
Silver	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:39	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:39	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 03:39	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	07/15/19 22:55	07/17/19 01:36	7440-42-8	
Lithium	**26.8**	ug/L	2.5	1	07/15/19 22:55	07/17/19 01:36	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/15/19 22:55	07/17/19 01:36	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	07/15/19 09:44	07/16/19 10:41	7439-97-6	
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
Acetone	ND	ug/L	25.0	1		07/13/19 15:44	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/13/19 15:44	107-13-1	
Benzene	ND	ug/L	1.0	1		07/13/19 15:44	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/13/19 15:44	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/13/19 15:44	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/13/19 15:44	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/13/19 15:44	74-83-9	v2
2-Butanone (MEK)	ND	ug/L	5.0	1		07/13/19 15:44	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/13/19 15:44	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/13/19 15:44	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/13/19 15:44	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/13/19 15:44	75-00-3	
Chloroform	ND	ug/L	5.0	1		07/13/19 15:44	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/13/19 15:44	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/13/19 15:44	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/13/19 15:44	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 15:44	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 15:44	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/13/19 15:44	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/13/19 15:44	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: MW-4 **Lab ID: 92436599004** Collected: 07/09/19 10:55 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/13/19 15:44	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/13/19 15:44	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 15:44	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 15:44	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/13/19 15:44	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 15:44	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 15:44	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/13/19 15:44	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/13/19 15:44	591-78-6	
Iodomethane	ND	ug/L	20.0	1		07/13/19 15:44	74-88-4	v1
Methylene Chloride	ND	ug/L	5.0	1		07/13/19 15:44	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/13/19 15:44	108-10-1	
Styrene	ND	ug/L	1.0	1		07/13/19 15:44	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 15:44	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 15:44	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/13/19 15:44	127-18-4	
Toluene	ND	ug/L	1.0	1		07/13/19 15:44	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/13/19 15:44	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/13/19 15:44	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/13/19 15:44	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/13/19 15:44	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/13/19 15:44	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/13/19 15:44	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/13/19 15:44	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/13/19 15:44	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	97	%	70-130	1		07/13/19 15:44	460-00-4	
1,2-Dichloroethane-d4 (S)	106	%	70-130	1		07/13/19 15:44	17060-07-0	
Toluene-d8 (S)	99	%	70-130	1		07/13/19 15:44	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**1170**	mg/L	50.0	1		07/13/19 00:39		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**467**	mg/L	10.0	10		07/14/19 02:02	16887-00-6	
Fluoride	**0.34**	mg/L	0.10	1		07/13/19 20:49	16984-48-8	
Sulfate	**11.2**	mg/L	1.0	1		07/13/19 20:49	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: MW-5 **Lab ID: 92436599005** Collected: 07/09/19 14:50 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:42	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 03:42	7440-38-2	
Barium	**153**	ug/L	5.0	1	07/17/19 16:36	07/18/19 16:03	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 16:03	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 03:42	7440-43-9	
Calcium	**14300**	ug/L	100	1	07/17/19 16:36	07/18/19 03:42	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:42	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:42	7440-48-4	
Copper	**5.6**	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:42	7440-50-8	
Lead	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:42	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:42	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:42	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 03:42	7782-49-2	
Silver	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:42	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:42	7440-62-2	
Zinc	**11.4**	ug/L	10.0	1	07/17/19 16:36	07/18/19 03:42	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	125	5	07/15/19 22:55	07/17/19 22:05	7440-42-8	D3
Lithium	**11.6**	ug/L	2.5	1	07/15/19 22:55	07/17/19 01:44	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/15/19 22:55	07/17/19 01:44	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	07/15/19 09:44	07/16/19 10:43	7439-97-6	
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
Acetone	ND	ug/L	25.0	1		07/13/19 16:02	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/13/19 16:02	107-13-1	
Benzene	ND	ug/L	1.0	1		07/13/19 16:02	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/13/19 16:02	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/13/19 16:02	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/13/19 16:02	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/13/19 16:02	74-83-9	v2
2-Butanone (MEK)	ND	ug/L	5.0	1		07/13/19 16:02	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/13/19 16:02	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/13/19 16:02	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/13/19 16:02	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/13/19 16:02	75-00-3	
Chloroform	ND	ug/L	5.0	1		07/13/19 16:02	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/13/19 16:02	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/13/19 16:02	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/13/19 16:02	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 16:02	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 16:02	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/13/19 16:02	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/13/19 16:02	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: MW-5 **Lab ID: 92436599005** Collected: 07/09/19 14:50 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/13/19 16:02	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/13/19 16:02	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 16:02	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 16:02	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/13/19 16:02	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 16:02	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 16:02	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/13/19 16:02	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/13/19 16:02	591-78-6	
Iodomethane	ND	ug/L	20.0	1		07/13/19 16:02	74-88-4	v1
Methylene Chloride	ND	ug/L	5.0	1		07/13/19 16:02	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/13/19 16:02	108-10-1	
Styrene	ND	ug/L	1.0	1		07/13/19 16:02	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 16:02	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 16:02	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/13/19 16:02	127-18-4	
Toluene	ND	ug/L	1.0	1		07/13/19 16:02	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/13/19 16:02	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/13/19 16:02	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/13/19 16:02	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/13/19 16:02	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/13/19 16:02	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/13/19 16:02	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/13/19 16:02	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/13/19 16:02	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	98	%	70-130	1		07/13/19 16:02	460-00-4	
1,2-Dichloroethane-d4 (S)	108	%	70-130	1		07/13/19 16:02	17060-07-0	
Toluene-d8 (S)	98	%	70-130	1		07/13/19 16:02	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**254**	mg/L	25.0	1		07/13/19 00:39		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**22.3**	mg/L	1.0	1		07/13/19 21:04	16887-00-6	
Fluoride	**0.60**	mg/L	0.10	1		07/13/19 21:04	16984-48-8	
Sulfate	**3.5**	mg/L	1.0	1		07/13/19 21:04	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: MW-6 **Lab ID: 92436599006** Collected: 07/09/19 13:15 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:45	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 03:45	7440-38-2	
Barium	**47.8**	ug/L	5.0	1	07/17/19 16:36	07/18/19 16:06	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 16:06	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 03:45	7440-43-9	
Calcium	**37800**	ug/L	100	1	07/17/19 16:36	07/18/19 03:45	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:45	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:45	7440-48-4	
Copper	**5.5**	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:45	7440-50-8	
Lead	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:45	7439-92-1	
Molybdenum	**8.3**	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:45	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:45	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 03:45	7782-49-2	
Silver	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:45	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:45	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 03:45	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	07/15/19 22:55	07/17/19 01:52	7440-42-8	
Lithium	**22.7**	ug/L	2.5	1	07/15/19 22:55	07/17/19 01:52	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/15/19 22:55	07/17/19 01:52	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	07/15/19 09:44	07/16/19 10:45	7439-97-6	
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
Acetone	ND	ug/L	25.0	1		07/13/19 16:20	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/13/19 16:20	107-13-1	
Benzene	ND	ug/L	1.0	1		07/13/19 16:20	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/13/19 16:20	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/13/19 16:20	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/13/19 16:20	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/13/19 16:20	74-83-9	v2
2-Butanone (MEK)	ND	ug/L	5.0	1		07/13/19 16:20	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/13/19 16:20	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/13/19 16:20	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/13/19 16:20	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/13/19 16:20	75-00-3	
Chloroform	ND	ug/L	5.0	1		07/13/19 16:20	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/13/19 16:20	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/13/19 16:20	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/13/19 16:20	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 16:20	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 16:20	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/13/19 16:20	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/13/19 16:20	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: MW-6 **Lab ID: 92436599006** Collected: 07/09/19 13:15 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/13/19 16:20	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/13/19 16:20	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 16:20	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 16:20	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/13/19 16:20	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 16:20	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 16:20	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/13/19 16:20	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/13/19 16:20	591-78-6	
Iodomethane	ND	ug/L	20.0	1		07/13/19 16:20	74-88-4	v1
Methylene Chloride	ND	ug/L	5.0	1		07/13/19 16:20	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/13/19 16:20	108-10-1	
Styrene	ND	ug/L	1.0	1		07/13/19 16:20	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 16:20	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 16:20	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/13/19 16:20	127-18-4	
Toluene	ND	ug/L	1.0	1		07/13/19 16:20	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/13/19 16:20	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/13/19 16:20	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/13/19 16:20	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/13/19 16:20	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/13/19 16:20	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/13/19 16:20	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/13/19 16:20	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/13/19 16:20	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	97	%	70-130	1		07/13/19 16:20	460-00-4	
1,2-Dichloroethane-d4 (S)	109	%	70-130	1		07/13/19 16:20	17060-07-0	
Toluene-d8 (S)	101	%	70-130	1		07/13/19 16:20	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**574**	mg/L	50.0	1		07/13/19 00:39		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**208**	mg/L	4.0	4		07/14/19 02:17	16887-00-6	
Fluoride	**0.38**	mg/L	0.10	1		07/13/19 21:49	16984-48-8	
Sulfate	**25.8**	mg/L	1.0	1		07/13/19 21:49	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: MW-7R **Lab ID: 92436599007** Collected: 07/10/19 09:50 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	**13.6**	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:58	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 03:58	7440-38-2	
Barium	**395**	ug/L	5.0	1	07/17/19 16:36	07/18/19 16:21	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 16:21	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 03:58	7440-43-9	
Calcium	**102000**	ug/L	500	5	07/17/19 16:36	07/18/19 16:18	7440-70-2	
Chromium	**1940**	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:58	7440-47-3	
Cobalt	**20.4**	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:58	7440-48-4	
Copper	**79.3**	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:58	7440-50-8	
Lead	**6.8**	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:58	7439-92-1	
Molybdenum	**49.5**	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:58	7439-98-7	
Nickel	**880**	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:58	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 03:58	7782-49-2	
Silver	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:58	7440-22-4	
Vanadium	**18.8**	ug/L	5.0	1	07/17/19 16:36	07/18/19 03:58	7440-62-2	
Zinc	**53.4**	ug/L	10.0	1	07/17/19 16:36	07/18/19 03:58	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	125	5	07/15/19 22:55	07/17/19 22:09	7440-42-8	D3
Lithium	**31.7**	ug/L	2.5	1	07/15/19 22:55	07/17/19 02:00	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/15/19 22:55	07/17/19 02:00	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	07/15/19 09:44	07/16/19 10:48	7439-97-6	
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
Acetone	ND	ug/L	25.0	1		07/13/19 16:38	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/13/19 16:38	107-13-1	
Benzene	ND	ug/L	1.0	1		07/13/19 16:38	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/13/19 16:38	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/13/19 16:38	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/13/19 16:38	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/13/19 16:38	74-83-9	v2
2-Butanone (MEK)	ND	ug/L	5.0	1		07/13/19 16:38	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/13/19 16:38	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/13/19 16:38	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/13/19 16:38	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/13/19 16:38	75-00-3	
Chloroform	ND	ug/L	5.0	1		07/13/19 16:38	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/13/19 16:38	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/13/19 16:38	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/13/19 16:38	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 16:38	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 16:38	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/13/19 16:38	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/13/19 16:38	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: MW-7R **Lab ID: 92436599007** Collected: 07/10/19 09:50 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/13/19 16:38	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/13/19 16:38	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 16:38	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 16:38	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/13/19 16:38	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 16:38	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 16:38	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/13/19 16:38	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/13/19 16:38	591-78-6	
Iodomethane	ND	ug/L	20.0	1		07/13/19 16:38	74-88-4	v1
Methylene Chloride	ND	ug/L	5.0	1		07/13/19 16:38	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/13/19 16:38	108-10-1	
Styrene	ND	ug/L	1.0	1		07/13/19 16:38	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 16:38	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 16:38	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/13/19 16:38	127-18-4	
Toluene	ND	ug/L	1.0	1		07/13/19 16:38	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/13/19 16:38	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/13/19 16:38	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/13/19 16:38	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/13/19 16:38	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/13/19 16:38	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/13/19 16:38	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/13/19 16:38	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/13/19 16:38	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	97	%	70-130	1		07/13/19 16:38	460-00-4	
1,2-Dichloroethane-d4 (S)	107	%	70-130	1		07/13/19 16:38	17060-07-0	
Toluene-d8 (S)	99	%	70-130	1		07/13/19 16:38	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**790**	mg/L	50.0	1		07/16/19 14:15		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**275**	mg/L	6.0	6		07/14/19 02:32	16887-00-6	
Fluoride	**0.12**	mg/L	0.10	1		07/13/19 22:05	16984-48-8	
Sulfate	**16.8**	mg/L	1.0	1		07/13/19 22:05	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: MW-8 **Lab ID: 92436599008** Collected: 07/10/19 13:25 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:01	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 04:01	7440-38-2	
Barium	**976**	ug/L	5.0	1	07/17/19 16:36	07/18/19 16:33	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 16:33	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 04:01	7440-43-9	
Calcium	**94600**	ug/L	500	5	07/17/19 16:36	07/18/19 16:24	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:01	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:01	7440-48-4	
Copper	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:01	7440-50-8	
Lead	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:01	7439-92-1	
Molybdenum	**5.2**	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:01	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:01	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 04:01	7782-49-2	
Silver	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:01	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:01	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 04:01	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	125	5	07/15/19 22:55	07/17/19 22:13	7440-42-8	D3
Lithium	**21.1**	ug/L	2.5	1	07/15/19 22:55	07/17/19 02:08	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/15/19 22:55	07/17/19 02:08	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	07/15/19 09:44	07/16/19 10:50	7439-97-6	
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
Acetone	ND	ug/L	25.0	1		07/13/19 16:56	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/13/19 16:56	107-13-1	
Benzene	ND	ug/L	1.0	1		07/13/19 16:56	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/13/19 16:56	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/13/19 16:56	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/13/19 16:56	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/13/19 16:56	74-83-9	v2
2-Butanone (MEK)	ND	ug/L	5.0	1		07/13/19 16:56	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/13/19 16:56	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/13/19 16:56	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/13/19 16:56	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/13/19 16:56	75-00-3	
Chloroform	ND	ug/L	5.0	1		07/13/19 16:56	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/13/19 16:56	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/13/19 16:56	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/13/19 16:56	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 16:56	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 16:56	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/13/19 16:56	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/13/19 16:56	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: MW-8 **Lab ID: 92436599008** Collected: 07/10/19 13:25 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/13/19 16:56	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/13/19 16:56	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 16:56	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 16:56	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/13/19 16:56	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 16:56	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 16:56	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/13/19 16:56	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/13/19 16:56	591-78-6	
Iodomethane	ND	ug/L	20.0	1		07/13/19 16:56	74-88-4	v1
Methylene Chloride	ND	ug/L	5.0	1		07/13/19 16:56	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/13/19 16:56	108-10-1	
Styrene	ND	ug/L	1.0	1		07/13/19 16:56	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 16:56	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 16:56	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/13/19 16:56	127-18-4	
Toluene	ND	ug/L	1.0	1		07/13/19 16:56	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/13/19 16:56	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/13/19 16:56	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/13/19 16:56	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/13/19 16:56	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/13/19 16:56	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/13/19 16:56	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/13/19 16:56	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/13/19 16:56	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	98	%	70-130	1		07/13/19 16:56	460-00-4	
1,2-Dichloroethane-d4 (S)	107	%	70-130	1		07/13/19 16:56	17060-07-0	
Toluene-d8 (S)	99	%	70-130	1		07/13/19 16:56	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**768**	mg/L	50.0	1		07/16/19 14:15		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**309**	mg/L	7.0	7		07/14/19 02:47	16887-00-6	
Fluoride	ND	mg/L	0.10	1		07/13/19 22:20	16984-48-8	
Sulfate	**7.5**	mg/L	1.0	1		07/13/19 22:20	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: DUP **Lab ID: 92436599009** Collected: 07/10/19 12:20 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:04	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 04:04	7440-38-2	
Barium	**992**	ug/L	5.0	1	07/17/19 16:36	07/18/19 16:39	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 16:39	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 04:04	7440-43-9	
Calcium	**98000**	ug/L	500	5	07/17/19 16:36	07/18/19 16:36	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:04	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:04	7440-48-4	
Copper	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:04	7440-50-8	
Lead	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:04	7439-92-1	
Molybdenum	**5.4**	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:04	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:04	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 04:04	7782-49-2	
Silver	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:04	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:04	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 04:04	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	125	5	07/15/19 22:55	07/17/19 22:29	7440-42-8	D3
Lithium	**21.8**	ug/L	2.5	1	07/15/19 22:55	07/17/19 02:15	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/15/19 22:55	07/17/19 02:15	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	07/15/19 09:44	07/16/19 10:57	7439-97-6	
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
Acetone	ND	ug/L	25.0	1		07/13/19 17:14	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/13/19 17:14	107-13-1	
Benzene	ND	ug/L	1.0	1		07/13/19 17:14	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/13/19 17:14	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/13/19 17:14	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/13/19 17:14	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/13/19 17:14	74-83-9	v2
2-Butanone (MEK)	ND	ug/L	5.0	1		07/13/19 17:14	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/13/19 17:14	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/13/19 17:14	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/13/19 17:14	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/13/19 17:14	75-00-3	
Chloroform	ND	ug/L	5.0	1		07/13/19 17:14	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/13/19 17:14	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/13/19 17:14	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/13/19 17:14	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 17:14	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 17:14	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/13/19 17:14	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/13/19 17:14	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: DUP **Lab ID: 92436599009** Collected: 07/10/19 12:20 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/13/19 17:14	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/13/19 17:14	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 17:14	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 17:14	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/13/19 17:14	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 17:14	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 17:14	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/13/19 17:14	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/13/19 17:14	591-78-6	
Iodomethane	ND	ug/L	20.0	1		07/13/19 17:14	74-88-4	v1
Methylene Chloride	ND	ug/L	5.0	1		07/13/19 17:14	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/13/19 17:14	108-10-1	
Styrene	ND	ug/L	1.0	1		07/13/19 17:14	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 17:14	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 17:14	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/13/19 17:14	127-18-4	
Toluene	ND	ug/L	1.0	1		07/13/19 17:14	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/13/19 17:14	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/13/19 17:14	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/13/19 17:14	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/13/19 17:14	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/13/19 17:14	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/13/19 17:14	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/13/19 17:14	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/13/19 17:14	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	97	%	70-130	1		07/13/19 17:14	460-00-4	
1,2-Dichloroethane-d4 (S)	105	%	70-130	1		07/13/19 17:14	17060-07-0	
Toluene-d8 (S)	98	%	70-130	1		07/13/19 17:14	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**792**	mg/L	50.0	1		07/16/19 14:18		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**312**	mg/L	7.0	7		07/14/19 03:01	16887-00-6	
Fluoride	ND	mg/L	0.10	1		07/13/19 22:35	16984-48-8	
Sulfate	**7.5**	mg/L	1.0	1		07/13/19 22:35	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: LEACHATE **Lab ID: 92436599010** Collected: 07/08/19 11:30 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:13	7440-36-0	
Arsenic	**20.5**	ug/L	10.0	1	07/17/19 16:36	07/18/19 16:45	7440-38-2	
Barium	**76.9**	ug/L	5.0	1	07/17/19 16:36	07/18/19 16:45	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 16:45	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 04:13	7440-43-9	
Calcium	**310000**	ug/L	500	5	07/17/19 16:36	07/18/19 16:42	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:13	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:13	7440-48-4	
Copper	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:13	7440-50-8	
Lead	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:13	7439-92-1	
Molybdenum	**248**	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:13	7439-98-7	
Nickel	**9.1**	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:13	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 04:13	7782-49-2	
Silver	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:13	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:13	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 04:13	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	**3250**	ug/L	300	12	07/15/19 22:55	07/17/19 02:23	7440-42-8	
Lithium	**51.2**	ug/L	30.0	12	07/15/19 22:55	07/17/19 02:23	7439-93-2	
Thallium	ND	ug/L	1.2	12	07/15/19 22:55	07/17/19 02:23	7440-28-0	D3
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	07/15/19 09:44	07/16/19 11:00	7439-97-6	
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
Acetone	ND	ug/L	25.0	1		07/13/19 17:32	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/13/19 17:32	107-13-1	
Benzene	ND	ug/L	1.0	1		07/13/19 17:32	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/13/19 17:32	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/13/19 17:32	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/13/19 17:32	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/13/19 17:32	74-83-9	v2
2-Butanone (MEK)	ND	ug/L	5.0	1		07/13/19 17:32	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/13/19 17:32	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/13/19 17:32	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/13/19 17:32	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/13/19 17:32	75-00-3	
Chloroform	ND	ug/L	5.0	1		07/13/19 17:32	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/13/19 17:32	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/13/19 17:32	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/13/19 17:32	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 17:32	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 17:32	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/13/19 17:32	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/13/19 17:32	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: LEACHATE **Lab ID: 92436599010** Collected: 07/08/19 11:30 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/13/19 17:32	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/13/19 17:32	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 17:32	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 17:32	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/13/19 17:32	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 17:32	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 17:32	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/13/19 17:32	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/13/19 17:32	591-78-6	
Iodomethane	ND	ug/L	20.0	1		07/13/19 17:32	74-88-4	v1
Methylene Chloride	ND	ug/L	5.0	1		07/13/19 17:32	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/13/19 17:32	108-10-1	
Styrene	ND	ug/L	1.0	1		07/13/19 17:32	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 17:32	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 17:32	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/13/19 17:32	127-18-4	
Toluene	ND	ug/L	1.0	1		07/13/19 17:32	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/13/19 17:32	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/13/19 17:32	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/13/19 17:32	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/13/19 17:32	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/13/19 17:32	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/13/19 17:32	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/13/19 17:32	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/13/19 17:32	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	97	%	70-130	1		07/13/19 17:32	460-00-4	
1,2-Dichloroethane-d4 (S)	105	%	70-130	1		07/13/19 17:32	17060-07-0	
Toluene-d8 (S)	98	%	70-130	1		07/13/19 17:32	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**1490**	mg/L	50.0	1		07/13/19 00:38		D6
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**18.3**	mg/L	1.0	1		07/13/19 22:50	16887-00-6	
Fluoride	**0.22**	mg/L	0.10	1		07/13/19 22:50	16984-48-8	
Sulfate	**592**	mg/L	13.0	13		07/14/19 04:01	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: EQUIPMENT BLANK **Lab ID: 92436599011** Collected: 07/11/19 13:30 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:16	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 16:48	7440-38-2	
Barium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 16:48	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 16:48	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 04:16	7440-43-9	
Calcium	ND	ug/L	100	1	07/17/19 16:36	07/18/19 04:16	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:16	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:16	7440-48-4	
Copper	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:16	7440-50-8	
Lead	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:16	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:16	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:16	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 04:16	7782-49-2	
Silver	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:16	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:16	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 04:16	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	07/15/19 22:55	07/17/19 22:33	7440-42-8	
Lithium	ND	ug/L	2.5	1	07/15/19 22:55	07/17/19 22:33	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/15/19 22:55	07/17/19 22:33	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	07/15/19 09:44	07/16/19 11:02	7439-97-6	
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
Acetone	ND	ug/L	25.0	1		07/13/19 13:03	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/13/19 13:03	107-13-1	
Benzene	ND	ug/L	1.0	1		07/13/19 13:03	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/13/19 13:03	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/13/19 13:03	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/13/19 13:03	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/13/19 13:03	74-83-9	v3
2-Butanone (MEK)	ND	ug/L	5.0	1		07/13/19 13:03	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/13/19 13:03	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/13/19 13:03	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/13/19 13:03	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/13/19 13:03	75-00-3	
Chloroform	ND	ug/L	5.0	1		07/13/19 13:03	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/13/19 13:03	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/13/19 13:03	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/13/19 13:03	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 13:03	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 13:03	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/13/19 13:03	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/13/19 13:03	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: EQUIPMENT BLANK **Lab ID: 92436599011** Collected: 07/11/19 13:30 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/13/19 13:03	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/13/19 13:03	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 13:03	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 13:03	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/13/19 13:03	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 13:03	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 13:03	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/13/19 13:03	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/13/19 13:03	591-78-6	
Iodomethane	ND	ug/L	20.0	1		07/13/19 13:03	74-88-4	v1
Methylene Chloride	ND	ug/L	5.0	1		07/13/19 13:03	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/13/19 13:03	108-10-1	
Styrene	ND	ug/L	1.0	1		07/13/19 13:03	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 13:03	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 13:03	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/13/19 13:03	127-18-4	
Toluene	ND	ug/L	1.0	1		07/13/19 13:03	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/13/19 13:03	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/13/19 13:03	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/13/19 13:03	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/13/19 13:03	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/13/19 13:03	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/13/19 13:03	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/13/19 13:03	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/13/19 13:03	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	98	%	70-130	1		07/13/19 13:03	460-00-4	
1,2-Dichloroethane-d4 (S)	104	%	70-130	1		07/13/19 13:03	17060-07-0	
Toluene-d8 (S)	98	%	70-130	1		07/13/19 13:03	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	ND	mg/L	25.0	1		07/16/19 14:31		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	ND	mg/L	1.0	1		07/13/19 23:05	16887-00-6	
Fluoride	ND	mg/L	0.10	1		07/13/19 23:05	16984-48-8	
Sulfate	ND	mg/L	1.0	1		07/13/19 23:05	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: AMBIENT BLANK **Lab ID: 92436599012** Collected: 07/09/19 15:20 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:20	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 16:51	7440-38-2	
Barium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 16:51	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 16:51	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 04:20	7440-43-9	
Calcium	ND	ug/L	100	1	07/17/19 16:36	07/18/19 04:20	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:20	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:20	7440-48-4	
Copper	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:20	7440-50-8	
Lead	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:20	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:20	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:20	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 04:20	7782-49-2	
Silver	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:20	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:20	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 04:20	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	25.0	1	07/15/19 22:55	07/17/19 02:47	7440-42-8	
Lithium	ND	ug/L	2.5	1	07/15/19 22:55	07/17/19 02:47	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/15/19 22:55	07/17/19 02:47	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	07/15/19 09:44	07/16/19 11:04	7439-97-6	
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
Acetone	ND	ug/L	25.0	1		07/13/19 13:21	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/13/19 13:21	107-13-1	
Benzene	ND	ug/L	1.0	1		07/13/19 13:21	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/13/19 13:21	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/13/19 13:21	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/13/19 13:21	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/13/19 13:21	74-83-9	v2
2-Butanone (MEK)	ND	ug/L	5.0	1		07/13/19 13:21	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/13/19 13:21	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/13/19 13:21	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/13/19 13:21	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/13/19 13:21	75-00-3	
Chloroform	ND	ug/L	5.0	1		07/13/19 13:21	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/13/19 13:21	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/13/19 13:21	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/13/19 13:21	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 13:21	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 13:21	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/13/19 13:21	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/13/19 13:21	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: AMBIENT BLANK **Lab ID: 92436599012** Collected: 07/09/19 15:20 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/13/19 13:21	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/13/19 13:21	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 13:21	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 13:21	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/13/19 13:21	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 13:21	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 13:21	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/13/19 13:21	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/13/19 13:21	591-78-6	
Iodomethane	ND	ug/L	20.0	1		07/13/19 13:21	74-88-4	v1
Methylene Chloride	ND	ug/L	5.0	1		07/13/19 13:21	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/13/19 13:21	108-10-1	
Styrene	ND	ug/L	1.0	1		07/13/19 13:21	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 13:21	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 13:21	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/13/19 13:21	127-18-4	
Toluene	ND	ug/L	1.0	1		07/13/19 13:21	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/13/19 13:21	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/13/19 13:21	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/13/19 13:21	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/13/19 13:21	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/13/19 13:21	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/13/19 13:21	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/13/19 13:21	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/13/19 13:21	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	97	%	70-130	1		07/13/19 13:21	460-00-4	
1,2-Dichloroethane-d4 (S)	105	%	70-130	1		07/13/19 13:21	17060-07-0	
Toluene-d8 (S)	98	%	70-130	1		07/13/19 13:21	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	ND	mg/L	25.0	1		07/13/19 00:39		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	ND	mg/L	1.0	1		07/13/19 23:20	16887-00-6	
Fluoride	ND	mg/L	0.10	1		07/13/19 23:20	16984-48-8	
Sulfate	ND	mg/L	1.0	1		07/13/19 23:20	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: SW-2 **Lab ID: 92436599013** Collected: 07/08/19 12:15 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:23	7440-36-0	
Arsenic	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 16:54	7440-38-2	
Barium	**81.0**	ug/L	5.0	1	07/17/19 16:36	07/18/19 16:54	7440-39-3	
Beryllium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 16:54	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 04:23	7440-43-9	
Calcium	**35400**	ug/L	100	1	07/17/19 16:36	07/18/19 04:23	7440-70-2	
Chromium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:23	7440-47-3	
Cobalt	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:23	7440-48-4	
Copper	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:23	7440-50-8	
Lead	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:23	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:23	7439-98-7	
Nickel	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:23	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 04:23	7782-49-2	
Silver	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:23	7440-22-4	
Vanadium	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:23	7440-62-2	
Zinc	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 04:23	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	**40.5**	ug/L	25.0	1	07/15/19 22:55	07/17/19 02:51	7440-42-8	
Lithium	ND	ug/L	2.5	1	07/15/19 22:55	07/17/19 02:51	7439-93-2	
Thallium	ND	ug/L	0.10	1	07/15/19 22:55	07/17/19 02:51	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	07/15/19 09:44	07/16/19 11:07	7439-97-6	
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
Acetone	ND	ug/L	25.0	1		07/13/19 17:50	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/13/19 17:50	107-13-1	
Benzene	ND	ug/L	1.0	1		07/13/19 17:50	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/13/19 17:50	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/13/19 17:50	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/13/19 17:50	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/13/19 17:50	74-83-9	v2
2-Butanone (MEK)	ND	ug/L	5.0	1		07/13/19 17:50	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/13/19 17:50	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/13/19 17:50	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/13/19 17:50	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/13/19 17:50	75-00-3	
Chloroform	ND	ug/L	5.0	1		07/13/19 17:50	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/13/19 17:50	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/13/19 17:50	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/13/19 17:50	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 17:50	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 17:50	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/13/19 17:50	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/13/19 17:50	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: SW-2 **Lab ID: 92436599013** Collected: 07/08/19 12:15 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/13/19 17:50	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/13/19 17:50	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 17:50	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 17:50	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/13/19 17:50	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 17:50	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 17:50	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/13/19 17:50	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/13/19 17:50	591-78-6	
Iodomethane	ND	ug/L	20.0	1		07/13/19 17:50	74-88-4	v1
Methylene Chloride	ND	ug/L	5.0	1		07/13/19 17:50	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/13/19 17:50	108-10-1	
Styrene	ND	ug/L	1.0	1		07/13/19 17:50	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 17:50	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 17:50	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/13/19 17:50	127-18-4	
Toluene	ND	ug/L	1.0	1		07/13/19 17:50	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/13/19 17:50	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/13/19 17:50	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/13/19 17:50	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/13/19 17:50	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/13/19 17:50	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/13/19 17:50	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/13/19 17:50	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/13/19 17:50	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	97	%	70-130	1		07/13/19 17:50	460-00-4	
1,2-Dichloroethane-d4 (S)	106	%	70-130	1		07/13/19 17:50	17060-07-0	
Toluene-d8 (S)	98	%	70-130	1		07/13/19 17:50	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**225**	mg/L	25.0	1		07/13/19 00:38		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**50.2**	mg/L	1.0	1		07/13/19 21:19	16887-00-6	M1
Fluoride	**0.16**	mg/L	0.10	1		07/13/19 21:19	16984-48-8	
Sulfate	**47.0**	mg/L	1.0	1		07/13/19 21:19	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: SW-1 **Lab ID: 92436599014** Collected: 07/08/19 12:00 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3010A							
Antimony	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:26	7440-36-0	
Arsenic	**10.6**	ug/L	10.0	1	07/17/19 16:36	07/18/19 16:57	7440-38-2	
Barium	**737**	ug/L	5.0	1	07/17/19 16:36	07/18/19 16:57	7440-39-3	
Beryllium	**1.3**	ug/L	1.0	1	07/17/19 16:36	07/18/19 16:57	7440-41-7	
Cadmium	ND	ug/L	1.0	1	07/17/19 16:36	07/18/19 04:26	7440-43-9	
Calcium	**11400**	ug/L	100	1	07/17/19 16:36	07/18/19 04:26	7440-70-2	
Chromium	**16.3**	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:26	7440-47-3	
Cobalt	**13.8**	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:26	7440-48-4	
Copper	**22.5**	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:26	7440-50-8	
Lead	**46.3**	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:26	7439-92-1	
Molybdenum	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:26	7439-98-7	
Nickel	**12.0**	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:26	7440-02-0	
Selenium	ND	ug/L	10.0	1	07/17/19 16:36	07/18/19 04:26	7782-49-2	
Silver	ND	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:26	7440-22-4	
Vanadium	**78.1**	ug/L	5.0	1	07/17/19 16:36	07/18/19 04:26	7440-62-2	
Zinc	**83.5**	ug/L	10.0	1	07/17/19 16:36	07/18/19 04:26	7440-66-6	
6020 MET ICPMS	Analytical Method: EPA 6020B Preparation Method: EPA 3010A							
Boron	ND	ug/L	125	5	07/15/19 22:55	07/17/19 22:37	7440-42-8	D3
Lithium	**13.2**	ug/L	12.5	5	07/15/19 22:55	07/17/19 22:37	7439-93-2	
Thallium	**0.19**	ug/L	0.10	1	07/15/19 22:55	07/17/19 02:55	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A							
Mercury	ND	ug/L	0.20	1	07/15/19 09:44	07/16/19 11:09	7439-97-6	
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
Acetone	ND	ug/L	25.0	1		07/13/19 18:08	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/13/19 18:08	107-13-1	
Benzene	ND	ug/L	1.0	1		07/13/19 18:08	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/13/19 18:08	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/13/19 18:08	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/13/19 18:08	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/13/19 18:08	74-83-9	v2
2-Butanone (MEK)	ND	ug/L	5.0	1		07/13/19 18:08	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/13/19 18:08	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/13/19 18:08	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/13/19 18:08	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/13/19 18:08	75-00-3	
Chloroform	ND	ug/L	5.0	1		07/13/19 18:08	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/13/19 18:08	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/13/19 18:08	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/13/19 18:08	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 18:08	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 18:08	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/13/19 18:08	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/13/19 18:08	75-34-3	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: SW-1 **Lab ID: 92436599014** Collected: 07/08/19 12:00 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
1,2-Dichloroethane	ND	ug/L	1.0	1		07/13/19 18:08	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/13/19 18:08	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 18:08	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 18:08	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/13/19 18:08	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 18:08	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 18:08	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/13/19 18:08	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/13/19 18:08	591-78-6	
Iodomethane	ND	ug/L	20.0	1		07/13/19 18:08	74-88-4	v1
Methylene Chloride	ND	ug/L	5.0	1		07/13/19 18:08	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/13/19 18:08	108-10-1	
Styrene	ND	ug/L	1.0	1		07/13/19 18:08	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 18:08	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 18:08	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/13/19 18:08	127-18-4	
Toluene	ND	ug/L	1.0	1		07/13/19 18:08	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/13/19 18:08	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/13/19 18:08	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/13/19 18:08	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/13/19 18:08	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/13/19 18:08	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/13/19 18:08	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/13/19 18:08	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/13/19 18:08	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	95	%	70-130	1		07/13/19 18:08	460-00-4	
1,2-Dichloroethane-d4 (S)	107	%	70-130	1		07/13/19 18:08	17060-07-0	
Toluene-d8 (S)	99	%	70-130	1		07/13/19 18:08	2037-26-5	
2540C Total Dissolved Solids	Analytical Method: SM 2540C-2011							
Total Dissolved Solids	**1090**	mg/L	25.0	1		07/13/19 00:38		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0 Rev 2.1 1993							
Chloride	**7.8**	mg/L	1.0	1		07/13/19 22:32	16887-00-6	
Fluoride	**0.25**	mg/L	0.10	1		07/13/19 22:32	16984-48-8	
Sulfate	**21.6**	mg/L	1.0	1		07/13/19 22:32	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: TRIP BLANK **Lab ID: 92436599015** Collected: 07/08/19 11:00 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
Acetone	ND	ug/L	25.0	1		07/13/19 13:39	67-64-1	
Acrylonitrile	ND	ug/L	10.0	1		07/13/19 13:39	107-13-1	
Benzene	ND	ug/L	1.0	1		07/13/19 13:39	71-43-2	
Bromochloromethane	ND	ug/L	1.0	1		07/13/19 13:39	74-97-5	
Bromodichloromethane	ND	ug/L	1.0	1		07/13/19 13:39	75-27-4	
Bromoform	ND	ug/L	1.0	1		07/13/19 13:39	75-25-2	
Bromomethane	ND	ug/L	2.0	1		07/13/19 13:39	74-83-9	v2
2-Butanone (MEK)	ND	ug/L	5.0	1		07/13/19 13:39	78-93-3	
Carbon disulfide	ND	ug/L	2.0	1		07/13/19 13:39	75-15-0	
Carbon tetrachloride	ND	ug/L	1.0	1		07/13/19 13:39	56-23-5	
Chlorobenzene	ND	ug/L	1.0	1		07/13/19 13:39	108-90-7	
Chloroethane	ND	ug/L	1.0	1		07/13/19 13:39	75-00-3	
Chloroform	ND	ug/L	5.0	1		07/13/19 13:39	67-66-3	
Chloromethane	ND	ug/L	1.0	1		07/13/19 13:39	74-87-3	
Dibromochloromethane	ND	ug/L	1.0	1		07/13/19 13:39	124-48-1	
Dibromomethane	ND	ug/L	1.0	1		07/13/19 13:39	74-95-3	
1,2-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 13:39	95-50-1	
1,4-Dichlorobenzene	ND	ug/L	1.0	1		07/13/19 13:39	106-46-7	
trans-1,4-Dichloro-2-butene	ND	ug/L	1.0	1		07/13/19 13:39	110-57-6	
1,1-Dichloroethane	ND	ug/L	1.0	1		07/13/19 13:39	75-34-3	
1,2-Dichloroethane	ND	ug/L	1.0	1		07/13/19 13:39	107-06-2	
1,1-Dichloroethene	ND	ug/L	1.0	1		07/13/19 13:39	75-35-4	
cis-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 13:39	156-59-2	
trans-1,2-Dichloroethene	ND	ug/L	1.0	1		07/13/19 13:39	156-60-5	
1,2-Dichloropropane	ND	ug/L	1.0	1		07/13/19 13:39	78-87-5	
cis-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 13:39	10061-01-5	
trans-1,3-Dichloropropene	ND	ug/L	1.0	1		07/13/19 13:39	10061-02-6	
Ethylbenzene	ND	ug/L	1.0	1		07/13/19 13:39	100-41-4	
2-Hexanone	ND	ug/L	5.0	1		07/13/19 13:39	591-78-6	
Iodomethane	ND	ug/L	20.0	1		07/13/19 13:39	74-88-4	v1
Methylene Chloride	ND	ug/L	5.0	1		07/13/19 13:39	75-09-2	
4-Methyl-2-pentanone (MIBK)	ND	ug/L	5.0	1		07/13/19 13:39	108-10-1	
Styrene	ND	ug/L	1.0	1		07/13/19 13:39	100-42-5	
1,1,1,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 13:39	630-20-6	
1,1,2,2-Tetrachloroethane	ND	ug/L	1.0	1		07/13/19 13:39	79-34-5	
Tetrachloroethene	ND	ug/L	1.0	1		07/13/19 13:39	127-18-4	
Toluene	ND	ug/L	1.0	1		07/13/19 13:39	108-88-3	
1,1,1-Trichloroethane	ND	ug/L	1.0	1		07/13/19 13:39	71-55-6	
1,1,2-Trichloroethane	ND	ug/L	1.0	1		07/13/19 13:39	79-00-5	
Trichloroethene	ND	ug/L	1.0	1		07/13/19 13:39	79-01-6	
Trichlorofluoromethane	ND	ug/L	1.0	1		07/13/19 13:39	75-69-4	
1,2,3-Trichloropropane	ND	ug/L	1.0	1		07/13/19 13:39	96-18-4	
Vinyl acetate	ND	ug/L	2.0	1		07/13/19 13:39	108-05-4	
Vinyl chloride	ND	ug/L	1.0	1		07/13/19 13:39	75-01-4	
Xylene (Total)	ND	ug/L	1.0	1		07/13/19 13:39	1330-20-7	
Surrogates								
4-Bromofluorobenzene (S)	96	%	70-130	1		07/13/19 13:39	460-00-4	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

ANALYTICAL RESULTS

Project: Charah GW
Pace Project No.: 92436599

Sample: TRIP BLANK **Lab ID: 92436599015** Collected: 07/08/19 11:00 Received: 07/12/19 12:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260D MSV Low Level Landfill	Analytical Method: EPA 8260D							
Surrogates								
1,2-Dichloroethane-d4 (S)	106	%	70-130	1		07/13/19 13:39	17060-07-0	
Toluene-d8 (S)	99	%	70-130	1		07/13/19 13:39	2037-26-5	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL DATA

Project: Charah GW
Pace Project No.: 92436599

QC Batch: 486358 Analysis Method: EPA 7470A
QC Batch Method: EPA 7470A Analysis Description: 7470 Mercury
Associated Lab Samples: 92436599001, 92436599002, 92436599003, 92436599004, 92436599005, 92436599006, 92436599007, 92436599008, 92436599009, 92436599010, 92436599011, 92436599012, 92436599013, 92436599014

METHOD BLANK: 2626496 Matrix: Water
Associated Lab Samples: 92436599001, 92436599002, 92436599003, 92436599004, 92436599005, 92436599006, 92436599007, 92436599008, 92436599009, 92436599010, 92436599011, 92436599012, 92436599013, 92436599014

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

LABORATORY CONTROL SAMPLE: 2626497

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	2.5	2.7	107	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2626498 2626499

Parameter	Units	92435887010 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	2.5	2.5	2.1	2.3	83	89	75-125	6	25	

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

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL DATA

Project: Charah GW
Pace Project No.: 92436599

QC Batch: 486524 Analysis Method: EPA 6010D
QC Batch Method: EPA 3010A Analysis Description: 6010 MET
Associated Lab Samples: 92436599001, 92436599002, 92436599003, 92436599004, 92436599005, 92436599006, 92436599007, 92436599008, 92436599009, 92436599010, 92436599011, 92436599012, 92436599013, 92436599014

METHOD BLANK: 2627460 Matrix: Water
Associated Lab Samples: 92436599001, 92436599002, 92436599003, 92436599004, 92436599005, 92436599006, 92436599007, 92436599008, 92436599009, 92436599010, 92436599011, 92436599012, 92436599013, 92436599014

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	5.0	07/18/19 03:17	
Arsenic	ug/L	ND	10.0	07/18/19 03:17	
Barium	ug/L	ND	5.0	07/18/19 03:17	
Beryllium	ug/L	ND	1.0	07/18/19 03:17	
Cadmium	ug/L	ND	1.0	07/18/19 03:17	
Calcium	ug/L	ND	100	07/18/19 03:17	
Chromium	ug/L	ND	5.0	07/18/19 03:17	
Cobalt	ug/L	ND	5.0	07/18/19 03:17	
Copper	ug/L	ND	5.0	07/18/19 03:17	
Lead	ug/L	ND	5.0	07/18/19 03:17	
Molybdenum	ug/L	ND	5.0	07/18/19 03:17	
Nickel	ug/L	ND	5.0	07/18/19 03:17	
Selenium	ug/L	ND	10.0	07/18/19 03:17	
Silver	ug/L	ND	5.0	07/18/19 03:17	
Vanadium	ug/L	ND	5.0	07/18/19 03:17	
Zinc	ug/L	ND	10.0	07/18/19 03:17	

LABORATORY CONTROL SAMPLE: 2627461

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	500	447	89	80-120	
Arsenic	ug/L	500	421	84	80-120	
Barium	ug/L	500	516	103	80-120	
Beryllium	ug/L	500	523	105	80-120	
Cadmium	ug/L	500	466	93	80-120	
Calcium	ug/L	5000	5020	100	80-120	
Chromium	ug/L	500	500	100	80-120	
Cobalt	ug/L	500	452	90	80-120	
Copper	ug/L	500	486	97	80-120	
Lead	ug/L	500	447	89	80-120	
Molybdenum	ug/L	500	442	88	80-120	
Nickel	ug/L	500	465	93	80-120	
Selenium	ug/L	500	441	88	80-120	
Silver	ug/L	250	238	95	80-120	
Vanadium	ug/L	500	471	94	80-120	
Zinc	ug/L	500	442	88	80-120	

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REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL DATA

Project: Charah GW
Pace Project No.: 92436599

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2627462 2627463

Parameter	Units	92436599006 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	500	500	473	468	94	93	75-125	1	20	
Arsenic	ug/L	ND	500	500	438	432	88	86	75-125	1	20	
Barium	ug/L	47.8	500	500	523	525	95	95	75-125	0	20	
Beryllium	ug/L	ND	500	500	497	505	99	101	75-125	2	20	
Cadmium	ug/L	ND	500	500	482	476	96	95	75-125	1	20	
Calcium	ug/L	37800	5000	5000	42900	42800	102	100	75-125	0	20	
Chromium	ug/L	ND	500	500	513	509	102	102	75-125	1	20	
Cobalt	ug/L	ND	500	500	450	443	90	89	75-125	1	20	
Copper	ug/L	5.5	500	500	505	501	100	99	75-125	1	20	
Lead	ug/L	ND	500	500	444	438	89	88	75-125	1	20	
Molybdenum	ug/L	8.3	500	500	470	466	92	92	75-125	1	20	
Nickel	ug/L	ND	500	500	463	457	92	91	75-125	1	20	
Selenium	ug/L	ND	500	500	464	461	93	92	75-125	1	20	
Silver	ug/L	ND	250	250	250	250	100	100	75-125	0	20	
Vanadium	ug/L	ND	500	500	495	492	99	98	75-125	1	20	
Zinc	ug/L	ND	500	500	447	442	89	88	75-125	1	20	

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REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL DATA

Project: Charah GW
Pace Project No.: 92436599

QC Batch: 486252 Analysis Method: EPA 6020B
QC Batch Method: EPA 3010A Analysis Description: 6020 MET
Associated Lab Samples: 92436599001, 92436599002, 92436599003, 92436599004, 92436599005, 92436599006, 92436599007, 92436599008, 92436599009, 92436599010, 92436599011, 92436599012, 92436599013, 92436599014

METHOD BLANK: 2626174 Matrix: Water
Associated Lab Samples: 92436599001, 92436599002, 92436599003, 92436599004, 92436599005, 92436599006, 92436599007, 92436599008, 92436599009, 92436599010, 92436599011, 92436599012, 92436599013, 92436599014

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	ug/L	ND	25.0	07/17/19 00:37	
Lithium	ug/L	ND	2.5	07/17/19 00:37	
Thallium	ug/L	ND	0.10	07/17/19 00:37	

LABORATORY CONTROL SAMPLE: 2626175

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	50	51.6	103	80-120	
Lithium	ug/L	50	50.0	100	80-120	
Thallium	ug/L	10	9.8	98	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2626176 2626177

Parameter	Units	92436599001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	ND	50	50	53.7	52.8	94	92	75-125	2	20	
Lithium	ug/L	17.1	50	50	63.6	65.7	93	97	75-125	3	20	
Thallium	ug/L	ND	10	10	10.0	10.1	100	101	75-125	1	20	

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REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL DATA

Project: Charah GW
Pace Project No.: 92436599

QC Batch: 486282 Analysis Method: EPA 8260D
QC Batch Method: EPA 8260D Analysis Description: 8260D MSV Low Level Landfill
Associated Lab Samples: 92436599001, 92436599002, 92436599003, 92436599004, 92436599005, 92436599006, 92436599007, 92436599008, 92436599009, 92436599010, 92436599011, 92436599012, 92436599013, 92436599014, 92436599015

METHOD BLANK: 2626318 Matrix: Water
Associated Lab Samples: 92436599001, 92436599002, 92436599003, 92436599004, 92436599005, 92436599006, 92436599007, 92436599008, 92436599009, 92436599010, 92436599011, 92436599012, 92436599013, 92436599014, 92436599015

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	ND	1.0	07/13/19 12:45	
1,1,1-Trichloroethane	ug/L	ND	1.0	07/13/19 12:45	
1,1,2,2-Tetrachloroethane	ug/L	ND	1.0	07/13/19 12:45	
1,1,2-Trichloroethane	ug/L	ND	1.0	07/13/19 12:45	
1,1-Dichloroethane	ug/L	ND	1.0	07/13/19 12:45	
1,1-Dichloroethene	ug/L	ND	1.0	07/13/19 12:45	
1,2,3-Trichloropropane	ug/L	ND	1.0	07/13/19 12:45	
1,2-Dichlorobenzene	ug/L	ND	1.0	07/13/19 12:45	
1,2-Dichloroethane	ug/L	ND	1.0	07/13/19 12:45	
1,2-Dichloropropane	ug/L	ND	1.0	07/13/19 12:45	
1,4-Dichlorobenzene	ug/L	ND	1.0	07/13/19 12:45	
2-Butanone (MEK)	ug/L	ND	5.0	07/13/19 12:45	
2-Hexanone	ug/L	ND	5.0	07/13/19 12:45	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	5.0	07/13/19 12:45	
Acetone	ug/L	ND	25.0	07/13/19 12:45	
Acrylonitrile	ug/L	ND	10.0	07/13/19 12:45	
Benzene	ug/L	ND	1.0	07/13/19 12:45	
Bromochloromethane	ug/L	ND	1.0	07/13/19 12:45	
Bromodichloromethane	ug/L	ND	1.0	07/13/19 12:45	
Bromoform	ug/L	ND	1.0	07/13/19 12:45	
Bromomethane	ug/L	ND	2.0	07/13/19 12:45	v3
Carbon disulfide	ug/L	ND	2.0	07/13/19 12:45	
Carbon tetrachloride	ug/L	ND	1.0	07/13/19 12:45	
Chlorobenzene	ug/L	ND	1.0	07/13/19 12:45	
Chloroethane	ug/L	ND	1.0	07/13/19 12:45	
Chloroform	ug/L	ND	5.0	07/13/19 12:45	
Chloromethane	ug/L	ND	1.0	07/13/19 12:45	
cis-1,2-Dichloroethene	ug/L	ND	1.0	07/13/19 12:45	
cis-1,3-Dichloropropene	ug/L	ND	1.0	07/13/19 12:45	
Dibromochloromethane	ug/L	ND	1.0	07/13/19 12:45	
Dibromomethane	ug/L	ND	1.0	07/13/19 12:45	
Ethylbenzene	ug/L	ND	1.0	07/13/19 12:45	
Iodomethane	ug/L	ND	20.0	07/13/19 12:45	v1
Methylene Chloride	ug/L	ND	5.0	07/13/19 12:45	
Styrene	ug/L	ND	1.0	07/13/19 12:45	
Tetrachloroethene	ug/L	ND	1.0	07/13/19 12:45	
Toluene	ug/L	ND	1.0	07/13/19 12:45	
trans-1,2-Dichloroethene	ug/L	ND	1.0	07/13/19 12:45	

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REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL DATA

Project: Charah GW
Pace Project No.: 92436599

METHOD BLANK: 2626318 Matrix: Water

Associated Lab Samples: 92436599001, 92436599002, 92436599003, 92436599004, 92436599005, 92436599006, 92436599007, 92436599008, 92436599009, 92436599010, 92436599011, 92436599012, 92436599013, 92436599014, 92436599015

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
trans-1,3-Dichloropropene	ug/L	ND	1.0	07/13/19 12:45	
trans-1,4-Dichloro-2-butene	ug/L	ND	1.0	07/13/19 12:45	
Trichloroethene	ug/L	ND	1.0	07/13/19 12:45	
Trichlorofluoromethane	ug/L	ND	1.0	07/13/19 12:45	
Vinyl acetate	ug/L	ND	2.0	07/13/19 12:45	
Vinyl chloride	ug/L	ND	1.0	07/13/19 12:45	
Xylene (Total)	ug/L	ND	1.0	07/13/19 12:45	
1,2-Dichloroethane-d4 (S)	%	102	70-130	07/13/19 12:45	
4-Bromofluorobenzene (S)	%	96	70-130	07/13/19 12:45	
Toluene-d8 (S)	%	99	70-130	07/13/19 12:45	

LABORATORY CONTROL SAMPLE: 2626319

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
1,1,1,2-Tetrachloroethane	ug/L	50	47.5	95	70-130	
1,1,1-Trichloroethane	ug/L	50	40.3	81	70-130	
1,1,2,2-Tetrachloroethane	ug/L	50	49.2	98	70-130	
1,1,2-Trichloroethane	ug/L	50	43.5	87	70-130	
1,1-Dichloroethane	ug/L	50	42.9	86	70-130	
1,1-Dichloroethene	ug/L	50	46.1	92	70-130	
1,2,3-Trichloropropane	ug/L	50	51.1	102	70-130	
1,2-Dichlorobenzene	ug/L	50	47.4	95	70-130	
1,2-Dichloroethane	ug/L	50	38.8	78	70-130	
1,2-Dichloropropane	ug/L	50	44.0	88	70-130	
1,4-Dichlorobenzene	ug/L	50	46.8	94	70-130	
2-Butanone (MEK)	ug/L	100	82.1	82	64-135	
2-Hexanone	ug/L	100	103	103	66-135	
4-Methyl-2-pentanone (MIBK)	ug/L	100	93.3	93	70-130	
Acetone	ug/L	100	88.4	88	61-157	
Acrylonitrile	ug/L	250	219	88	61-143	
Benzene	ug/L	50	44.6	89	70-130	
Bromochloromethane	ug/L	50	46.7	93	70-130	
Bromodichloromethane	ug/L	50	44.8	90	70-130	
Bromoform	ug/L	50	48.4	97	70-130	
Bromomethane	ug/L	50	40.3	81	38-130	v3
Carbon disulfide	ug/L	50	44.4	89	68-130	
Carbon tetrachloride	ug/L	50	43.1	86	70-130	
Chlorobenzene	ug/L	50	46.4	93	70-130	
Chloroethane	ug/L	50	40.9	82	37-142	
Chloroform	ug/L	50	40.5	81	70-130	
Chloromethane	ug/L	50	48.0	96	48-130	
cis-1,2-Dichloroethene	ug/L	50	41.5	83	70-130	

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REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL DATA

Project: Charah GW
Pace Project No.: 92436599

LABORATORY CONTROL SAMPLE: 2626319

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
cis-1,3-Dichloropropene	ug/L	50	46.7	93	70-130	
Dibromochloromethane	ug/L	50	47.4	95	70-130	
Dibromomethane	ug/L	50	43.2	86	70-130	
Ethylbenzene	ug/L	50	46.7	93	70-130	
Iodomethane	ug/L	100	115	115	40-130	v1
Methylene Chloride	ug/L	50	41.0	82	67-132	
Styrene	ug/L	50	48.8	98	70-130	
Tetrachloroethene	ug/L	50	47.4	95	69-130	
Toluene	ug/L	50	43.5	87	70-130	
trans-1,2-Dichloroethene	ug/L	50	43.3	87	70-130	
trans-1,3-Dichloropropene	ug/L	50	45.3	91	70-130	
trans-1,4-Dichloro-2-butene	ug/L	50	74.4	149	35-189	
Trichloroethene	ug/L	50	42.5	85	70-130	
Trichlorofluoromethane	ug/L	50	42.9	86	63-130	
Vinyl acetate	ug/L	100	84.4	84	55-143	
Vinyl chloride	ug/L	50	44.9	90	70-131	
Xylene (Total)	ug/L	150	146	97	70-130	
1,2-Dichloroethane-d4 (S)	%			95	70-130	
4-Bromofluorobenzene (S)	%			98	70-130	
Toluene-d8 (S)	%			97	70-130	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2626320 2626321

Parameter	Units	92436011001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
1,1,1,2-Tetrachloroethane	ug/L	ND	50	50	51.3	52.3	103	105	73-134	2	30	
1,1,1-Trichloroethane	ug/L	ND	50	50	46.9	47.7	94	95	82-143	2	30	
1,1,2,2-Tetrachloroethane	ug/L	ND	50	50	50.4	52.4	101	105	70-136	4	30	
1,1,2-Trichloroethane	ug/L	ND	50	50	48.3	48.1	97	96	70-135	0	30	
1,1-Dichloroethane	ug/L	ND	50	50	48.7	49.9	97	100	70-139	2	30	
1,1-Dichloroethene	ug/L	ND	50	50	53.0	54.9	106	110	70-154	4	30	
1,2,3-Trichloropropane	ug/L	ND	50	50	53.7	54.5	107	109	71-137	2	30	
1,2-Dichlorobenzene	ug/L	ND	50	50	48.1	49.5	96	99	70-133	3	30	
1,2-Dichloroethane	ug/L	ND	50	50	43.8	44.2	88	88	70-137	1	30	
1,2-Dichloropropane	ug/L	ND	50	50	48.7	49.6	97	99	70-140	2	30	
1,4-Dichlorobenzene	ug/L	ND	50	50	46.5	49.2	93	98	70-133	6	30	
2-Butanone (MEK)	ug/L	ND	100	100	94.7	95.7	95	96	60-139	1	30	
2-Hexanone	ug/L	ND	100	100	104	107	104	107	65-138	3	30	
4-Methyl-2-pentanone (MIBK)	ug/L	ND	100	100	95.4	97.6	95	98	65-135	2	30	
Acetone	ug/L	ND	100	100	112	116	112	116	60-148	4	30	
Acrylonitrile	ug/L	ND	250	250	251	257	100	103	64-147	2	30	
Benzene	ug/L	ND	50	50	49.8	50.5	98	100	70-151	1	30	
Bromochloromethane	ug/L	ND	50	50	55.7	55.9	111	112	70-141	0	30	
Bromodichloromethane	ug/L	ND	50	50	48.8	49.7	98	99	70-138	2	30	

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REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL DATA

Project: Charah GW
Pace Project No.: 92436599

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2626320 2626321

Parameter	Units	92436011001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Bromoform	ug/L	ND	50	50	51.7	50.3	103	101	63-130	3	30	
Bromomethane	ug/L	ND	50	50	47.3	48.4	95	97	15-152	2	30	v3
Carbon disulfide	ug/L	ND	50	50	54.2	55.9	108	112	69-149	3	30	
Carbon tetrachloride	ug/L	ND	50	50	48.1	48.6	96	97	70-143	1	30	
Chlorobenzene	ug/L	ND	50	50	48.9	50.0	98	100	70-138	2	30	
Chloroethane	ug/L	ND	50	50	54.5	56.5	109	113	52-163	4	30	
Chloroform	ug/L	ND	50	50	48.4	47.1	95	93	70-139	3	30	
Chloromethane	ug/L	ND	50	50	57.5	59.7	115	119	41-139	4	30	
cis-1,2-Dichloroethene	ug/L	37.4	50	50	81.6	86.1	88	97	70-141	5	30	
cis-1,3-Dichloropropene	ug/L	ND	50	50	43.4	43.8	87	88	70-137	1	30	
Dibromochloromethane	ug/L	ND	50	50	50.8	50.8	102	102	70-134	0	30	
Dibromomethane	ug/L	ND	50	50	45.6	46.5	91	93	70-138	2	30	
Ethylbenzene	ug/L	ND	50	50	50.1	51.9	100	104	66-153	3	30	
Iodomethane	ug/L	ND	100	100	111	113	111	113	20-138	2	30	
Methylene Chloride	ug/L	ND	50	50	49.0	49.1	98	98	42-159	0	30	
Styrene	ug/L	ND	50	50	49.9	50.4	100	101	70-135	1	30	
Tetrachloroethene	ug/L	334	50	50	349	379	28	89	59-143	8	30	M1
Toluene	ug/L	ND	50	50	47.5	48.7	95	97	59-148	2	30	
trans-1,2-Dichloroethene	ug/L	ND	50	50	49.1	51.5	98	103	70-146	5	30	
trans-1,3-Dichloropropene	ug/L	ND	50	50	42.1	41.8	84	84	70-135	1	30	
trans-1,4-Dichloro-2-butene	ug/L	ND	50	50	33.6	34.9	67	70	47-135	4	30	
Trichloroethene	ug/L	5.8	50	50	51.9	53.4	92	95	70-147	3	30	
Trichlorofluoromethane	ug/L	ND	50	50	49.4	52.4	99	105	70-148	6	30	
Vinyl acetate	ug/L	ND	100	100	51.3	47.2	51	47	49-151	8	30	M1
Vinyl chloride	ug/L	ND	50	50	50.7	52.8	101	106	70-156	4	30	
Xylene (Total)	ug/L	ND	150	150	152	156	101	104	63-158	3	30	
1,2-Dichloroethane-d4 (S)	%						95	94	70-130			
4-Bromofluorobenzene (S)	%						101	99	70-130			
Toluene-d8 (S)	%						98	96	70-130			

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REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
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(704)875-9092

QUALITY CONTROL DATA

Project: Charah GW
Pace Project No.: 92436599

QC Batch: 486231 Analysis Method: SM 2540C-2011
QC Batch Method: SM 2540C-2011 Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 92436599004, 92436599005, 92436599006, 92436599010, 92436599012, 92436599013, 92436599014

METHOD BLANK: 2626107 Matrix: Water
Associated Lab Samples: 92436599004, 92436599005, 92436599006, 92436599010, 92436599012, 92436599013, 92436599014

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	25.0	07/13/19 00:38	

LABORATORY CONTROL SAMPLE: 2626108

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	251	234	93	90-110	

SAMPLE DUPLICATE: 2626109

Parameter	Units	92436599010 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	1490	1640	10	5	D6

SAMPLE DUPLICATE: 2626110

Parameter	Units	92436210001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	761	762	0	5	

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REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
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QUALITY CONTROL DATA

Project: Charah GW
Pace Project No.: 92436599

QC Batch: 486653 Analysis Method: SM 2540C-2011
QC Batch Method: SM 2540C-2011 Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 92436599003, 92436599007, 92436599008, 92436599009

METHOD BLANK: 2627907 Matrix: Water
Associated Lab Samples: 92436599003, 92436599007, 92436599008, 92436599009

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	25.0	07/16/19 14:15	

LABORATORY CONTROL SAMPLE: 2627908

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	251	240	96	90-110	

SAMPLE DUPLICATE: 2627909

Parameter	Units	92436210003 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	384	444	14	5	D6

SAMPLE DUPLICATE: 2627910

Parameter	Units	92436451001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	704	768	9	5	D6

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Charah GW
Pace Project No.: 92436599

QC Batch: 486655 Analysis Method: SM 2540C-2011
QC Batch Method: SM 2540C-2011 Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 92436599001, 92436599002, 92436599011

METHOD BLANK: 2627912 Matrix: Water
Associated Lab Samples: 92436599001, 92436599002, 92436599011

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	25.0	07/16/19 14:22	

LABORATORY CONTROL SAMPLE: 2627913

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	251	248	99	90-110	

SAMPLE DUPLICATE: 2627914

Parameter	Units	92435891071 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	687	725	5	5	

SAMPLE DUPLICATE: 2627915

Parameter	Units	92435891081 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	52.0	55.0	6	5	D6

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Charah GW
Pace Project No.: 92436599

QC Batch: 486233 Analysis Method: EPA 300.0 Rev 2.1 1993
QC Batch Method: EPA 300.0 Rev 2.1 1993 Analysis Description: 300.0 IC Anions
Associated Lab Samples: 92436599001, 92436599002, 92436599003, 92436599004, 92436599005, 92436599006, 92436599007, 92436599008, 92436599009, 92436599010, 92436599011, 92436599012

METHOD BLANK: 2626117 Matrix: Water
Associated Lab Samples: 92436599001, 92436599002, 92436599003, 92436599004, 92436599005, 92436599006, 92436599007, 92436599008, 92436599009, 92436599010, 92436599011, 92436599012

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	07/13/19 15:50	
Fluoride	mg/L	ND	0.10	07/13/19 15:50	
Sulfate	mg/L	ND	1.0	07/13/19 15:50	

LABORATORY CONTROL SAMPLE: 2626118

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	50	51.7	103	90-110	
Fluoride	mg/L	2.5	2.6	105	90-110	
Sulfate	mg/L	50	50.6	101	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2626119 2626120

Parameter	Units	92435891078 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	331	50	50	374	374	86	86	90-110	0	10	M6
Fluoride	mg/L	0.15	2.5	2.5	3.0	3.0	116	115	90-110	1	10	M1
Sulfate	mg/L	33.6	50	50	83.6	83.9	100	101	90-110	0	10	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2626121 2626122

Parameter	Units	92436599003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	855	50	50	894	894	77	77	90-110	0	10	M6
Fluoride	mg/L	0.17	2.5	2.5	2.9	2.9	108	110	90-110	2	10	
Sulfate	mg/L	7.2	50	50	57.9	58.5	101	103	90-110	1	10	

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QUALITY CONTROL DATA

Project: Charah GW
Pace Project No.: 92436599

QC Batch: 486234 Analysis Method: EPA 300.0 Rev 2.1 1993
QC Batch Method: EPA 300.0 Rev 2.1 1993 Analysis Description: 300.0 IC Anions
Associated Lab Samples: 92436599013, 92436599014

METHOD BLANK: 2626123 Matrix: Water
Associated Lab Samples: 92436599013, 92436599014

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	07/13/19 20:50	
Fluoride	mg/L	ND	0.10	07/13/19 20:50	
Sulfate	mg/L	ND	1.0	07/13/19 20:50	

LABORATORY CONTROL SAMPLE: 2626124

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	50	51.5	103	90-110	
Fluoride	mg/L	2.5	2.7	110	90-110	
Sulfate	mg/L	50	51.8	104	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2626125 2626126

Parameter	Units	92436599013 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	50.2	50	50	94.0	93.5	88	87	90-110	0	10	M1
Fluoride	mg/L	0.16	2.5	2.5	2.7	2.6	100	99	90-110	1	10	
Sulfate	mg/L	47.0	50	50	98.1	98.1	102	102	90-110	0	10	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2626127 2626128

Parameter	Units	92436687002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	17000	50	50	16300	16200	-1500	-1720	90-110	1	10	M6
Fluoride	mg/L	25.4	2.5	2.5	27.8	27.8	96	98	90-110	0	10	
Sulfate	mg/L	1740	50	50	1760	1760	44	34	90-110	0	10	M6

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REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Charah GW
Pace Project No.: 92436599

Sample: BG-1 **Lab ID: 92436599001** Collected: 07/11/19 13:00 Received: 07/12/19 12:00 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 ± 0.525 (0.940) C:NA T:86%**	pCi/L	07/26/19 13:48	13982-63-3	
Radium-228	EPA 904.0	**0.823 ± 0.435 (0.787) C:81% T:76%**	pCi/L	07/25/19 12:48	15262-20-1	
Total Radium	Total Radium Calculation	**0.823 ± 0.960 (1.73)**	pCi/L	07/30/19 13:54	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Charah GW
Pace Project No.: 92436599

Sample: BG-2 **Lab ID: 92436599002** Collected: 07/11/19 09:50 Received: 07/12/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.247 ± 0.625 (1.03) C:NA T:87%**	pCi/L	07/26/19 13:48	13982-63-3	
Radium-228	EPA 904.0	**0.205 ± 0.329 (0.715) C:81% T:83%**	pCi/L	07/25/19 12:48	15262-20-1	
Total Radium	Total Radium Calculation	**0.452 ± 0.954 (1.75)**	pCi/L	07/30/19 13:54	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Charah GW
Pace Project No.: 92436599

Sample: MW-1 **Lab ID: 92436599003** Collected: 07/10/19 17:05 Received: 07/12/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**1.03 ± 0.736 (0.964) C:NA T:86%**	pCi/L	07/26/19 13:48	13982-63-3	
Radium-228	EPA 904.0	**1.45 ± 0.478 (0.661) C:81% T:89%**	pCi/L	07/25/19 12:48	15262-20-1	
Total Radium	Total Radium Calculation	**2.48 ± 1.21 (1.63)**	pCi/L	07/30/19 13:54	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Charah GW
Pace Project No.: 92436599

Sample: MW-4 **Lab ID: 92436599004** Collected: 07/09/19 10:55 Received: 07/12/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.760 ± 0.551 (0.714) C:NA T:94%**	pCi/L	07/26/19 13:48	13982-63-3	
Radium-228	EPA 904.0	**0.556 ± 0.380 (0.734) C:82% T:79%**	pCi/L	07/25/19 12:49	15262-20-1	
Total Radium	Total Radium Calculation	**1.32 ± 0.931 (1.45)**	pCi/L	07/30/19 13:54	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Charah GW
Pace Project No.: 92436599

Sample: MW-5 **Lab ID: 92436599005** Collected: 07/09/19 14:50 Received: 07/12/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**-0.0968 ± 0.718 (1.28) C:NA T:77%**	pCi/L	07/26/19 13:48	13982-63-3	
Radium-228	EPA 904.0	**0.987 ± 0.440 (0.737) C:80% T:80%**	pCi/L	07/25/19 12:49	15262-20-1	
Total Radium	Total Radium Calculation	**0.987 ± 1.16 (2.02)**	pCi/L	07/30/19 13:54	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Charah GW
Pace Project No.: 92436599

Sample: MW-6 **Lab ID: 92436599006** Collected: 07/09/19 13:15 Received: 07/12/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.681 ± 0.785 (1.17) C:NA T:87%**	pCi/L	07/26/19 13:48	13982-63-3	
Radium-228	EPA 904.0	**0.685 ± 0.444 (0.850) C:80% T:80%**	pCi/L	07/25/19 15:54	15262-20-1	
Total Radium	Total Radium Calculation	**1.37 ± 1.23 (2.02)**	pCi/L	07/30/19 13:54	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Charah GW
Pace Project No.: 92436599

Sample: MW-7R **Lab ID: 92436599007** Collected: 07/10/19 09:50 Received: 07/12/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.316 ± 0.650 (1.05) C:NA T:81%**	pCi/L	07/26/19 14:06	13982-63-3	
Radium-228	EPA 904.0	**0.686 ± 0.424 (0.803) C:78% T:86%**	pCi/L	07/25/19 15:55	15262-20-1	
Total Radium	Total Radium Calculation	**1.00 ± 1.07 (1.85)**	pCi/L	07/30/19 13:54	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Charah GW
Pace Project No.: 92436599

Sample: MW-8 **Lab ID: 92436599008** Collected: 07/10/19 13:25 Received: 07/12/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.105 ± 0.507 (0.871) C:NA T:91%**	pCi/L	07/26/19 14:06	13982-63-3	
Radium-228	EPA 904.0	**0.535 ± 0.389 (0.762) C:81% T:85%**	pCi/L	07/25/19 15:55	15262-20-1	
Total Radium	Total Radium Calculation	**0.640 ± 0.896 (1.63)**	pCi/L	07/30/19 13:54	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Charah GW
Pace Project No.: 92436599

Sample: DUP **Lab ID: 92436599009** Collected: 07/10/19 12:20 Received: 07/12/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.280 ± 0.650 (1.05) C:NA T:91%**	pCi/L	07/26/19 14:06	13982-63-3	
Radium-228	EPA 904.0	**0.649 ± 0.430 (0.826) C:82% T:77%**	pCi/L	07/25/19 15:55	15262-20-1	
Total Radium	Total Radium Calculation	**0.929 ± 1.08 (1.88)**	pCi/L	07/30/19 13:54	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Charah GW
Pace Project No.: 92436599

Sample: LEACHATE **Lab ID: 92436599010** Collected: 07/08/19 11:30 Received: 07/12/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.458 ± 0.554 (0.832) C:NA T:96%**	pCi/L	07/26/19 14:06	13982-63-3	
Radium-228	EPA 904.0	**0.517 ± 0.391 (0.771) C:79% T:84%**	pCi/L	07/25/19 15:55	15262-20-1	
Total Radium	Total Radium Calculation	**0.975 ± 0.945 (1.60)**	pCi/L	07/30/19 13:54	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Charah GW
Pace Project No.: 92436599

Sample: EQUIPMENT BLANK **Lab ID: 92436599011** Collected: 07/11/19 13:30 Received: 07/12/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**-0.0338 ± 0.672 (1.20) C:NA T:82%**	pCi/L	07/26/19 14:06	13982-63-3	
Radium-228	EPA 904.0	**0.557 ± 0.396 (0.772) C:78% T:85%**	pCi/L	07/25/19 15:55	15262-20-1	
Total Radium	Total Radium Calculation	**0.557 ± 1.07 (1.97)**	pCi/L	07/30/19 13:55	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Charah GW
Pace Project No.: 92436599

Sample: AMBIENT BLANK **Lab ID: 92436599012** Collected: 07/09/19 15:20 Received: 07/12/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.459 ± 0.374 (0.454) C:NA T:93%**	pCi/L	07/26/19 14:06	13982-63-3	
Radium-228	EPA 904.0	**0.403 ± 0.387 (0.795) C:79% T:83%**	pCi/L	07/25/19 15:55	15262-20-1	
Total Radium	Total Radium Calculation	**0.862 ± 0.761 (1.25)**	pCi/L	07/30/19 13:55	7440-14-4	

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Charah GW
Pace Project No.: 92436599

Sample: SW-2 **Lab ID: 92436599013** Collected: 07/08/19 12:15 Received: 07/12/19 12:00 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 ± 0.655 (0.745) C:NA T:73%**	pCi/L	07/26/19 14:06	13982-63-3	
Radium-228	EPA 904.0	**0.658 ± 0.466 (0.908) C:79% T:71%**	pCi/L	07/25/19 15:55	15262-20-1	
Total Radium	Total Radium Calculation	**1.70 ± 1.12 (1.65)**	pCi/L	07/30/19 13:55	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Charah GW
Pace Project No.: 92436599

Sample: SW-1 **Lab ID: 92436599014** Collected: 07/08/19 12:00 Received: 07/12/19 12:00 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**2.08 ± 1.05 (0.352) C:NA T:86%**	pCi/L	07/26/19 14:06	13982-63-3	
Radium-228	EPA 904.0	**1.96 ± 0.838 (1.38) C:81% T:57%**	pCi/L	07/25/19 15:55	15262-20-1	
Total Radium	Total Radium Calculation	**4.04 ± 1.89 (1.73)**	pCi/L	07/30/19 13:55	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL - RADIOCHEMISTRY

Project: Charah GW
Pace Project No.: 92436599

QC Batch: 352403 Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1 Analysis Description: 903.1 Radium-226
Associated Lab Samples: 92436599001, 92436599002, 92436599003, 92436599004, 92436599005, 92436599006, 92436599007, 92436599008, 92436599009, 92436599010, 92436599011, 92436599012, 92436599013, 92436599014

METHOD BLANK: 1712126 Matrix: Water
Associated Lab Samples: 92436599001, 92436599002, 92436599003, 92436599004, 92436599005, 92436599006, 92436599007, 92436599008, 92436599009, 92436599010, 92436599011, 92436599012, 92436599013, 92436599014

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.327 ± 0.351 (0.503) C:NA T:83%	pCi/L	07/26/19 13:48	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL - RADIOCHEMISTRY

Project: Charah GW
Pace Project No.: 92436599

QC Batch: 352407 Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0 Analysis Description: 904.0 Radium 228
Associated Lab Samples: 92436599001, 92436599002, 92436599003, 92436599004, 92436599005, 92436599006, 92436599007, 92436599008, 92436599009, 92436599010, 92436599011, 92436599012, 92436599013, 92436599014

METHOD BLANK: 1712129 Matrix: Water
Associated Lab Samples: 92436599001, 92436599002, 92436599003, 92436599004, 92436599005, 92436599006, 92436599007, 92436599008, 92436599009, 92436599010, 92436599011, 92436599012, 92436599013, 92436599014

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.404 ± 0.331 (0.661) C:83% T:86%	pCi/L	07/25/19 11:21	

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REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: Charah GW
Pace Project No.: 92436599

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.

Acid preservation may not be appropriate for 2 Chloroethylvinyl ether.

A separate vial preserved to a pH of 4-5 is recommended in SW846 Chapter 4 for the analysis of Acrolein and Acrylonitrile by EPA Method 8260.

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-A	Pace Analytical Services - Asheville
PASI-C	Pace Analytical Services - Charlotte
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.
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.
M6	Matrix spike and Matrix spike duplicate recovery not evaluated against control limits due to sample dilution.
v1	The continuing calibration verification was above the method acceptance limit. Any detection for the analyte in the associated samples may have a high bias.

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALIFIERS

Project: Charah GW
Pace Project No.: 92436599

ANALYTE QUALIFIERS

v2	The continuing calibration verification was below the method acceptance limit. The analyte was not detected in the associated samples and the sensitivity of the instrument was verified with a reporting limit check standard.
v3	The continuing calibration verification was below the method acceptance limit. Any detection for the analyte in the associated samples may have low bias.

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Charah GW
Pace Project No.: 92436599

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92436599001	**BG-1**	EPA 3010A	486524	EPA 6010D	486982
92436599002	**BG-2**	EPA 3010A	486524	EPA 6010D	486982
92436599003	**MW-1**	EPA 3010A	486524	EPA 6010D	486982
92436599004	**MW-4**	EPA 3010A	486524	EPA 6010D	486982
92436599005	**MW-5**	EPA 3010A	486524	EPA 6010D	486982
92436599006	**MW-6**	EPA 3010A	486524	EPA 6010D	486982
92436599007	**MW-7R**	EPA 3010A	486524	EPA 6010D	486982
92436599008	**MW-8**	EPA 3010A	486524	EPA 6010D	486982
92436599009	**DUP**	EPA 3010A	486524	EPA 6010D	486982
92436599010	**LEACHATE**	EPA 3010A	486524	EPA 6010D	486982
92436599011	**EQUIPMENT BLANK**	EPA 3010A	486524	EPA 6010D	486982
92436599012	**AMBIENT BLANK**	EPA 3010A	486524	EPA 6010D	486982
92436599013	**SW-2**	EPA 3010A	486524	EPA 6010D	486982
92436599014	**SW-1**	EPA 3010A	486524	EPA 6010D	486982
92436599001	**BG-1**	EPA 3010A	486252	EPA 6020B	486518
92436599002	**BG-2**	EPA 3010A	486252	EPA 6020B	486518
92436599003	**MW-1**	EPA 3010A	486252	EPA 6020B	486518
92436599004	**MW-4**	EPA 3010A	486252	EPA 6020B	486518
92436599005	**MW-5**	EPA 3010A	486252	EPA 6020B	486518
92436599006	**MW-6**	EPA 3010A	486252	EPA 6020B	486518
92436599007	**MW-7R**	EPA 3010A	486252	EPA 6020B	486518
92436599008	**MW-8**	EPA 3010A	486252	EPA 6020B	486518
92436599009	**DUP**	EPA 3010A	486252	EPA 6020B	486518
92436599010	**LEACHATE**	EPA 3010A	486252	EPA 6020B	486518
92436599011	**EQUIPMENT BLANK**	EPA 3010A	486252	EPA 6020B	486518
92436599012	**AMBIENT BLANK**	EPA 3010A	486252	EPA 6020B	486518
92436599013	**SW-2**	EPA 3010A	486252	EPA 6020B	486518
92436599014	**SW-1**	EPA 3010A	486252	EPA 6020B	486518
92436599001	**BG-1**	EPA 7470A	486358	EPA 7470A	486379
92436599002	**BG-2**	EPA 7470A	486358	EPA 7470A	486379
92436599003	**MW-1**	EPA 7470A	486358	EPA 7470A	486379
92436599004	**MW-4**	EPA 7470A	486358	EPA 7470A	486379
92436599005	**MW-5**	EPA 7470A	486358	EPA 7470A	486379
92436599006	**MW-6**	EPA 7470A	486358	EPA 7470A	486379
92436599007	**MW-7R**	EPA 7470A	486358	EPA 7470A	486379
92436599008	**MW-8**	EPA 7470A	486358	EPA 7470A	486379
92436599009	**DUP**	EPA 7470A	486358	EPA 7470A	486379
92436599010	**LEACHATE**	EPA 7470A	486358	EPA 7470A	486379
92436599011	**EQUIPMENT BLANK**	EPA 7470A	486358	EPA 7470A	486379
92436599012	**AMBIENT BLANK**	EPA 7470A	486358	EPA 7470A	486379
92436599013	**SW-2**	EPA 7470A	486358	EPA 7470A	486379
92436599014	**SW-1**	EPA 7470A	486358	EPA 7470A	486379
92436599001	**BG-1**	EPA 8260D	486282		
92436599002	**BG-2**	EPA 8260D	486282		
92436599003	**MW-1**	EPA 8260D	486282		
92436599004	**MW-4**	EPA 8260D	486282		
92436599005	**MW-5**	EPA 8260D	486282		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Charah GW
Pace Project No.: 92436599

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92436599006	**MW-6**	EPA 8260D	486282		
92436599007	**MW-7R**	EPA 8260D	486282		
92436599008	**MW-8**	EPA 8260D	486282		
92436599009	**DUP**	EPA 8260D	486282		
92436599010	**LEACHATE**	EPA 8260D	486282		
92436599011	**EQUIPMENT BLANK**	EPA 8260D	486282		
92436599012	**AMBIENT BLANK**	EPA 8260D	486282		
92436599013	**SW-2**	EPA 8260D	486282		
92436599014	**SW-1**	EPA 8260D	486282		
92436599015	**TRIP BLANK**	EPA 8260D	486282		
92436599001	**BG-1**	EPA 903.1	352403		
92436599002	**BG-2**	EPA 903.1	352403		
92436599003	**MW-1**	EPA 903.1	352403		
92436599004	**MW-4**	EPA 903.1	352403		
92436599005	**MW-5**	EPA 903.1	352403		
92436599006	**MW-6**	EPA 903.1	352403		
92436599007	**MW-7R**	EPA 903.1	352403		
92436599008	**MW-8**	EPA 903.1	352403		
92436599009	**DUP**	EPA 903.1	352403		
92436599010	**LEACHATE**	EPA 903.1	352403		
92436599011	**EQUIPMENT BLANK**	EPA 903.1	352403		
92436599012	**AMBIENT BLANK**	EPA 903.1	352403		
92436599013	**SW-2**	EPA 903.1	352403		
92436599014	**SW-1**	EPA 903.1	352403		
92436599001	**BG-1**	EPA 904.0	352407		
92436599002	**BG-2**	EPA 904.0	352407		
92436599003	**MW-1**	EPA 904.0	352407		
92436599004	**MW-4**	EPA 904.0	352407		
92436599005	**MW-5**	EPA 904.0	352407		
92436599006	**MW-6**	EPA 904.0	352407		
92436599007	**MW-7R**	EPA 904.0	352407		
92436599008	**MW-8**	EPA 904.0	352407		
92436599009	**DUP**	EPA 904.0	352407		
92436599010	**LEACHATE**	EPA 904.0	352407		
92436599011	**EQUIPMENT BLANK**	EPA 904.0	352407		
92436599012	**AMBIENT BLANK**	EPA 904.0	352407		
92436599013	**SW-2**	EPA 904.0	352407		
92436599014	**SW-1**	EPA 904.0	352407		
92436599001	**BG-1**	Total Radium Calculation	354228		
92436599002	**BG-2**	Total Radium Calculation	354228		
92436599003	**MW-1**	Total Radium Calculation	354228		
92436599004	**MW-4**	Total Radium Calculation	354228		
92436599005	**MW-5**	Total Radium Calculation	354228		
92436599006	**MW-6**	Total Radium Calculation	354228		
92436599007	**MW-7R**	Total Radium Calculation	354228		
92436599008	**MW-8**	Total Radium Calculation	354228		
92436599009	**DUP**	Total Radium Calculation	354228		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
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(704)875-9092

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Charah GW
Pace Project No.: 92436599

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92436599010	**LEACHATE**	Total Radium Calculation	354228		
92436599011	**EQUIPMENT BLANK**	Total Radium Calculation	354231		
92436599012	**AMBIENT BLANK**	Total Radium Calculation	354231		
92436599013	**SW-2**	Total Radium Calculation	354231		
92436599014	**SW-1**	Total Radium Calculation	354231		
92436599001	**BG-1**	SM 2540C-2011	486655		
92436599002	**BG-2**	SM 2540C-2011	486655		
92436599003	**MW-1**	SM 2540C-2011	486653		
92436599004	**MW-4**	SM 2540C-2011	486231		
92436599005	**MW-5**	SM 2540C-2011	486231		
92436599006	**MW-6**	SM 2540C-2011	486231		
92436599007	**MW-7R**	SM 2540C-2011	486653		
92436599008	**MW-8**	SM 2540C-2011	486653		
92436599009	**DUP**	SM 2540C-2011	486653		
92436599010	**LEACHATE**	SM 2540C-2011	486231		
92436599011	**EQUIPMENT BLANK**	SM 2540C-2011	486655		
92436599012	**AMBIENT BLANK**	SM 2540C-2011	486231		
92436599013	**SW-2**	SM 2540C-2011	486231		
92436599014	**SW-1**	SM 2540C-2011	486231		
92436599001	**BG-1**	EPA 300.0 Rev 2.1 1993	486233		
92436599002	**BG-2**	EPA 300.0 Rev 2.1 1993	486233		
92436599003	**MW-1**	EPA 300.0 Rev 2.1 1993	486233		
92436599004	**MW-4**	EPA 300.0 Rev 2.1 1993	486233		
92436599005	**MW-5**	EPA 300.0 Rev 2.1 1993	486233		
92436599006	**MW-6**	EPA 300.0 Rev 2.1 1993	486233		
92436599007	**MW-7R**	EPA 300.0 Rev 2.1 1993	486233		
92436599008	**MW-8**	EPA 300.0 Rev 2.1 1993	486233		
92436599009	**DUP**	EPA 300.0 Rev 2.1 1993	486233		
92436599010	**LEACHATE**	EPA 300.0 Rev 2.1 1993	486233		
92436599011	**EQUIPMENT BLANK**	EPA 300.0 Rev 2.1 1993	486233		
92436599012	**AMBIENT BLANK**	EPA 300.0 Rev 2.1 1993	486233		
92436599013	**SW-2**	EPA 300.0 Rev 2.1 1993	486234		
92436599014	**SW-1**	EPA 300.0 Rev 2.1 1993	486234		

WO# : 92436599

CHAIN-OF-CUSTODY Analytical Request Document

Pace Analytical

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevent fields

LAB USE ONLY-

Company: HDR
Address: 440 S Church Street Suite 900, Charlotte, NC 28202
Billing Information:
Report To: Jacob Ruffing
Email To: jacob.ruffing@hdrinc.com
Copy To:
Site Collection Info/Address: Charah Brickhaven
Customer Project Name/Number:
State: NC / County/City: Moncure / Time Zone Collected: [ ]PT [ ]MT [ ]CT [x]ET
Phone:
Email:
Site/Facility ID #:
Compliance Monitoring? [ ] Yes [ ] No
Collected By (print):
Purchase Order # :
Quote #:
DW PWS ID #:
DW Location Code:
Collected By (signature):
Turnaround Date Required:
Immediately Packed on Ice: [ ] Yes [ ] No
Sample Disposal: [ ] Dispose as appropriate [ ] Return [ ] Archive: ____ [ ] Hold: ____
Rush: [ ] Same Day [ ] Next Day [ ] 2 Day [ ] 3 Day [ ] 4 Day [ ] 5 Day (Expedite Charges Apply)
Field Filtered (if applicable): [ ] Yes [ ] No
Analysis: ____

Lab Project Manager:

Container Preservative Type **

** Preservative Types: (1) nitric acid, (2) sulfuric acid, (3) hydrochloric acid, (4) sodium hydroxide, (5) zinc acetate, (6) methanol, (7) sodium bisulfate, (8) sodium thiosulfate, (9) hexane, (A) ascorbic acid, (B) ammonium sulfate, (C) ammonium hydroxide, (D) TSP, (U) Unpreserved, (O) Other ____

* 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)

Customer Sample ID	Matrix *	Comp / Grab	Collected (or Composite Start) Date	Time	Composite End Date	Time	Res Cl	# of Ctns	8260 full list	300.0-Cl, SO4, F	2540C TDS	Radium 226/228	6010/7470	6020-B, Li, Tl	Trip Blank	SPLP*	LAB USE ONLY: Lab Sample # / Comments: 92436599
BG-1	GW	Grab	7/11/19	~~0~~ 1300					X	X	X	X	X	X			001
BG-2	GW	Grab	7/11/19	0950					X	X	X	X	X	X			002
MW-1	GW	Grab	7/10/19	1705					X	X	X	X	X	X			003
~~MW-2~~	~~GW~~	~~Grab~~							~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			
~~MW-3~~	~~GW~~	~~Grab~~							~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			
MW-4	GW	Grab	~~7/11/19~~ 7/9/19	1055					X	X	X	X	X	X			004
MW-5	GW	Grab	7/9/19	1450					X	X	X	X	X	X			005
MW-6	GW	Grab	7/9/19	1315					X	X	X	X	X	X			006
MW-7R	GW	Grab	7/10/19	0950					X	X	X	X	X	X			007
MW-8	GW	Grab	7/10/19	1325					X	X	X	X	X	X			008

Lab Profile/Line:
Lab Sample Receipt Checklist:
Custody Seals Present/Intact Y (N) NA
Custody Signatures Present (Y) N NA
Collector Signature Present (Y) N NA
Bottles Intact (Y) N NA
Correct Bottles (Y) N NA
Sufficient Volume (Y) N NA
Samples Received on Ice (Y) N NA
VOA - Headspace Acceptable (Y) N NA
USDA Regulated Soils Y N (NA)
Samples in Holding Time (Y) N NA
Residual Chlorine Present Y (N) NA
Cl Strips: ____
Sample pH Acceptable (Y) N NA
pH Strips: ____
Sulfide Present Y N (NA)
Lead Acetate Strips: ____

Customer Remarks / Special Conditions / Possible Hazards:
provied NC Solid Waste format EDD
SPLP for all listed analyses minus radium

Type of Ice Used: (Wet) Blue Dry None
Packing Material Used: B BAGS
Radchem sample(s) screened (<500 cpm): Y N (NA)
SHORT HOLDS PRESENT (<72 hours) : Y (N) N/A
Lab Tracking #:
Samples received via: FEDEX UPS (Client) Courier Pace Courier

LAB Sample Temperature Info:
Temp Blank Received: Y N NA
Therm ID#: 92T048
Cooler 1 Temp Upon Receipt: 2.1 oC
Cooler 1 Therm Corr. Factor: 0 oC
Cooler 1 Corrected Temp: 2.1 oC
Comments:

Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:	MTJL LAB USE ONLY
[signature]	7/12/19 1200	MDC Pace	7-12-19 1200	Table #:
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:	Acctnum: Template: Prelogin:
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:	PM: PB:

Trip Blank Received: Y N NA
(HCL) MeOH TSP Other

Non Conformance(s): YES / (NO)
Page: 1 of: 2

CHAIN-OF-CUSTODY Analytical Request Document

Pace Analytical®

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevent fields

LAB USE ONLY

WO# : 92436599

PM: KLH1 Due Date: 07/19/19

CLIENT: 92-HDR

Company: HDR	Billing Information:
Address: 440 S Church Street Suite 900, Charlotte, NC 28202	
Report To: Jacob Ruffing	Email To: jacob.ruffing@hdrinc.com
Copy To:	Site Collection Info/Address: Charah Brickhaven
Customer Project Name/Number:	State: NC / County/City: Moncure Time Zone Collected: [ ]PT [ ]MT [ ]CT [x]ET
Phone: / Email:	Site/Facility ID #: / Compliance Monitoring? [ ] Yes [ ] No
Collected By (print):	Purchase Order # : / Quote #: / DW PWS ID #: / DW Location Code:
Collected By (signature):	Turnaround Date Required: / Immediately Packed on Ice: [ ] Yes [ ] No
Sample Disposal: [ ] Dispose as appropriate [ ] Return [ ] Archive: _____ [ ] Hold: _____	Rush: [ ] Same Day [ ] Next Day [ ] 2 Day [ ] 3 Day [ ] 4 Day [ ] 5 Day (Expedite Charges Apply) / Field Filtered (if applicable): [ ] Yes [ ] No Analysis: _____

Container Preservative Type

Lab Project Manager:

** Preservative Types: (1) nitric acid, (2) sulfuric acid, (3) hydrochloric acid, (4) sodium hydroxide, (5) zinc acetate, (6) methanol, (7) sodium bisulfate, (8) sodium thiosulfate, (9) hexane, (A) ascorbic acid, (B) ammonium sulfate, (C) ammonium hydroxide, (D) TSP, (U) Unpreserved, (O) Other _____

* 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)

Customer Sample ID	Matrix *	Comp / Grab	Collected (or Composite Start) Date	Collected (or Composite Start) Time	Composite End Date	Composite End Time	Res Cl	# of Ctns	Analyses: 8260 full list	300.0-Cl, SO4, F	2540C TDS	Radium 226/228	6010/7470	6020-B, Li, Tl	Trip Blank	SPLP*			Lab Profile/Line:
DUP	GW	Grab	7/10/19	1220					X	X	X	X	X	X					009
Leachate	GW	Grab	7/8/19	1136					X	X	X	X	X	X					010
Equipment Blank	GW	Grab	7/11/19	1830					X	X	X	X	X	X					011
Ambient Blank	GW	Grab	7/4/19	1520					X	X	X	X	X	X					012
Trip Blank	GW	Grab	7/8/19	1100											X				015
~~Ash composite~~	~~SL~~	~~Comp~~														X			
SW-2	GW	Grab	7/8/19	1215					X	X	X	X	X	X					013
SW-1	GW	Grab	7/4/19	1200					X	X	X	X	X	X					014

Lab Profile/Line:

Lab Sample Receipt Checklist:
Custody Seals Present/Intact Y N NA
Custody Signatures Present Y N NA
Collector Signature Present Y N NA
Bottles Intact Y N NA
Correct Bottles Y N NA
Sufficient Volume Y N NA
Samples Received on Ice Y N NA
VOA - Headspace Acceptable Y N NA
USDA Regulated Soils Y N NA
Samples in Holding Time Y N NA
Residual Chlorine Present Y N NA
Cl Strips: _____
Sample pH Acceptable Y N NA
pH Strips: _____
Sulfide Present Y N NA
Lead Acetate Strips: _____

LAB USE ONLY:
Lab Sample # / Comments:
92436599

Customer Remarks / Special Conditions / Possible Hazards:
provied NC Solid Waste format EDD

~~SPLP for all listed analyses minus radium~~

Type of Ice Used: Wet Blue Dry None

Packing Material Used: ~~WPC~~ BBAGS

Radchem sample(s) screened (<500 cpm): Y N NA

SHORT HOLDS PRESENT (<72 hours): Y N N/A

Lab Tracking #:

Samples received via: FEDEX UPS Client Courier Pace Courier

LAB Sample Temperature Info:
Temp Blank Received: Y N NA
Therm ID#: 97DL15
Cooler 1 Temp Upon Receipt: 2.1°C
Cooler 1 Therm Corr. Factor: 0°C
Cooler 1 Corrected Temp: 2.1°C
Comments:

Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:	MTJL LAB USE ONLY
	12 Jul 2019 1200	MDL-Pace	7-12-19 1200	Table #:
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:	Acctnum: / Template: / Prelogin:
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:	PM: / PB:

Trip Blank Received: Y N NA
HCL MeOH TSP Other

Non Conformance(s): YES / NO

Page: 2 of: 2

Pace Analytical®	Document Name: Sample Condition Upon Receipt(SCUR)	Document Revised: February 7, 2018 Page 1 of 2
	Document No.: F-CAR-CS-033-Rev.06	Issuing Authority: Pace Carolinas Quality Office

***Check mark top half of box if pH and/or dechlorination is verified and within the acceptance range for preservation samples.**

Exceptions: VOA, Coliform, TOC, Oil and Grease, DRO/8015 (water) DOC, LLHg

****Bottom half of box is to list number of bottle**

Project **WO# : 92436599**

PM: KLH1 **Due Date: 07/19/19**

CLIENT: 92-HDR

Item#	BP4U-125 mL Plastic Unpreserved (N/A) (Cl-)	BP3U-250 mL Plastic Unpreserved (N/A)	BP2U-500 mL Plastic Unpreserved (N/A)	BP1U-1 liter Plastic Unpreserved (N/A)	BP4S-125 mL Plastic H2SO4 (pH < 2) (Cl-)	BP3N-250 mL plastic HNO3 (pH < 2)	BP4Z-125 mL Plastic ZN Acetate & NaOH (>9)	BP4C-125 mL Plastic NaOH (pH > 12) (Cl-)	WGFU-Wide-mouthed Glass jar Unpreserved	AG1U-1 liter Amber Unpreserved (N/A) (Cl-)	AG1H-1 liter Amber HCl (pH < 2)	AG3U-250 mL Amber Unpreserved (N/A) (Cl-)	AG1S-1 liter Amber H2SO4 (pH < 2)	AG3S-250 mL Amber H2SO4 (pH < 2)	AG3A(DG3A)-250 mL Amber NH4Cl (N/A)(Cl-)	DG9H-40 mL VOA HCl (N/A)	VG9T-40 mL VOA Na2S2O3 (N/A)	VG9U-40 mL VOA Unp (N/A)	DG9P-40 mL VOA H3PO4 (N/A)	VOAK (6 vials per kit)-5035 kit (N/A)	V/GK (3 vials per kit)-VPH/Gas kit (N/A)	SP5T-125 mL Sterile Plastic (N/A – lab)	SP2T-250 mL Sterile Plastic (N/A – lab)	RAD	BP3A-250 mL Plastic (NH2)2SO4 (9.3-9.7)	AG0U-100 mL Amber Unpreserved vials (N/A)	VSGU-20 mL Scintillation vials (N/A)	DG9U-40 mL Amber Unpreserved vials (N/A)
1		1	1			1										3								3				
2		1	1			1										3								3				
3		1	1			1										3								3				
4		1	1			1										3								3				
5		1	1			1										3								3				
6		1	1			1										3								3				
7		1	1			1										3								3				
8		1	1			1										3								3				
9		1	1			1										3								3				
10		1	1			1										3								3				
11		1	1			1										3								3				
12		1	1			1										3								3				

pH Adjustment Log for Preserved Samples

Sample ID	Type of Preservative	pH upon receipt	Date preservation adjusted	Time preservation adjusted	Amount of Preservative added	Lot #

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.

Pace Analytical®	Document Name: Sample Condition Upon Receipt(SCUR)	Document Revised: February 7, 2018 Page 1 of 2
	Document No.: F-CAR-CS-033-Rev.06	Issuing Authority: Pace Carolinas Quality Office

***Check mark top half of box if pH and/or dechlorination is verified and within the acceptance range for preservation samples.**

Exceptions: VOA, Coliform, TOC, Oil and Grease, DRO/8015 (water) DOC, LLHg

****Bottom half of box is to list number of bottle**

Project # **WO# : 92436599**

PM: KLH1 **Due Date: 07/19/19**

CLIENT: 92-HDR

Item#	BP4U-125 mL Plastic Unpreserved (N/A) (Cl-)	BP3U-250 mL Plastic Unpreserved (N/A)	BP2U-500 mL Plastic Unpreserved (N/A)	BP1U-1 liter Plastic Unpreserved (N/A)	BP4S-125 mL Plastic H2SO4 (pH < 2) (Cl-)	BP3N-250 mL plastic HNO3 (pH < 2)	BP4Z-125 mL Plastic ZN Acetate & NaOH (>9)	BP4C-125 mL Plastic NaOH (pH > 12) (Cl-)	WGFU-Wide-mouthed Glass jar Unpreserved	AG1U-1 liter Amber Unpreserved (N/A) (Cl-)	AG1H-1 liter Amber HCl (pH < 2)	AG3U-250 mL Amber Unpreserved (N/A) (Cl-)	AG1S-1 liter Amber H2SO4 (pH < 2)	AG3S-250 mL Amber H2SO4 (pH < 2)	AG3A(DG3A)-250 mL Amber NH4Cl (N/A)(Cl-)	DG9H-40 mL VOA HCl (N/A)	VG9T-40 mL VOA Na2S2O3 (N/A)	VG9U-40 mL VOA Unp (N/A)	DG9P-40 mL VOA H3PO4 (N/A)	VOAK (6 vials per kit)-5035 kit (N/A)	V/GK (3 vials per kit)-VPH/Gas kit (N/A)	SP5T-125 mL Sterile Plastic (N/A – lab)	SP2T-250 mL Sterile Plastic (N/A – lab)	R R2	BP3A-250 mL Plastic (NH2)2SO4 (9.3-9.7)	AG0U-100 mL Amber Unpreserved vials (N/A)	VSGU-20 mL Scintillation vials (N/A)	DG9U-40 mL Amber Unpreserved vials (N/A)
1																2													
2		1	1			1 X										3								3					
3		1	1			1										3								3					
4																													
5																													
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11																													
12																													

pH Adjustment Log for Preserved Samples

Sample ID	Type of Preservative	pH upon receipt	Date preservation adjusted	Time preservation adjusted	Amount of Preservative added	Lot #

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.

D

Appendix D – Electronic Data Deliverables (CD-ROM only)

E

Appendix E – Statistical Analysis Memo

Summary of Statistical Analysis and Evaluation for SSIs

Background and Downgradient Wells

Charah, LLC

Moncure, Chatham County, North Carolina
September 5, 2019

Contents

Tables

Figures

1 Introduction

This report summarizes the statistical analysis of background and downgradient groundwater quality for the Charah, LLC Brickhaven No. Mine Tract 'A' Site (Brickhaven Mine) and operating under the Facility Permit #1910-STRUC-2015 as a municipal solid waste landfill (MSWLF). Background groundwater quality was evaluated such that statistically-derived background concentrations could be established for Brickhaven Mine. Groundwater quality in downgradient wells was then compared to background concentrations to determine if a statistically significant increase (SSI) over background has occurred, as required by Section .1600 rules of the North Carolina Solid Waste Management Rules 15A NCAC 13B .1600. Sampling results used to establish background threshold values (BTVs) were obtained during sixteen monitoring events performed between October 2015 and January 2019. Downgradient sampling results from two detection monitoring rounds in January 2019 and July 2019 were used to evaluate for SSIs. The current Brickhaven Mine groundwater monitoring network is presented in **Table 1**.

Software packages ProUCL [1], NCSS [2], R [3], and SPSS [4] were used in the production of the statistics. ProUCL is offered by the USEPA, R is a free software environment, NCSS and SPSS are licensed software packages.

Table 1: Brickhaven Mine Monitoring Well Network

Background	Downgradient
BG-1	MW-1
BG-2	MW-2
	MW-3
	MW-4
	MW-5
	MW-6
	MW-7R
	MW-8

Groundwater samples collected as part of the 15A NCAC 13B .1600 monitoring program were analyzed for EPA Appendix III and Appendix IV constituents, Appendix I metals, and Appendix I volatile organic compounds (VOCs). Only non-filtered sample results were utilized for the statistical analysis of monitored constituents. A summary of constituents included in the data analysis is provided in **Table 2**.

Table 2: Brickhaven Mine Monitored Constituents

Appendix I VOCs	Appendix I Metals	Appendix III Constituents	Appendix IV Constituents
1,4-Dichlorobenzene	Copper	Boron	Antimony
Acetone	Nickel	Calcium	Arsenic
Bromodichloromethane	Silver	Chloride	Barium
Bromoform	Vanadium	Fluoride	Beryllium
Carbon disulfide	Zinc	pH (Field)	Cadmium
Chloroform		Sulfate	Chromium
Dibromochloromethane		Total Dissolved Solids	Cobalt
Dibromomethane			Fluoride
			Lead
			Lithium
			Mercury
			Molybdenum
			Radium-226
			Radium-228
			Selenium
			Thallium
			Total Radium

2 Statistical Analysis

The background sample size (i.e., quantity of qualifying samples) was evaluated per constituent. Descriptive statistics were calculated for the background data set including non-detect (ND) values and excluding ND values. When NDs were included in the data set, the method detection limit (MDL) was substituted as the ND value for simple descriptive statistics. The analysis was performed with NDs removed to better understand the central tendency and range of the detected values. A summary of the descriptive statistics for the background data set is provided in **Table 3**. Trend analyses in Section 2.3 and for the establishment of statistically-derived background concentration levels in Section 4, imputation methods using the maximum likelihood method (MLE) for NDs, regression on order statistics (ROS) or Kaplan-Meier (KM) methods, where appropriate, were used.

Following the calculation of descriptive statistics, the statistical analysis for the background data set was performed to evaluate for outliers, data distributions, and trends for Appendix I metals, Appendix I VOCs, and Appendix III and IV constituents, where data quantity and quality permit. Spatial variability between the background wells was evaluated for each constituent to assess whether the data can be pooled for establishing background concentrations. A total of seventeen samples (sixteen monitoring events from well BG-1 and one monitoring event from well BG-2) were included for the descriptive analysis of the background monitoring well results for the monitored constituents. The first monitoring round sampled in August 2015 was not included in the analysis as it was deemed not representative of the other monitoring events as the samples were tested at a different lab.

For downgradient monitoring results, the data analysis included the calculation of descriptive statistics for Appendix I metals, Appendix I VOCs, and Appendix III and IV constituents (for the data sets including and excluding ND values), followed by an evaluation of outliers and trends. A total of seventeen monitoring events performed between November 2015 and July 2019 were included for the descriptive analysis of the downgradient monitoring well results for the monitored constituents. A summary of the descriptive statistics for each downgradient well is provided in **Appendix E.A**.

Table 3: Summary of Background Data Set Descriptive Statistics (BG-1 and BG-2)

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Appendix I VOCs											
1,4-Dichlorobenzene	ug/L	17	17	0.260	0.330	0.322	0.330	--	--	--	--
Acetone	ug/L	17	17	6.20	10.0	9.55	10.0	--	--	--	--
Bromodichloromethane	ug/L	17	17	0.180	0.260	0.189	0.180	--	--	--	--
Bromoform	ug/L	17	17	0.260	0.620	0.302	0.260	--	--	--	--
Carbon disulfide	ug/L	17	17	0.400	1.20	1.11	1.20	--	--	--	--
Chloroform	ug/L	17	17	0.140	2.30	0.394	0.140	--	--	--	--
Dibromochloromethane	ug/L	17	17	0.210	0.410	0.234	0.210	--	--	--	--
Dibromomethane	ug/L	17	17	0.210	0.460	0.239	0.210	--	--	--	--
Appendix I Metals											
Copper	ug/L	17	17	2.50	2.50	2.50	2.50	--	--	--	--
Nickel	ug/L	17	17	2.50	2.50	2.50	2.50	--	--	--	--
Silver	ug/L	17	17	2.50	2.50	2.50	2.50	--	--	--	--
Vanadium	ug/L	17	12	2.50	5.50	3.30	2.50	5.10	5.50	5.22	5.10
Zinc	ug/L	17	16	5.00	10.0	5.29	5.00	10.0	10.0	10.0	10.0
Appendix III Constituents											
Boron	ug/L	17	8	0.570	7.50	4.06	5.50	5.50	7.50	6.46	6.10
Calcium	ug/L	17	0	23,900	89,600	32,912	29,000	23,900	89,600	32,912	29,000
Chloride	mg/L	17	0	213	311	269	277	213	311	269	277
Fluoride	mg/L	17	0	0.100	0.170	0.131	0.130	0.100	0.170	0.131	0.130
pH (Field)	S.U.	13	0	6.24	6.80	6.55	6.52	6.24	6.80	6.55	6.52
Sulfate	mg/L	17	0	15.1	64.7	21.4	18.6	15.1	64.7	21.4	18.6
Total Dissolved Solids	mg/L	17	0	546	2,630	762	643	546	2,630	762	643
Appendix IV Constituents											
Antimony	ug/L	17	17	3.80	3.90	3.86	3.90	--	--	--	--

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Arsenic	ug/L	17	17	2.50	5.00	3.97	5.00	--	--	--	--
Barium	ug/L	17	0	123	443	324	329	123	443	324	329
Beryllium	ug/L	17	17	0.500	0.500	0.500	0.500	--	--	--	--
Cadmium	ug/L	17	17	0.500	0.500	0.500	0.500	--	--	--	--
Chromium	ug/L	17	17	2.50	2.50	2.50	2.50	--	--	--	--
Cobalt	ug/L	17	17	2.50	2.50	2.50	2.50	--	--	--	--
Fluoride	mg/L	17	0	0.100	0.170	0.131	0.130	0.100	0.170	0.131	0.130
Lead	ug/L	17	17	2.50	2.50	2.50	2.50	--	--	--	--
Lithium	ug/L	17	0	12.1	36.8	20.2	17.9	12.1	36.8	20.2	17.9
Mercury	ug/L	17	17	0.100	0.100	0.100	0.100	--	--	--	--
Molybdenum	ug/L	17	16	2.50	6.80	2.75	2.50	6.80	6.80	6.80	6.80
Radium-226	pCi/L	16	0	-0.206	0.800	0.355	0.360	--	--	--	--
Radium-228	pCi/L	16	0	0.0108	1.29	0.633	0.645	--	--	--	--
Selenium	ug/L	17	17	5.00	5.00	5.00	5.00	--	--	--	--
Thallium	ug/L	17	16	0.0200	13.7	2.59	0.0600	13.7	13.7	13.7	13.7
Total Radium	pCi/L	16	0	0.271	2.09	1.00	0.957	--	--	--	--

Notes:
1. ND = not detected above the laboratory method detection limit.
2. MDL = method detection limit.
3. "--" indicates all results for the respective constituent were NDs, or with the case of total radium, NDs were flagged but the laboratory did not provide a value for the MDL.
4. Numbers are displayed using the same number of significant figures as reported by the laboratory.
5. If a constituent had 100% detections the descriptive statistics provided above are identical for the data including NDs and excluding NDs.

2.1 Outliers

Outliers are values that are not representative of the population from which they are sampled. The background and downgradient data sets were screened for outliers using Dixon's outlier test, which is suitable for data sets containing less than 25 samples. The outlier test was conducted using a significance of one percent. For constituents that had NDs, the NDs were removed prior to testing for outliers.

2.1.1 Background

Statistical outliers were identified in the background data set evaluated for three Appendix III constituents (calcium, sulfate, and total dissolved solids) and one Appendix IV constituent (barium). The constituent concentrations identified as statistical outliers were sampled from the newly installed background well BG-2, except for total dissolved solids, and are listed in **Table 4**.

Table 4: Dixon's Outlier Test Results – Background

Well	Constituent	Constituent Type	Potential Outlier Value	Units	Sampling Event	Sample Date
BG-1	Total Dissolved Solids	Appendix III	2,630	mg/L	R10	4/3/2017
	Total Dissolved Solids	Appendix III	546	mg/L	R17	1/22/2019
BG-2	Calcium	Appendix III	89,600	ug/L	R17	1/22/2019
	Sulfate	Appendix III	64.7	mg/L	R17	1/22/2019
	Barium	Appendix IV	123	ug/L	R17	1/22/2019

A visual inspection of concentration vs. time scatter plots for barium (**Figure 1**), calcium (**Figure 2**), sulfate (**Figure 3**), and total dissolved solids (**Figure 4**) reveal the presence of the potential outliers. The statistical outliers were investigated as possible data entry or measurement errors. The values were all within one order of magnitude of other observations and deemed correct. Although the elevated values appears as a statistical outliers, it is within a reasonable range of the remaining concentrations throughout the monitoring period and should not be removed from the data set at this time for purposes of determining background concentrations. Given the variable nature of groundwater samples, the small sample sizes and that it is common for groundwater quality samples to have very low or very high concentrations over time, statistical outliers are expected but do not necessarily signify that the outliers are from different distributions. As additional background samples are collected over time, the variability in concentrations will be better understood. Outlier test results may change and earlier observations thought to be outliers may no longer be outliers.

Figure 1: Barium Concentrations (ug/L) vs. Time

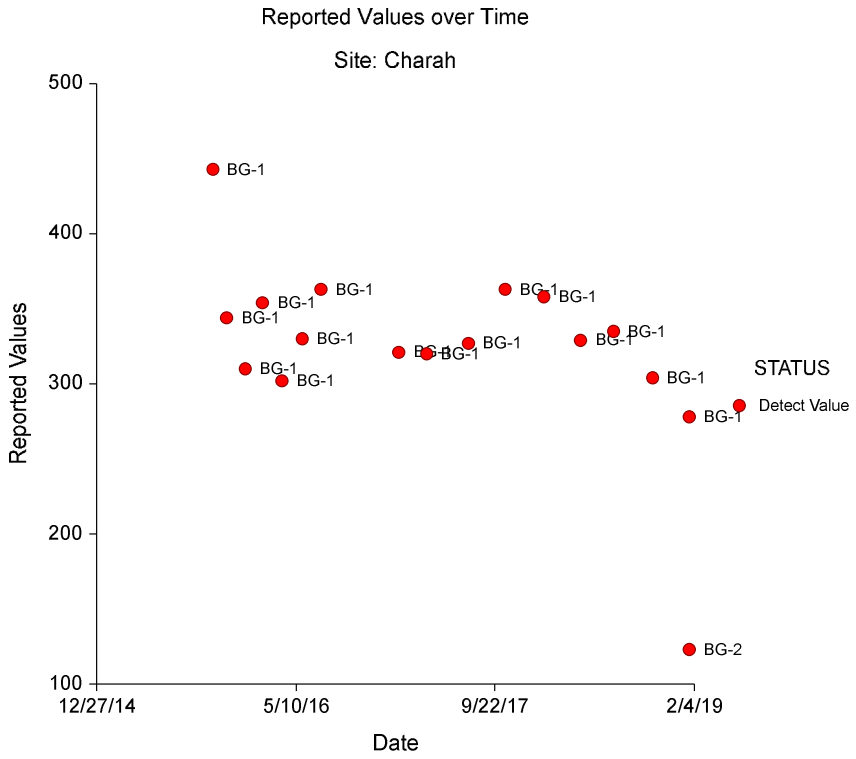


Figure 2: Calcium Concentrations (ug/L) vs. Time

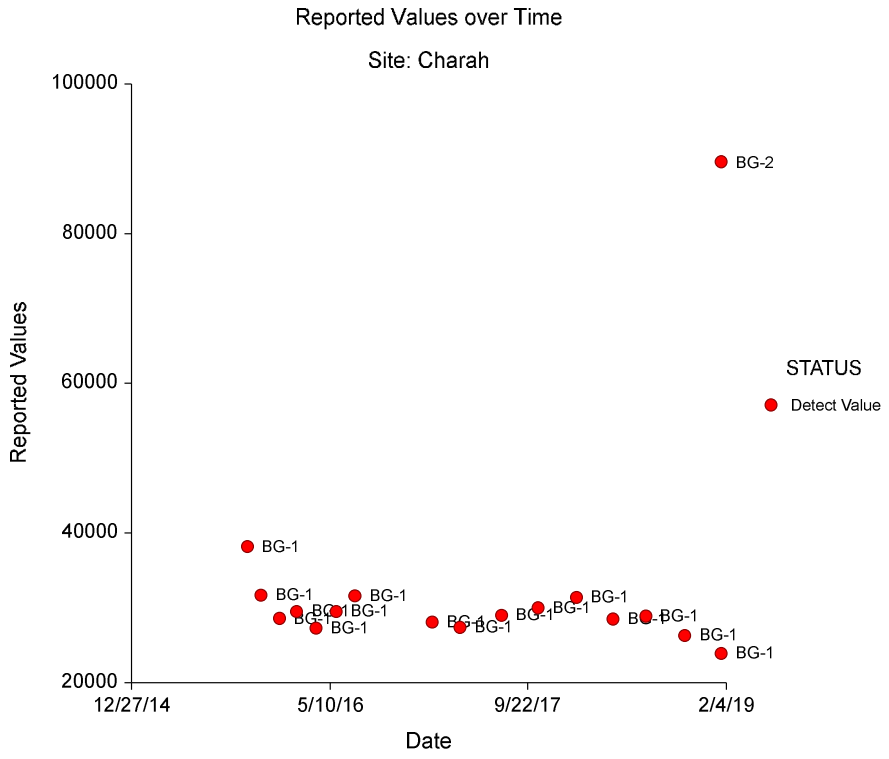


Figure 3: Sulfate Concentrations (mg/L) vs. Time

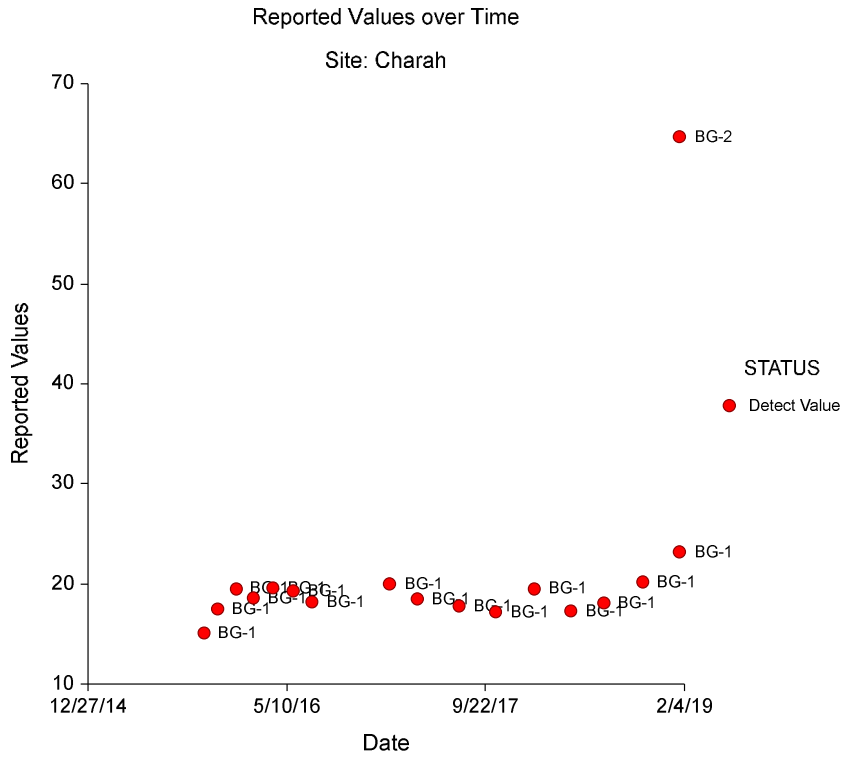
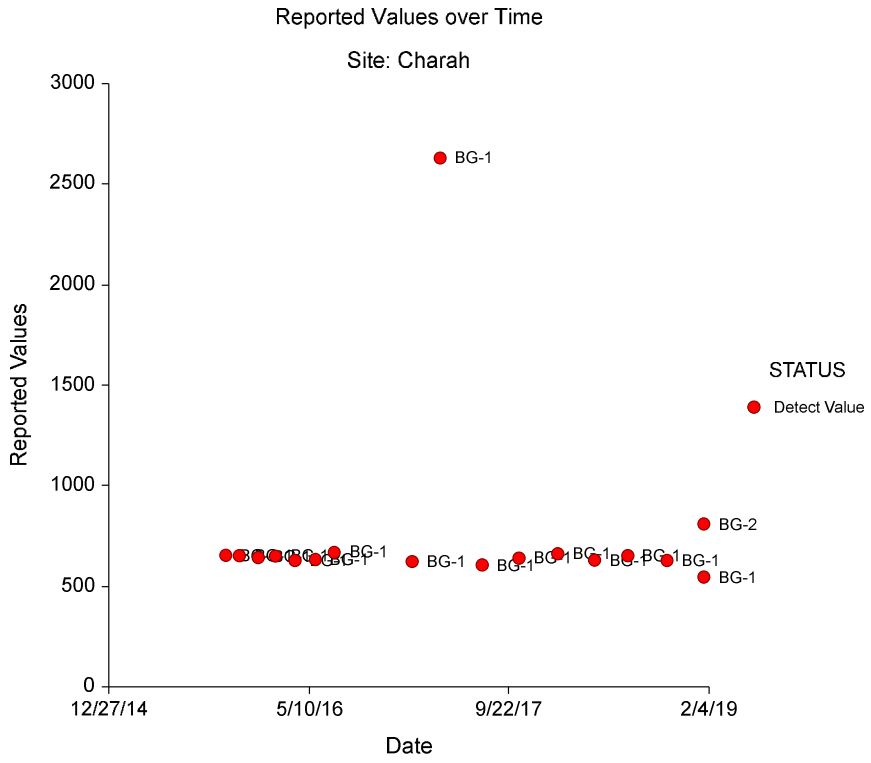


Figure 4: Total Dissolved Solids Concentrations (mg/L) vs. Time



2.1.2 Downgradient

Statistical outliers were identified for Appendix I metals, Appendix III and Appendix IV constituents in the data sets evaluated for downgradient monitoring wells throughout the monitoring period, and are listed in **Table 5**.

Table 5: Dixon's Outlier Test Results – Downgradient

Well	Constituent	Constituent Type	Potential Outlier Value	Units	Sampling Event	Sample Date
MW-2	Total Dissolved Solids	App. III	257	mg/L	R03	11/19/2015
	Calcium	App. III	1,300	ug/L	R07	5/27/2016
MW-3	Lithium	App. IV	236	ug/L	R12	10/18/2017
MW-4	Boron	App. III	165	ug/L	R12	10/17/2017
MW-5	Boron	App. III	39.3	ug/L	R09	1/23/2017
	Total Dissolved Solids	App. III	1,160	mg/L	R12	10/17/2017
	pH (Field)	App. III	6.25	S.U.	R19	7/9/2019
MW-6	Chloride	App. III	15.3	mg/L	R06	4/5/2016
MW-7R	Fluoride	App. III	0.320	mg/L	R11	7/20/2017
	pH (Field)	App. III	9.60	S.U.	R11	7/20/2017
	Sulfate	App. III	51.2	mg/L	R11	7/20/2017
	Nickel	App. I Metals	880	ug/L	R19	7/10/2019
	Chromium	App. IV	1,940	ug/L	R19	7/10/2019
MW-8	Nickel	App. I Metals	42.1	ug/L	R09	1/24/2017

A visual inspection of concentration vs. time scatter plots for constituents included in the outliers listed in **Table 5** reveal the presence of the potential outliers.[1] Following review of the sampling protocols and field sampling records, there were no obvious reasons for the outliers noted on the sampling dates. The value for each statistical outlier listed above is within a reasonable range of the remaining concentrations for each constituent throughout the monitoring period. The variability in concentrations will be better understood as additional samples are obtained.

2.2 Data Distribution

Groundwater data was fitted to known distribution models using Goodness-of-Fit (GOF) tests incorporated into ProUCL. For data sets comprised of 50 or fewer samples, ProUCL's GOF module incorporates the Shapiro-Wilk GOF test to determine normal or lognormal distribution and Anderson-Darling to determine gamma distribution. Normal, lognormal and gamma distributions are parametric distributions. If a data set could not be fit with any of these three parametric distributions, it was considered to follow a nonparametric distribution. Note that

[1] See Appendix E.B for scatter plots of constituents with downgradient statistically-derived outliers.

ProUCL does not provide GOF results for data sets with less than three detected values due to insufficient data. For purposes of estimating background concentrations, these data sets were treated under non-parametric distribution assumptions with the maximum detected value chosen to represent the background concentrations. In addition, the data for total radium is set to nonparametric as the MDL values were not provided by the laboratory. Data distributions are listed in **Table 6**.

Table 6: Data Distributions – Background

Constituent	Sample Size	No. of NDs	Distribution Fit[1]
Appendix I VOCs			
1,4-Dichlorobenzene	17	17	Nonparametric
Acetone	17	17	Nonparametric
Bromodichloromethane	17	17	Nonparametric
Bromoform	17	17	Nonparametric
Carbon disulfide	17	17	Nonparametric
Chloroform	17	17	Nonparametric
Dibromochloromethane	17	17	Nonparametric
Dibromomethane	17	17	Nonparametric
Appendix I Metals			
Copper	17	17	Nonparametric
Nickel	17	17	Nonparametric
Silver	17	17	Nonparametric
Vanadium	17	12	Nonparametric
Zinc	17	16	Nonparametric
Appendix III Constituents			
Boron	17	8	Parametric
Calcium	17	0	Nonparametric
Chloride	17	0	Parametric
Fluoride	17	0	Parametric
pH (Field)	13	0	Parametric
Sulfate	17	0	Nonparametric
Total Dissolved Solids	17	0	Nonparametric
Appendix IV Constituents			
Antimony	17	17	Nonparametric
Arsenic	17	17	Nonparametric
Barium	17	0	Nonparametric
Beryllium	17	17	Nonparametric
Cadmium	17	17	Nonparametric
Chromium	17	17	Nonparametric

Constituent	Sample Size	No. of NDs	Distribution Fit[1]
Cobalt	17	17	Nonparametric
Fluoride	17	0	Parametric
Lead	17	17	Nonparametric
Lithium	17	0	Parametric
Mercury	17	17	Nonparametric
Molybdenum	17	16	Nonparametric
Radium-226	16	0	Nonparametric
Radium-228	16	0	Nonparametric
Selenium	17	17	Nonparametric
Thallium	17	16	Nonparametric
Total Radium	16	0	Nonparametric

[1]Best fit is based on detected data.

2.3 Trends

2.3.1 Background

Background constituent concentrations in groundwater should demonstrate stationary conditions through time, free of trends. Constituents were analyzed for trends within the data set using a maximum likelihood estimate (MLE) regression for constituents which followed parametric distributions and Mann-Kendall tests for those that were treated under nonparametric distributional assumptions. The MLE regression can be applied to data sets that can be fitted to a specific distribution model and that contain NDs with multiple MDLs. The Mann-Kendall test is suitable for data series with no discernable distributions and only one MDL value for NDs.

Constituents treated under nonparametric data assumptions (either tested as nonparametric or having more than 50 percent NDs) and with multiple MDLs or with less than three detected values were not assessed for trends. A summary of the trend analysis results for constituents with sufficient detected values in the background data set is provided in

Table 7.

The background well regression analysis showed a potential increasing trend for one Appendix III constituent (fluoride) and a potential decreasing trend for two Appendix III constituents (boron and chloride) and one Appendix IV constituent (barium).There were no increasing or decreasing trends identified for other monitoring constituents with sufficient data quantity and quality for testing with the MLE analysis or Mann-Kendall test. Although statistical trends were identified for boron, barium, chloride, and fluoride, the results can be misleading due to the short duration of the sampling program.

Table 7: Summary of Trend Analysis Results – Background

Constituent	Trend
Appendix III Constituents	
Boron	↓
Chloride	↓
Fluoride	↑
Appendix IV Constituents	
Barium	↓
Fluoride	↑

2.3.2 Downgradient

Trends were also evaluated for constituents in each downgradient well using the same methods as described above for the background data set. Trends were identified for certain constituents at select monitoring well locations, and should be monitored as additional downgradient groundwater data are collected at the site. A summary of the statistical trends identified within the downgradient data set is provided in **Table 8**.

Table 8: Summary of Trend Analysis Results – Downgradient

Constituent	Downgradient Well with Increasing or Decreasing Trend							
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7R	MW-8
Appendix I Metals								
Copper		↓	↓					
Nickel			↓					
Vanadium			↓					
Zinc		↓						
Appendix III Constituents								
Boron			↓					
Calcium				↓				↓
Chloride	↑		↓					↓
Fluoride			↑					
pH (Field)				↓			↓	↑
Sulfate	↓	↓	↑	↑		↓	↓	↑
Total Dissolved Solids	↑			↓				
Appendix IV Constituents								
Antimony		↓	↓					
Barium				↑	↑	↓	↓	↓
Chromium			↓					
Fluoride			↑					
Lithium	↑			↑		↓	↓	↓

Constituent	Downgradient Well with Increasing or Decreasing Trend							
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7R	MW-8
Molybdenum		↓	↓					
Radium-226	↓			↓				
Total Radium	↓			↓				

2.4 Spatial Variability

Spatial variability refers to identifying whether or not there are statistically identifiable differences in mean concentrations or variance levels across the well field (i.e., the pooled background data). The results from background wells BG-1 and BG-2 were assessed to determine if it is appropriate to pool the data and use it to calculate background concentrations. The sampling round from well BG-2 was compared to the BTVs established in 2018 with the BG-1 well concentrations. The majority of the concentrations in BG-2 were below the former BTVs, therefore no evidence of spatial variability was identified. The constituents in BG-2 will be monitored as additional background groundwater data are collected at the site.

3 Summary of Statistical Analysis

A summary of the statistical analysis results is provided in **Table 9** and discussed below.

- The statistical outliers identified for barium, calcium, sulfate, and total dissolved solids should not be removed from the data set to be used for developing background concentrations for the site at this time.
- For the background data set, all of the Appendix I VOCs are 100 percent NDs and will be treated under nonparametric distribution assumptions with the maximum MDL chosen to represent background.
- For the background data set, all of the five Appendix I metals exhibited high percentages of NDs and will be treated under nonparametric distribution assumptions with the maximum detected value chosen to represent background, until additional results can be included in the data sets. For the background data set, there are currently sufficient data to fit the Appendix III constituents to known parametric distribution models (e.g., gamma, lognormal, or normal) using GOF tests, except for calcium, sulfate, and total dissolved solids, which are nonparametric. Statistical tests conducted under parametric distribution assumptions have more power to detect an SSI when compared to tests conducted under nonparametric distribution assumptions.
- For the background data set, eleven of the seventeen Appendix IV constituents exhibited high percentages of NDs and will be treated under nonparametric distribution assumptions with the maximum detected value chosen to represent background, until additional results can be included in the data sets. The data for radium-226, radium-228 and total radium are set to a nonparametric distribution as the MDL values were not provided by the laboratory. Currently, the background data sets for fluoride and lithium can be fitted to known parametric distribution models using GOF tests.
- Based on the small data set and short duration of the monitoring program, results from the outlier and trend analyses should be considered preliminary until additional sample results are included in the data set and re-evaluated.
- At this time, for the purpose of calculating background concentrations and testing for SSIs over background for Appendix I metals, and Appendix III and IV constituents, results from seventeen samples (sixteen monitoring events taken during October 2015 to January 2019 from BG-1 and one monitoring event taken January 2019 from BG-2) were used. The statistically-derived background concentrations and the evaluation for SSIs over background for Appendix I VOCs, Appendix I metals, and Appendix III and Appendix IV constituents are included in **Section 4**.

Table 9: Summary of Background Preliminary Data Analysis

Constituent	Statistical Outlier	Nonparametric Data Distribution	Trend
Appendix I VOCs			
1,4-Dichlorobenzene		✓	
Acetone		✓	
Bromodichloromethane		✓	
Bromoform		✓	
Carbon disulfide		✓	
Chloroform		✓	
Dibromochloromethane		✓	
Dibromomethane		✓	
Appendix I Metals			
Copper		✓	
Nickel		✓	
Silver		✓	
Vanadium		✓	
Zinc		✓	
Appendix III Constituents			
Boron			✓
Calcium	✓	✓	
Chloride			✓
Fluoride			✓
Sulfate	✓	✓	
Total Dissolved Solids	✓	✓	
Appendix IV Constituents			
Antimony		✓	
Arsenic		✓	
Barium	✓	✓	✓
Beryllium		✓	
Cadmium		✓	
Chromium		✓	
Cobalt		✓	
Fluoride			✓
Lead		✓	
Mercury		✓	
Molybdenum		✓	
Radium-226		✓	
Radium-228		✓	

Constituent	Statistical Outlier	Nonparametric Data Distribution	Trend
Selenium		✓	
Thallium		✓	
Total Radium		✓	

✓Constituent was flagged during the statistical analysis

4 Evaluation for SSIs over Background

Based on the statistical evaluations performed, background threshold values (BTVs) were determined for the detection monitoring program at the site for Appendix I metals, and Appendix III and IV constituents. Note that BTVs were not calculated for Appendix I VOCs as all of these constituents were 100 percent non-detects. For constituents that have all ND background values, the maximum MDL is chosen to represent background and the double quantification rule (DQR) is used to evaluate whether or not there is an SSI. The BTV provided for detection monitoring constituents is the statistically-derived background concentration (i.e., upper prediction limit [UPL]), the maximum detected value or the maximum MDL depending on the level of censorship in each of the background samples. For pH (field), both the UPL and the lower prediction limit (LPL) were computed as pH values above or below the prediction limits at the downgradient wells can be considered statistically significant. The test significance level per constituent has been estimated such that the cumulative false positive rate over all constituent/well pair comparisons is approximately ten percent. The number of verification samples per constituent has been selected to provide sufficient statistical power to detect an SSI when an SSI as occurred conditional to the background sample size, its distributional properties, and the total number of statistical test comparisons. The calculated background concentrations, or BTVs, for each detection monitoring constituent is provided below in **Table 10**.

Table 10: Background Concentrations for Detection Monitoring Constituents

Constituent	Unit	No. of Verification Samples.	BTV (UPL)
Appendix I VOCs			
1,4-Dichlorobenzene	ug/L	na	*0.330*
Acetone	ug/L	na	*10.0*
Bromodichloromethane	ug/L	na	*0.260*
Bromoform	ug/L	na	*0.620*
Carbon disulfide	ug/L	na	*1.20*
Chloroform	ug/L	na	*2.30*
Dibromochloromethane	ug/L	na	*0.410*
Dibromomethane	ug/L	na	*0.460*
Appendix I Metals			
Copper	ug/L	na	*2.50*
Nickel	ug/L	na	*2.50*
Silver	ug/L	na	*2.50*
Vanadium	ug/L	3	5.50
Zinc	ug/L	3	10.0
Appendix III Constituents			

Constituent	Unit	No. of Verification Samples.	BTV (UPL)
Boron	ug/L	1	9.26
Calcium	ug/L	3	89,600
Chloride	mg/L	1	355
Fluoride	mg/L	1	0.189
pH (Field)	S.U.	1	6.05 - 7.07*
Sulfate	mg/L	3	64.7
Total Dissolved Solids	mg/L	3	2,630
Appendix IV Constituents			
Antimony	ug/L	na	*3.90*
Arsenic	ug/L	na	*5.00*
Barium	ug/L	3	443
Beryllium	ug/L	na	*0.500*
Cadmium	ug/L	na	*0.500*
Chromium	ug/L	na	*2.50*
Cobalt	ug/L	na	*2.50*
Fluoride	mg/L	1	0.189
Lead	ug/L	na	*2.50*
Lithium	ug/L	1	42.7
Mercury	ug/L	na	*0.100*
Molybdenum	ug/L	3	6.80
Radium-226	pCi/L	3	0.800
Radium-228	pCi/L	3	1.29
Selenium	ug/L	na	*5.00*
Thallium	ug/L	3	13.7
Total Radium	pCi/L	3	2.09

Note:
* indicates the lower bound of the pH range is the lower prediction limit (LPL).
Italic concentration indicates a non-detect value and that the DQR is recommended for statistical evaluation.

Downgradient sampling results from the first detection monitoring round in January 2019 and the second detection monitoring round in July 2019 were used to test for SSIs. For constituents that have all ND background values, the DQR is applied; that is, an SSI is registered for the well-constituent pair if the downgradient concentrations exhibit detects in two consecutive sampling events. The downgradient sampling results collected in April 2019 were used to assess if an SSI occurred for detected constituents with all ND background values in the first detection monitoring round. For the second detection monitoring round, constituents under the DQR were flagged if they exhibited detect results. If the downgradient concentrations for these constituents remain as detects in the consecutive sampling event, then they will be considered

SSIs. The downgradient concentrations compared to the BTVs are summarized below in **Table 11** through

Table 14. Eight monitoring wells (MW-1 through MW-8) were installed and sampled (October 2015) prior to ash placement, thus representing a sample of pre-ash conditions at the site. The range of the concentrations of the pre-ash conditions are included in the tables below as a relative comparison to the current downgradient conditions.

Table 11: Summary of Evaluation for SSIs over Background for Appendix I Metals (Detection Monitoring)

	Appendix I Metals				
	Copper	Nickel	Silver	Vanadium	Zinc
Unit	ug/L	ug/L	ug/L	ug/L	ug/L
BTV (UPL)	*2.50*	*2.50*	*2.50*	5.50	10.0
Pre-Ash Range	2.50 - 16.4	2.50 - 18.2	2.50 - 2.50	2.50 - 9.90	5.00 - 106
Well	*First Detection Monitoring Round Results*				
MW-1	*2.50*	*2.50*	*2.50*	*2.50*	**14.7**
MW-2	**17.2**	9.70	*2.50*	**7.60**	**31.1**
MW-3	**36.0**	**86.0**	*2.50*	**13.9**	**42.7**
MW-4	*2.50*	*2.50*	*2.50*	*2.50*	**29.4**
MW-5	*2.50*	*2.50*	*2.50*	*2.50*	*5.00*
MW-6	*2.50*	*2.50*	*2.50*	*2.50*	**17.7**
MW-7R	*2.50*	*2.50*	*2.50*	*2.50*	**10.7**
MW-8	*2.50*	*2.50*	*2.50*	*2.50*	**13.6**
Well	*Second Detection Monitoring Round Results*				
MW-1	*2.10*	*0.900*	*2.50*	*1.30*	3.90
MW-2	--	--	--	--	--
MW-3	--	--	--	--	--
MW-4	*2.10*	5.10	*2.50*	*1.30*	3.90
MW-5	5.60	*0.900*	*2.50*	*1.30*	**11.4**
MW-6	5.50	*0.900*	*2.50*	*1.30*	3.90
MW-7R	79.3	880	*2.50*	**18.8**	**53.4**
MW-8	*2.10*	*0.900*	*2.50*	*1.30*	3.90

Notes:
Wells MW-2 and MW-3 were dry in the second detection monitoring round.
Italic concentration indicates a non-detect value.
Underlined concentration indicates a detect value in the first consecutive evaluation for constituents with 100% background non-detects.
Bold and underlined concentration indicates an SSI over background.

Table 12: Summary of Evaluation for SSIs over Background for Appendix I VOCs (Detection Monitoring)

	Appendix I VOCs							
	1,4-Dichloro-benzene	Acetone	Bromo-dichloro-methane	Bromo-form	Carbon disulfide	Chloroform	Dibro-mochloro-methane	Dibromo-methane
Unit	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
BTV (UPL)	*0.330*	*10.0*	*0.260*	*0.620*	*1.20*	*2.30*	*0.410*	*0.460*
Pre-Ash Range	0.330 - 0.330	10.0 - 10.0	0.180 - 0.180	0.260 - 0.260	1.20 - 1.20	0.140 - 1.80	0.210 - 0.210	0.210 - 0.210
Well	*First Detection Monitoring Round Results*							
MW-1	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*
MW-2	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*
MW-3	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*
MW-4	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*
MW-5	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*
MW-6	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*
MW-7R	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*
MW-8	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*
Well	*Second Detection Monitoring Round Results*							
MW-1	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*
MW-2	--	--	--	--	--	--	--	--
MW-3	--	--	--	--	--	--	--	--
MW-4	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*
MW-5	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*
MW-6	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*
MW-7R	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*
MW-8	*0.260*	*6.20*	*0.260*	*0.620*	*0.400*	*2.30*	*0.410*	*0.460*

Notes:
Wells MW-2 and MW-3 were dry in the second detection monitoring round.
Italic concentration indicates a non-detect value.
Underlined concentration indicates a detect value in the first consecutive evaluation for constituents with 100% background non-detects.
Bold and underlined concentration indicates an SSI over background.

Table 13: Summary of Evaluation for SSIs over Background for Appendix III Constituents (Detection Monitoring)

	Appendix III Constituents						
	Boron	Calcium	Chloride	Fluoride	pH (Field)	Sulfate	TDS
Unit	ug/L	ug/L	mg/L	mg/L	S.U.	mg/L	mg/L
BTV (UPL)	9.3	89,600	355	0.189	6.05 - 7.07*	65	2,630
Pre-Ash Range	6.20 - 53.1	16,900 - 185,000	22.2 - 1,160	0.0200 - 0.590	6.17 - 7.70	3.70 - 199	296 - 2,770
Well	*First Detection Monitoring Round Results*						

Appendix III Constituents							
	Boron	Calcium	Chloride	Fluoride	pH (Field)	Sulfate	TDS
Unit	ug/L	ug/L	mg/L	mg/L	S.U.	mg/L	mg/L
BTV (UPL)	9.3	89,600	355	0.189	6.05 - 7.07*	65	2,630
Pre-Ash Range	6.20 - 53.1	16,900 - 185,000	22.2 - 1,160	0.0200 - 0.590	6.17 - 7.70	3.70 - 199	296 - 2,770
MW-1	*2.60*	**205,000**	**756**	0.160	6.41	8.00	1,510
MW-2	**39.1**	**207,000**	**1,200**	**0.260**	**7.53**	**130**	2,590
MW-3	*2.60*	**194,000**	**1,120**	**0.420**	**7.13**	**80.2**	2,360
MW-4	*2.60*	64,300	**485**	**0.290**	6.10	12.2	1,170
MW-5	*2.60*	13,700	22.2	**0.570**	**7.26**	2.90	261
MW-6	*2.60*	34,400	229	**0.400**	6.23	48.7	649
MW-7R	*2.60*	89,100	289	0.110	**7.27**	18.3	820
MW-8	*2.60*	**110,000**	**377**	*0.0500*	6.94	7.90	814
Well	*Second Detection Monitoring Round Results*						
MW-1	*2.60*	**216,000**	**855**	0.170	6.50	7.20	1,800
MW-2	--	--	--	--	--	--	--
MW-3	--	--	--	--	--	--	--
MW-4	*2.60*	69,400	**467**	**0.340**	6.23	11.2	1,170
MW-5	*12.8*	14,300	22.3	**0.600**	6.25	3.50	254
MW-6	*2.60*	37,800	208	**0.380**	6.15	25.8	574
MW-7R	*12.8*	**102,000**	275	0.120	**7.29**	16.8	790
MW-8	*12.8*	**94,600**	309	*0.0500*	7.01	7.50	768

Notes:
Wells MW-2 and MW-3 were dry in the second detection monitoring round.
Italic concentration indicates a non-detect value.
Underlined concentration indicates a detect value in the first consecutive evaluation for constituents with 100% background non-detects.
Bold and underlined concentration indicates an SSI over background.
* indicates the lower bound of the pH range is the LPL. The upper bound is the UPL.

Table 14: Summary of Evaluation for SSIs over Background for Appendix IV Constituents (Detection Monitoring)

	Appendix IV Constituents																
	Anti-mony	Arsenic	Barium	Bery-llium	Cadmium	Chromium	Cobalt	Fluoride	Lead	Lithium	Mercury	Moly-bdenum	Radium-226	Radium-228	Selen-ium	Thall-ium	Total Radium
Unit	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	pCi/L	pCi/L	ug/L	ug/L	pCi/L
BTV (UPL)	*3.90*	*5.00*	443	*0.500*	*0.500*	*2.50*	*2.50*	0.189	*2.50*	42.7	*0.100*	6.80	0.800	1.29	*5.00*	13.7	2.09
Pre-Ash Range	3.80 - 12.0	2.50 - 2.50	117 - 1,240	0.500 - 0.500	0.500 - 0.500	2.50 - 33.9	2.50 - 7.00	0.0200 - 0.590	2.50 - 6.30	7.50 - 70.4	0.100 - 0.100	2.50 - 20.6	0.0774 - 0.820	0.0230 - 1.56	5.00 - 5.00	5.00 - 5.00	0.304 - 2.93
Well	*First Detection Monitoring Round Results*																
MW-1	*3.90*	*5.00*	242	*0.500*	*0.500*	*2.50*	*2.50*	0.160	*2.50*	30.9	*0.100*	*2.50*	0.607	0.737	*5.00*	*0.0600*	1.34
MW-2	*3.90*	*5.00*	360	*0.500*	*0.500*	**14.0**	*2.50*	**0.260**	*2.50*	**94.1**	*0.100*	**7.90**	**1.21**	**1.49**	*5.00*	*0.0600*	**2.70**
MW-3	*3.90*	*5.00*	**715**	*0.500*	*0.500*	**179**	6.20	**0.420**	7.30	**72.6**	*0.100*	**12.0**	**1.92**	**2.00**	*5.00*	*0.0600*	**3.92**
MW-4	*3.90*	*5.00*	268	*0.500*	*0.500*	*2.50*	*2.50*	**0.290**	*2.50*	25.4	*0.100*	*2.50*	**0.913**	**1.35**	*5.00*	*0.0600*	**2.26**
MW-5	*3.90*	*5.00*	123	*0.500*	*0.500*	*2.50*	*2.50*	**0.570**	*2.50*	8.00	*0.100*	*2.50*	0.108	0.695	*5.00*	*0.0600*	0.803
MW-6	*3.90*	*5.00*	89.7	*0.500*	*0.500*	5.30	*2.50*	**0.400**	*2.50*	27.9	*0.100*	*2.50*	0.00	0.628	*5.00*	*0.0600*	0.628
MW-7R	*3.90*	*5.00*	255	*0.500*	*0.500*	6.50	*2.50*	0.110	*2.50*	25.4	*0.100*	*2.50*	**0.987**	1.01	*5.00*	0.120	2.00
MW-8	*3.90*	*5.00*	**1,170**	*0.500*	*0.500*	*2.50*	*2.50*	*0.0500*	*2.50*	21.7	*0.100*	*2.50*	0.743	1.20	*5.00*	*0.0600*	1.94
Well	*Second Detection Monitoring Round Results*																
MW-1	*3.00*	*4.70*	261	*0.200*	*0.400*	*1.00*	*1.10*	0.170	*1.60*	35.6	*0.100*	14.5	1.03	1.45	*4.70*	*0.0600*	2.48
MW-2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-4	*3.00*	*4.70*	319	*0.200*	*0.400*	*1.00*	*1.10*	**0.340**	*1.60*	26.8	*0.100*	18.7	0.760	0.556	*4.70*	*0.0600*	1.32
MW-5	*3.00*	*4.70*	153	*0.200*	*0.400*	*1.00*	*1.10*	**0.600**	*1.60*	11.6	*0.100*	*0.900*	-0.0968	0.987	*4.70*	*0.0600*	0.987
MW-6	*3.00*	*4.70*	47.8	*0.200*	*0.400*	*1.00*	*1.10*	**0.380**	*1.60*	22.7	*0.100*	8.30	0.681	0.685	*4.70*	*0.0600*	1.37
MW-7R	13.6	*4.70*	395	*0.200*	*0.400*	1,940	20.4	0.120	6.80	31.7	*0.100*	**49.5**	0.316	0.686	*4.70*	0.0600	1.00
MW-8	*3.00*	*4.70*	**976**	*0.200*	*0.400*	*1.00*	*1.10*	*0.0500*	*1.60*	21.1	*0.100*	5.20	0.105	0.535	*4.70*	*0.0600*	0.640

Notes:
Wells MW-2 and MW-3 were dry in the second detection monitoring round.
Italic concentration indicates a non-detect value.
Underlined concentration indicates a detect value in the first consecutive evaluation for constituents with 100% background non-detects.
Bold and underlined concentration indicates an SSI over background.

In the first detection monitoring round, SSIs were found for six Appendix III constituents (boron, calcium, chloride, fluoride, pH (field), and sulfate), eight Appendix IV constituents (barium, chromium, fluoride, lithium, molybdenum, radium-226, radium-228, and total radium), and four Appendix I metals (copper, nickel, vanadium and zinc). No SSI was registered for the two Appendix IV constituents (cobalt and lead) because, although the non-detected constituents had detect values in the January 2019 detection monitoring round, the consecutive sampling event in April 2019 did not exhibit detects for these constituents at the specified downgradient wells. - When results of the January 2019 sampling event are compared to the pre-ash sampling results from those eight wells, current downgradient groundwater constituent concentrations are generally similar to concentrations reported prior to ash placement. Of the seventeen constituents with observed SSIs, eight of them are within the range of pre-ash conditions.

In the second detection monitoring round, wells MW-2 and MW-3 were dry and have no samples. SSIs were found for four Appendix III constituents (calcium, chloride, fluoride, and pH (field)), three Appendix IV constituents (barium, fluoride, and molybdenum), and two Appendix I metals (vanadium and zinc). Four Appendix IV constituents (antimony, chromium, cobalt, and lead) and two Appendix I metals (copper and nickel) were flagged as potential SSIs as they are non-detected constituents that had detected values. If the downgradient concentrations for these constituents exhibit detects in the consecutive sampling event, then an SSI would be registered. When results of the July 2019 sampling event are compared to the pre-ash sampling results from those six wells, current downgradient groundwater constituent concentrations are generally similar to concentrations reported prior to ash placement. Of the eight constituents with observed SSIs, four of them are within the range of pre-ash conditions.

Depending on the data distribution of the constituent, the BTVs have been computed to allow for one to three verification samples. With verification sampling, the validity of the SSIs can be confirmed.

5 Appendix E.A: Downgradient Well Descriptive Statistics

Table 15: Summary of Well MW-1 Data Set Descriptive Statistics

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Appendix I VOCs											
1,4-Dichlorobenzene	ug/L	17	17	0.260	0.330	0.318	0.330	--	--	--	--
Acetone	ug/L	17	17	6.20	10.0	9.33	10.0	--	--	--	--
Bromodichloromethane	ug/L	17	17	0.180	0.260	0.194	0.180	--	--	--	--
Bromoform	ug/L	17	17	0.260	0.620	0.324	0.260	--	--	--	--
Carbon disulfide	ug/L	17	17	0.400	1.20	1.06	1.20	--	--	--	--
Chloroform	ug/L	17	17	0.140	2.30	0.521	0.140	--	--	--	--
Dibromochloromethane	ug/L	17	17	0.210	0.410	0.245	0.210	--	--	--	--
Dibromomethane	ug/L	17	17	0.210	0.460	0.254	0.210	--	--	--	--
Appendix I Metals											
Copper	ug/L	17	16	2.10	7.20	2.75	2.50	7.20	7.20	7.20	7.20
Nickel	ug/L	17	14	0.900	13.3	3.54	2.50	5.60	13.3	8.93	7.90
Silver	ug/L	17	17	2.50	2.50	2.50	2.50	--	--	--	--
Vanadium	ug/L	17	13	1.30	7.80	3.29	2.50	5.00	7.80	6.15	5.90
Zinc	ug/L	17	10	3.90	28.0	9.79	5.00	10.2	28.0	16.8	14.7
Appendix III Constituents											
Boron	ug/L	17	9	0.570	14.5	5.33	2.90	6.20	14.5	9.63	9.65
Calcium	ug/L	17	0	43,100	216,000	120,600	124,000	43,100	216,000	120,600	124,000
Chloride	mg/L	17	0	167	855	478	455	167	855	478	455
Fluoride	mg/L	17	1	0.0200	0.170	0.133	0.130	0.110	0.170	0.140	0.135
pH (Field)	S.U.	15	0	6.41	7.30	6.71	6.70	6.41	7.30	6.71	6.70
Sulfate	mg/L	17	0	6.20	11.2	8.22	7.50	6.20	11.2	8.22	7.50
Total Dissolved Solids	mg/L	17	0	569	1,800	1,036	1,020	569	1,800	1,036	1,020
Appendix IV Constituents											
Antimony	ug/L	17	16	3.00	6.10	3.95	3.90	6.10	6.10	6.10	6.10
Arsenic	ug/L	17	17	2.50	5.00	4.10	5.00	--	--	--	--

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Barium	ug/L	17	0	61.9	261	162	155	61.9	261	162	155
Beryllium	ug/L	17	17	0.200	0.500	0.482	0.500	--	--	--	--
Cadmium	ug/L	17	17	0.400	0.500	0.494	0.500	--	--	--	--
Chromium	ug/L	17	12	1.00	18.4	4.62	2.50	6.60	18.4	10.0	7.40
Cobalt	ug/L	17	17	1.10	2.50	2.42	2.50	--	--	--	--
Fluoride	mg/L	17	1	0.0200	0.170	0.133	0.130	0.110	0.170	0.140	0.135
Lead	ug/L	17	17	1.60	2.50	2.45	2.50	--	--	--	--
Lithium	ug/L	17	0	19.2	36.1	30.2	31.2	19.2	36.1	30.2	31.2
Mercury	ug/L	17	17	0.100	0.100	0.100	0.100	--	--	--	--
Molybdenum	ug/L	17	16	2.50	14.5	3.21	2.50	14.5	14.5	14.5	14.5
Radium-226	pCi/L	16	0	-0.188	1.03	0.386	0.345	--	--	--	--
Radium-228	pCi/L	16	0	-0.0467	1.45	0.558	0.502	--	--	--	--
Selenium	ug/L	17	17	4.70	5.00	4.98	5.00	--	--	--	--
Thallium	ug/L	17	17	0.0200	5.00	1.79	0.0600	--	--	--	--
Total Radium	pCi/L	16	0	0.237	2.48	0.970	0.844	--	--	--	--

Notes:

1. ND = not detected above the method detection limit.
2. MDL = method detection limit.
3. "--" indicates all results for the respective constituent were NDs, or with the case of total radium, NDs were flagged but the laboratory did not provide a value for the MDL.
4. Numbers are displayed using the same number of significant figures as reported by the laboratory.
5. If a constituent had 100% detections the descriptive statistics provided above are identical for the data including NDs and excluding NDs.

Table 16: Summary of Well MW-2 Data Set Descriptive Statistics

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Appendix I VOCs											
1,4-Dichlorobenzene	ug/L	15	15	0.260	0.330	0.321	0.330	--	--	--	--
Acetone	ug/L	15	15	6.20	10.0	9.49	10.0	--	--	--	--
Bromodichloromethane	ug/L	15	15	0.180	0.260	0.191	0.180	--	--	--	--
Bromoform	ug/L	15	15	0.260	0.620	0.308	0.260	--	--	--	--
Carbon disulfide	ug/L	15	15	0.400	1.20	1.09	1.20	--	--	--	--
Chloroform	ug/L	15	15	0.140	2.30	0.428	0.140	--	--	--	--
Dibromochloromethane	ug/L	15	15	0.210	0.410	0.237	0.210	--	--	--	--
Dibromomethane	ug/L	15	15	0.210	0.460	0.243	0.210	--	--	--	--
Appendix I Metals											
Copper	ug/L	15	10	2.50	17.2	4.53	2.50	5.00	17.2	8.58	6.60
Nickel	ug/L	15	8	2.50	54.4	11.9	2.50	8.70	54.4	22.6	15.2
Silver	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Vanadium	ug/L	15	14	2.50	7.60	2.84	2.50	7.60	7.60	7.60	7.60
Zinc	ug/L	15	8	5.00	113	21.8	5.00	10.7	113	40.9	31.1
Appendix III Constituents											
Boron	ug/L	15	0	37.4	63.9	45.4	44.9	37.4	63.9	45.4	44.9
Calcium	ug/L	15	0	130,000	217,000	193,400	195,000	130,000	217,000	193,400	195,000
Chloride	mg/L	15	0	910	1,360	1,168	1,190	910	1,360	1,168	1,190
Fluoride	mg/L	15	1	0.0200	0.400	0.217	0.220	0.130	0.400	0.231	0.220
pH (Field)	S.U.	12	0	7.50	8.50	7.76	7.62	7.50	8.50	7.76	7.62
Sulfate	mg/L	15	0	73.3	338	191	205	73.3	338	191	205
Total Dissolved Solids	mg/L	15	0	257	3,290	2,364	2,470	257	3,290	2,364	2,470
Appendix IV Constituents											
Antimony	ug/L	15	7	3.90	12.3	6.69	5.60	5.60	12.3	9.13	9.10
Arsenic	ug/L	15	15	2.50	5.00	4.00	5.00	--	--	--	--
Barium	ug/L	15	0	177	360	257	262	177	360	257	262
Beryllium	ug/L	15	15	0.500	0.500	0.500	0.500	--	--	--	--
Cadmium	ug/L	15	15	0.500	0.500	0.500	0.500	--	--	--	--

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Chromium	ug/L	15	3	2.50	84.0	20.7	7.70	5.10	84.0	25.3	14.9
Cobalt	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Fluoride	mg/L	15	1	0.0200	0.400	0.217	0.220	0.130	0.400	0.231	0.220
Lead	ug/L	15	15	2.50	2.50	2.50	2.50	--	--	--	--
Lithium	ug/L	15	0	53.1	356	152	119	53.1	356	152	119
Mercury	ug/L	15	15	0.100	0.100	0.100	0.100	--	--	--	--
Molybdenum	ug/L	15	0	6.70	21.1	11.4	9.50	6.70	21.1	11.4	9.50
Radium-226	pCi/L	14	0	0.580	1.94	0.975	0.965	--	--	--	--
Radium-228	pCi/L	14	0	0.433	1.75	1.23	1.27	--	--	--	--
Selenium	ug/L	15	15	5.00	5.00	5.00	5.00	--	--	--	--
Thallium	ug/L	15	14	0.0200	10.3	2.37	0.0600	10.3	10.3	10.3	10.3
Total Radium	pCi/L	14	0	1.12	3.02	2.21	2.36	--	--	--	--

Notes:

1. ND = not detected above the method detection limit.
2. MDL = method detection limit.
3. "--" indicates all results for the respective constituent were NDs, or with the case of total radium, NDs were flagged but the laboratory did not provide a value for the MDL.
4. Numbers are displayed using the same number of significant figures as reported by the laboratory.
5. If a constituent had 100% detections the descriptive statistics provided above are identical for the data including NDs and excluding NDs.

Table 17: Summary of Well MW-3 Data Set Descriptive Statistics

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Appendix I VOCs											
1,4-Dichlorobenzene	ug/L	16	16	0.260	0.330	0.321	0.330	--	--	--	--
Acetone	ug/L	16	16	6.20	10.0	9.53	10.0	--	--	--	--
Bromodichloromethane	ug/L	16	16	0.180	0.260	0.190	0.180	--	--	--	--
Bromoform	ug/L	16	16	0.260	0.620	0.305	0.260	--	--	--	--
Carbon disulfide	ug/L	16	16	0.400	1.20	1.10	1.20	--	--	--	--
Chloroform	ug/L	16	16	0.140	2.30	0.410	0.140	--	--	--	--
Dibromochloromethane	ug/L	16	16	0.210	0.410	0.235	0.210	--	--	--	--
Dibromomethane	ug/L	16	16	0.210	0.460	0.241	0.210	--	--	--	--
Appendix I Metals											
Copper	ug/L	16	12	2.50	36.0	5.92	2.50	5.30	36.0	16.2	11.7
Nickel	ug/L	16	12	2.50	86.0	11.2	2.50	5.50	86.0	37.2	28.7
Silver	ug/L	16	16	2.50	2.50	2.50	2.50	--	--	--	--
Vanadium	ug/L	16	14	2.50	13.9	3.58	2.50	8.40	13.9	11.2	11.2
Zinc	ug/L	16	13	5.00	42.7	9.09	5.00	12.5	42.7	26.8	25.2
Appendix III Constituents											
Boron	ug/L	16	7	0.570	49.4	21.0	13.2	9.70	49.4	36.3	41.9
Calcium	ug/L	16	0	117,000	201,000	163,563	161,500	117,000	201,000	163,563	161,500
Chloride	mg/L	16	0	893	1,280	1,094	1,085	893	1,280	1,094	1,085
Fluoride	mg/L	16	1	0.0200	0.610	0.373	0.425	0.210	0.610	0.396	0.430
pH (Field)	S.U.	13	0	7.10	7.50	7.27	7.30	7.10	7.50	7.27	7.30
Sulfate	mg/L	16	0	9.10	174	79.1	84.5	9.10	174	79.1	84.5
Total Dissolved Solids	mg/L	16	0	256	3,180	1,938	2,155	256	3,180	1,938	2,155
Appendix IV Constituents											
Antimony	ug/L	16	9	3.90	11.4	6.36	3.90	5.80	11.4	9.53	10.1
Arsenic	ug/L	16	16	2.50	5.00	4.06	5.00	--	--	--	--
Barium	ug/L	16	0	353	855	611	574	353	855	611	574
Beryllium	ug/L	16	16	0.500	0.500	0.500	0.500	--	--	--	--
Cadmium	ug/L	16	16	0.500	0.500	0.500	0.500	--	--	--	--

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Chromium	ug/L	16	8	2.50	179	20.8	3.90	5.30	179	39.0	9.85
Cobalt	ug/L	16	15	2.50	6.20	2.73	2.50	6.20	6.20	6.20	6.20
Fluoride	mg/L	16	1	0.0200	0.610	0.373	0.425	0.210	0.610	0.396	0.430
Lead	ug/L	16	15	2.50	7.30	2.80	2.50	7.30	7.30	7.30	7.30
Lithium	ug/L	16	0	36.7	236	105	89.0	36.7	236	105	89.0
Mercury	ug/L	16	16	0.100	0.100	0.100	0.100	--	--	--	--
Molybdenum	ug/L	16	0	5.10	13.8	8.76	7.95	5.10	13.8	8.76	7.95
Radium-226	pCi/L	15	0	0.213	1.92	0.925	1.09	--	--	--	--
Radium-228	pCi/L	15	0	0.387	2.27	1.46	1.70	--	--	--	--
Selenium	ug/L	16	16	5.00	5.00	5.00	5.00	--	--	--	--
Thallium	ug/L	16	16	0.0200	5.00	1.89	0.0450	--	--	--	--
Total Radium	pCi/L	15	0	0.857	3.92	2.39	2.30	--	--	--	--

Notes:

1. ND = not detected above the method detection limit.
2. MDL = method detection limit.
3. "--" indicates all results for the respective constituent were NDs, or with the case of total radium, NDs were flagged but the laboratory did not provide a value for the MDL.
4. Numbers are displayed using the same number of significant figures as reported by the laboratory.
5. If a constituent had 100% detections the descriptive statistics provided above are identical for the data including NDs and excluding NDs.

Table 18: Summary of Well MW-4 Data Set Descriptive Statistics

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Appendix I VOCs											
1,4-Dichlorobenzene	ug/L	16	16	0.260	0.330	0.321	0.330	--	--	--	--
Acetone	ug/L	16	16	6.20	10.0	9.53	10.0	--	--	--	--
Bromodichloromethane	ug/L	16	16	0.180	0.260	0.190	0.180	--	--	--	--
Bromoform	ug/L	16	16	0.260	0.620	0.305	0.260	--	--	--	--
Carbon disulfide	ug/L	16	16	0.400	1.20	1.10	1.20	--	--	--	--
Chloroform	ug/L	16	16	0.140	2.30	0.410	0.140	--	--	--	--
Dibromochloromethane	ug/L	16	16	0.210	0.410	0.235	0.210	--	--	--	--
Dibromomethane	ug/L	16	16	0.210	0.460	0.241	0.210	--	--	--	--
Appendix I Metals											
Copper	ug/L	16	16	2.10	2.50	2.48	2.50	--	--	--	--
Nickel	ug/L	16	10	2.50	6.90	3.70	2.50	5.10	6.90	5.70	5.40
Silver	ug/L	16	16	2.50	2.50	2.50	2.50	--	--	--	--
Vanadium	ug/L	16	16	1.30	2.50	2.43	2.50	--	--	--	--
Zinc	ug/L	16	15	3.90	29.4	6.46	5.00	29.4	29.4	29.4	29.4
Appendix III Constituents											
Boron	ug/L	16	8	0.570	165	13.9	4.30	5.70	165	26.3	6.60
Calcium	ug/L	16	0	17,900	69,400	52,800	62,800	17,900	69,400	52,800	62,800
Chloride	mg/L	16	0	144	567	413	489	144	567	413	489
Fluoride	mg/L	16	0	0.210	0.420	0.323	0.315	0.210	0.420	0.323	0.315
pH (Field)	S.U.	14	0	6.10	6.50	6.32	6.32	6.10	6.50	6.32	6.32
Sulfate	mg/L	16	0	3.40	12.3	8.99	10.0	3.40	12.3	8.99	10.0
Total Dissolved Solids	mg/L	16	0	395	1,260	981	1,140	395	1,260	981	1,140
Appendix IV Constituents											
Antimony	ug/L	16	15	3.00	5.00	3.88	3.90	5.00	5.00	5.00	5.00
Arsenic	ug/L	16	16	2.50	5.00	4.04	5.00	--	--	--	--
Barium	ug/L	16	0	85.9	332	250	283	85.9	332	250	283
Beryllium	ug/L	16	16	0.200	0.500	0.481	0.500	--	--	--	--
Cadmium	ug/L	16	16	0.400	0.500	0.494	0.500	--	--	--	--

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Chromium	ug/L	16	15	1.00	5.70	2.61	2.50	5.70	5.70	5.70	5.70
Cobalt	ug/L	16	12	1.10	8.40	3.41	2.50	5.30	8.40	6.50	6.15
Fluoride	mg/L	16	0	0.210	0.420	0.323	0.315	0.210	0.420	0.323	0.315
Lead	ug/L	16	16	1.60	2.50	2.44	2.50	--	--	--	--
Lithium	ug/L	16	0	15.8	29.2	25.0	26.5	15.8	29.2	25.0	26.5
Mercury	ug/L	16	16	0.100	0.100	0.100	0.100	--	--	--	--
Molybdenum	ug/L	16	14	2.50	18.7	3.91	2.50	8.90	18.7	13.8	13.8
Radium-226	pCi/L	15	0	-0.120	0.913	0.417	0.424	--	--	--	--
Radium-228	pCi/L	15	0	0.0190	1.35	0.509	0.481	--	--	--	--
Selenium	ug/L	16	16	4.70	5.00	4.98	5.00	--	--	--	--
Thallium	ug/L	16	16	0.0200	5.00	1.89	0.0450	--	--	--	--
Total Radium	pCi/L	15	0	0.240	2.26	0.935	0.710	--	--	--	--

Notes:

1. ND = not detected above the method detection limit.
2. MDL = method detection limit.
3. "--" indicates all results for the respective constituent were NDs, or with the case of total radium, NDs were flagged but the laboratory did not provide a value for the MDL.
4. Numbers are displayed using the same number of significant figures as reported by the laboratory.
5. If a constituent had 100% detections the descriptive statistics provided above are identical for the data including NDs and excluding NDs.

Table 19: Summary of Well MW-5 Data Set Descriptive Statistics

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Appendix I VOCs											
1,4-Dichlorobenzene	ug/L	17	17	0.260	0.330	0.318	0.330	--	--	--	--
Acetone	ug/L	17	17	6.20	10.0	9.33	10.0	--	--	--	--
Bromodichloromethane	ug/L	17	17	0.180	0.260	0.194	0.180	--	--	--	--
Bromoform	ug/L	17	17	0.260	0.620	0.324	0.260	--	--	--	--
Carbon disulfide	ug/L	17	17	0.400	1.20	1.06	1.20	--	--	--	--
Chloroform	ug/L	17	17	0.140	2.30	0.521	0.140	--	--	--	--
Dibromochloromethane	ug/L	17	17	0.210	0.410	0.245	0.210	--	--	--	--
Dibromomethane	ug/L	17	17	0.210	0.460	0.254	0.210	--	--	--	--
Appendix I Metals											
Copper	ug/L	17	15	2.50	6.90	2.94	2.50	5.60	6.90	6.25	6.25
Nickel	ug/L	17	15	0.900	9.00	3.12	2.50	8.10	9.00	8.55	8.55
Silver	ug/L	17	17	2.50	2.50	2.50	2.50	--	--	--	--
Vanadium	ug/L	17	17	1.30	2.50	2.43	2.50	--	--	--	--
Zinc	ug/L	17	12	5.00	36.1	9.34	5.00	11.4	36.1	19.8	16.6
Appendix III Constituents											
Boron	ug/L	17	7	0.570	39.3	9.30	10.2	9.80	39.3	13.8	11.0
Calcium	ug/L	17	0	9,140	16,900	12,155	11,900	9,140	16,900	12,155	11,900
Chloride	mg/L	17	0	17.6	22.3	20.0	19.7	17.6	22.3	20.0	19.7
Fluoride	mg/L	17	0	0.410	0.680	0.527	0.520	0.410	0.680	0.527	0.520
pH (Field)	S.U.	15	0	6.25	7.30	6.99	7.00	6.25	7.30	6.99	7.00
Sulfate	mg/L	17	0	2.60	5.60	3.76	3.60	2.60	5.60	3.76	3.60
Total Dissolved Solids	mg/L	17	0	194	1,160	290	235	194	1,160	290	235
Appendix IV Constituents											
Antimony	ug/L	17	17	3.00	3.90	3.81	3.90	--	--	--	--
Arsenic	ug/L	17	17	2.50	5.00	4.10	5.00	--	--	--	--
Barium	ug/L	17	0	90.7	153	109	102	90.7	153	109	102
Beryllium	ug/L	17	17	0.200	0.500	0.482	0.500	--	--	--	--
Cadmium	ug/L	17	17	0.400	0.500	0.494	0.500	--	--	--	--

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Chromium	ug/L	17	13	1.00	16.8	4.32	2.50	5.10	16.8	10.6	10.3
Cobalt	ug/L	17	17	1.10	2.50	2.42	2.50	--	--	--	--
Fluoride	mg/L	17	0	0.410	0.680	0.527	0.520	0.410	0.680	0.527	0.520
Lead	ug/L	17	17	1.60	2.50	2.45	2.50	--	--	--	--
Lithium	ug/L	17	0	6.30	11.6	8.62	8.90	6.30	11.6	8.62	8.90
Mercury	ug/L	17	17	0.100	0.100	0.100	0.100	--	--	--	--
Molybdenum	ug/L	17	17	0.900	2.50	2.41	2.50	--	--	--	--
Radium-226	pCi/L	16	0	-0.142	0.778	0.127	0.0749	--	--	--	--
Radium-228	pCi/L	16	0	-0.0690	1.08	0.410	0.364	--	--	--	--
Selenium	ug/L	17	17	4.70	5.00	4.98	5.00	--	--	--	--
Thallium	ug/L	17	16	0.0200	14.8	2.36	0.0600	14.8	14.8	14.8	14.8
Total Radium	pCi/L	16	0	0.0766	1.15	0.571	0.529	--	--	--	--

Notes:

1. ND = not detected above the method detection limit.
2. MDL = method detection limit.
3. "--" indicates all results for the respective constituent were NDs, or with the case of total radium, NDs were flagged but the laboratory did not provide a value for the MDL.
4. Numbers are displayed using the same number of significant figures as reported by the laboratory.
5. If a constituent had 100% detections the descriptive statistics provided above are identical for the data including NDs and excluding NDs.

Table 20: Summary of Well MW-6 Data Set Descriptive Statistics

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Appendix I VOCs											
1,4-Dichlorobenzene	ug/L	17	17	0.260	0.330	0.318	0.330	--	--	--	--
Acetone	ug/L	17	17	6.20	10.0	9.33	10.0	--	--	--	--
Bromodichloromethane	ug/L	17	17	0.180	0.260	0.194	0.180	--	--	--	--
Bromoform	ug/L	17	17	0.260	0.620	0.324	0.260	--	--	--	--
Carbon disulfide	ug/L	17	17	0.400	1.20	1.06	1.20	--	--	--	--
Chloroform	ug/L	17	17	0.140	2.30	0.521	0.140	--	--	--	--
Dibromochloromethane	ug/L	17	17	0.210	0.410	0.245	0.210	--	--	--	--
Dibromomethane	ug/L	17	17	0.210	0.460	0.254	0.210	--	--	--	--
Appendix I Metals											
Copper	ug/L	17	16	2.50	5.50	2.68	2.50	5.50	5.50	5.50	5.50
Nickel	ug/L	17	17	0.900	2.50	2.41	2.50	--	--	--	--
Silver	ug/L	17	17	2.50	2.50	2.50	2.50	--	--	--	--
Vanadium	ug/L	17	17	1.30	2.50	2.43	2.50	--	--	--	--
Zinc	ug/L	17	13	3.90	17.7	6.90	5.00	11.3	17.7	13.4	12.2
Appendix III Constituents											
Boron	ug/L	17	9	0.570	10.8	4.60	2.90	6.10	10.8	8.07	8.15
Calcium	ug/L	17	0	31,300	40,200	35,006	34,500	31,300	40,200	35,006	34,500
Chloride	mg/L	17	0	15.3	279	230	240	15.3	279	230	240
Fluoride	mg/L	17	0	0.180	0.520	0.395	0.410	0.180	0.520	0.395	0.410
pH (Field)	S.U.	15	0	6.15	7.00	6.51	6.50	6.15	7.00	6.51	6.50
Sulfate	mg/L	17	0	25.8	214	99.9	87.7	25.8	214	99.9	87.7
Total Dissolved Solids	mg/L	17	0	371	946	681	689	371	946	681	689
Appendix IV Constituents											
Antimony	ug/L	17	17	3.00	3.90	3.81	3.90	--	--	--	--
Arsenic	ug/L	17	17	2.50	5.00	4.10	5.00	--	--	--	--
Barium	ug/L	17	0	47.8	142	106	104	47.8	142	106	104
Beryllium	ug/L	17	17	0.200	0.500	0.482	0.500	--	--	--	--
Cadmium	ug/L	17	17	0.400	0.500	0.494	0.500	--	--	--	--

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Chromium	ug/L	17	15	1.00	6.00	2.78	2.50	5.30	6.00	5.65	5.65
Cobalt	ug/L	17	17	1.10	2.50	2.42	2.50	--	--	--	--
Fluoride	mg/L	17	0	0.180	0.520	0.395	0.410	0.180	0.520	0.395	0.410
Lead	ug/L	17	17	1.60	2.50	2.45	2.50	--	--	--	--
Lithium	ug/L	17	0	22.7	60.5	41.9	41.2	22.7	60.5	41.9	41.2
Mercury	ug/L	17	16	0.100	0.320	0.113	0.100	0.320	0.320	0.320	0.320
Molybdenum	ug/L	17	15	2.50	8.30	3.01	2.50	5.40	8.30	6.85	6.85
Radium-226	pCi/L	16	0	-0.0750	0.910	0.278	0.263	--	--	--	--
Radium-228	pCi/L	16	0	0.148	1.07	0.641	0.654	--	--	--	--
Selenium	ug/L	17	17	4.70	5.00	4.98	5.00	--	--	--	--
Thallium	ug/L	17	16	0.0200	6.20	1.86	0.0600	6.20	6.20	6.20	6.20
Total Radium	pCi/L	16	0	0.148	1.47	0.929	0.913	--	--	--	--

Notes:

1. ND = not detected above the method detection limit.
2. MDL = method detection limit.
3. "--" indicates all results for the respective constituent were NDs, or with the case of total radium, NDs were flagged but the laboratory did not provide a value for the MDL.
4. Numbers are displayed using the same number of significant figures as reported by the laboratory.
5. If a constituent had 100% detections the descriptive statistics provided above are identical for the data including NDs and excluding NDs.

Table 21: Summary of Well MW-7R Data Set Descriptive Statistics

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Appendix I VOCs											
1,4-Dichlorobenzene	ug/L	7	7	0.260	0.330	0.300	0.330	--	--	--	--
Acetone	ug/L	7	7	6.20	10.0	8.37	10.0	--	--	--	--
Bromodichloromethane	ug/L	7	7	0.180	0.260	0.214	0.180	--	--	--	--
Bromoform	ug/L	7	7	0.260	0.620	0.414	0.260	--	--	--	--
Carbon disulfide	ug/L	7	7	0.400	1.20	0.857	1.20	--	--	--	--
Chloroform	ug/L	7	7	0.140	2.30	1.07	0.140	--	--	--	--
Dibromochloromethane	ug/L	7	7	0.210	0.410	0.296	0.210	--	--	--	--
Dibromomethane	ug/L	7	7	0.210	0.460	0.317	0.210	--	--	--	--
Appendix I Metals											
Copper	ug/L	7	5	2.50	79.3	14.1	2.50	7.10	79.3	43.2	43.2
Nickel	ug/L	7	4	2.50	880	132	2.50	17.4	880	305	18.0
Silver	ug/L	7	7	2.50	2.50	2.50	2.50	--	--	--	--
Vanadium	ug/L	7	5	2.50	18.8	6.99	2.50	17.6	18.8	18.2	18.2
Zinc	ug/L	7	5	5.00	53.4	12.7	5.00	10.7	53.4	32.0	32.0
Appendix III Constituents											
Boron	ug/L	7	3	2.60	25.3	12.9	13.8	13.8	25.3	18.1	16.6
Calcium	ug/L	7	0	74,000	102,000	87,914	89,100	74,000	102,000	87,914	89,100
Chloride	mg/L	7	0	275	312	288	285	275	312	288	285
Fluoride	mg/L	7	1	0.0500	0.320	0.137	0.120	0.110	0.320	0.152	0.120
pH (Field)	S.U.	7	0	7.22	9.60	7.75	7.60	7.22	9.60	7.75	7.60
Sulfate	mg/L	7	0	16.8	51.2	23.7	19.4	16.8	51.2	23.7	19.4
Total Dissolved Solids	mg/L	7	0	740	855	805	809	740	855	805	809
Appendix IV Constituents											
Antimony	ug/L	7	6	3.90	13.6	5.29	3.90	13.6	13.6	13.6	13.6
Arsenic	ug/L	7	7	4.70	5.00	4.96	5.00	--	--	--	--
Barium	ug/L	7	0	50.1	395	236	251	50.1	395	236	251
Beryllium	ug/L	7	7	0.200	0.500	0.457	0.500	--	--	--	--
Cadmium	ug/L	7	7	0.400	0.500	0.486	0.500	--	--	--	--

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Chromium	ug/L	7	1	2.50	1,940	290	9.60	6.50	1,940	338	21.3
Cobalt	ug/L	7	6	2.50	20.4	5.06	2.50	20.4	20.4	20.4	20.4
Fluoride	mg/L	7	1	0.0500	0.320	0.137	0.120	0.110	0.320	0.152	0.120
Lead	ug/L	7	6	2.50	6.80	3.11	2.50	6.80	6.80	6.80	6.80
Lithium	ug/L	7	0	5.60	31.7	22.5	24.7	5.60	31.7	22.5	24.7
Mercury	ug/L	7	7	0.100	0.100	0.100	0.100	--	--	--	--
Molybdenum	ug/L	7	5	2.50	49.5	11.6	2.50	19.5	49.5	34.5	34.5
Radium-226	pCi/L	6	0	-0.0590	0.987	0.304	0.195	--	--	--	--
Radium-228	pCi/L	6	0	-0.454	1.01	0.505	0.636	--	--	--	--
Selenium	ug/L	7	7	4.70	5.00	4.96	5.00	--	--	--	--
Thallium	ug/L	7	5	0.0280	0.480	0.115	0.0600	0.120	0.480	0.300	0.300
Total Radium	pCi/L	6	0	0.0741	2.00	0.895	0.793	--	--	--	--

Notes:

1. ND = not detected above the method detection limit.
2. MDL = method detection limit.
3. "--" indicates all results for the respective constituent were NDs, or with the case of total radium, NDs were flagged but the laboratory did not provide a value for the MDL.
4. Numbers are displayed using the same number of significant figures as reported by the laboratory.
5. If a constituent had 100% detections the descriptive statistics provided above are identical for the data including NDs and excluding NDs.

Table 22: Summary of Well MW-8 Data Set Descriptive Statistics

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Appendix I VOCs											
1,4-Dichlorobenzene	ug/L	17	17	0.260	0.330	0.318	0.330	--	--	--	--
Acetone	ug/L	17	17	6.20	10.0	9.33	10.0	--	--	--	--
Bromodichloromethane	ug/L	17	17	0.180	0.260	0.194	0.180	--	--	--	--
Bromoform	ug/L	17	17	0.260	0.620	0.324	0.260	--	--	--	--
Carbon disulfide	ug/L	17	17	0.400	1.20	1.06	1.20	--	--	--	--
Chloroform	ug/L	17	17	0.140	2.30	0.521	0.140	--	--	--	--
Dibromochloromethane	ug/L	17	17	0.210	0.410	0.245	0.210	--	--	--	--
Dibromomethane	ug/L	17	17	0.210	0.460	0.254	0.210	--	--	--	--
Appendix I Metals											
Copper	ug/L	17	16	2.10	10.2	2.93	2.50	10.2	10.2	10.2	10.2
Nickel	ug/L	17	13	0.900	42.1	6.46	2.50	10.8	42.1	19.8	13.1
Silver	ug/L	17	17	2.50	2.50	2.50	2.50	--	--	--	--
Vanadium	ug/L	17	17	1.30	2.50	2.43	2.50	--	--	--	--
Zinc	ug/L	17	9	3.90	50.7	15.2	5.00	13.6	50.7	26.8	20.4
Appendix III Constituents											
Boron	ug/L	17	8	0.570	12.8	6.39	8.90	8.70	12.3	9.74	9.30
Calcium	ug/L	17	0	94,600	194,000	125,665	115,000	94,600	194,000	125,665	115,000
Chloride	mg/L	17	0	309	939	496	396	309	939	496	396
Fluoride	mg/L	17	17	0.0200	0.0500	0.0359	0.0500	--	--	--	--
pH (Field)	S.U.	15	0	6.70	7.20	6.95	7.00	6.70	7.20	6.95	7.00
Sulfate	mg/L	17	0	4.40	8.00	6.56	6.50	4.40	8.00	6.56	6.50
Total Dissolved Solids	mg/L	17	0	224	1,530	981	934	224	1,530	981	934
Appendix IV Constituents											
Antimony	ug/L	17	11	3.00	10.1	5.24	3.90	6.50	10.1	7.83	7.55
Arsenic	ug/L	17	17	2.50	5.00	4.10	5.00	--	--	--	--
Barium	ug/L	17	0	976	1,550	1,202	1,190	976	1,550	1,202	1,190
Beryllium	ug/L	17	17	0.200	0.500	0.482	0.500	--	--	--	--
Cadmium	ug/L	17	17	0.400	0.500	0.494	0.500	--	--	--	--

Constituent	Unit	Sample Size	No. of NDs	With NDs=MDLs Included				With NDs Removed			
				Minimum	Maximum	Mean	Median	Minimum	Maximum	Mean	Median
Chromium	ug/L	17	13	1.00	82.0	10.8	2.50	16.6	82.0	38.1	26.9
Cobalt	ug/L	17	17	1.10	2.50	2.42	2.50	--	--	--	--
Fluoride	mg/L	17	17	0.0200	0.0500	0.0359	0.0500	--	--	--	--
Lead	ug/L	17	17	1.60	2.50	2.45	2.50	--	--	--	--
Lithium	ug/L	17	0	19.2	50.1	29.7	27.5	19.2	50.1	29.7	27.5
Mercury	ug/L	17	16	0.100	0.370	0.116	0.100	0.370	0.370	0.370	0.370
Molybdenum	ug/L	17	15	2.50	5.60	2.84	2.50	5.20	5.60	5.40	5.40
Radium-226	pCi/L	16	0	0.00	1.16	0.537	0.510	--	--	--	--
Radium-228	pCi/L	16	0	0.239	1.20	0.752	0.648	--	--	--	--
Selenium	ug/L	17	17	4.70	5.00	4.98	5.00	--	--	--	--
Thallium	ug/L	17	16	0.0200	8.80	2.01	0.0600	8.80	8.80	8.80	8.80
Total Radium	pCi/L	16	0	0.454	1.94	1.29	1.38	--	--	--	--

Notes:

1. ND = not detected above the method detection limit.
2. MDL = method detection limit.
3. "--" indicates all results for the respective constituent were NDs, or with the case of total radium, NDs were flagged but the laboratory did not provide a value for the MDL.
4. Numbers are displayed using the same number of significant figures as reported by the laboratory.
5. If a constituent had 100% detections the descriptive statistics provided above are identical for the data including NDs and excluding NDs.

6 Appendix E.B: Scatter Plots for Constituents with Downgradient Statistical Outliers

Figure 5: Total Dissolved Solids (mg/L) vs. Time (MW-2)

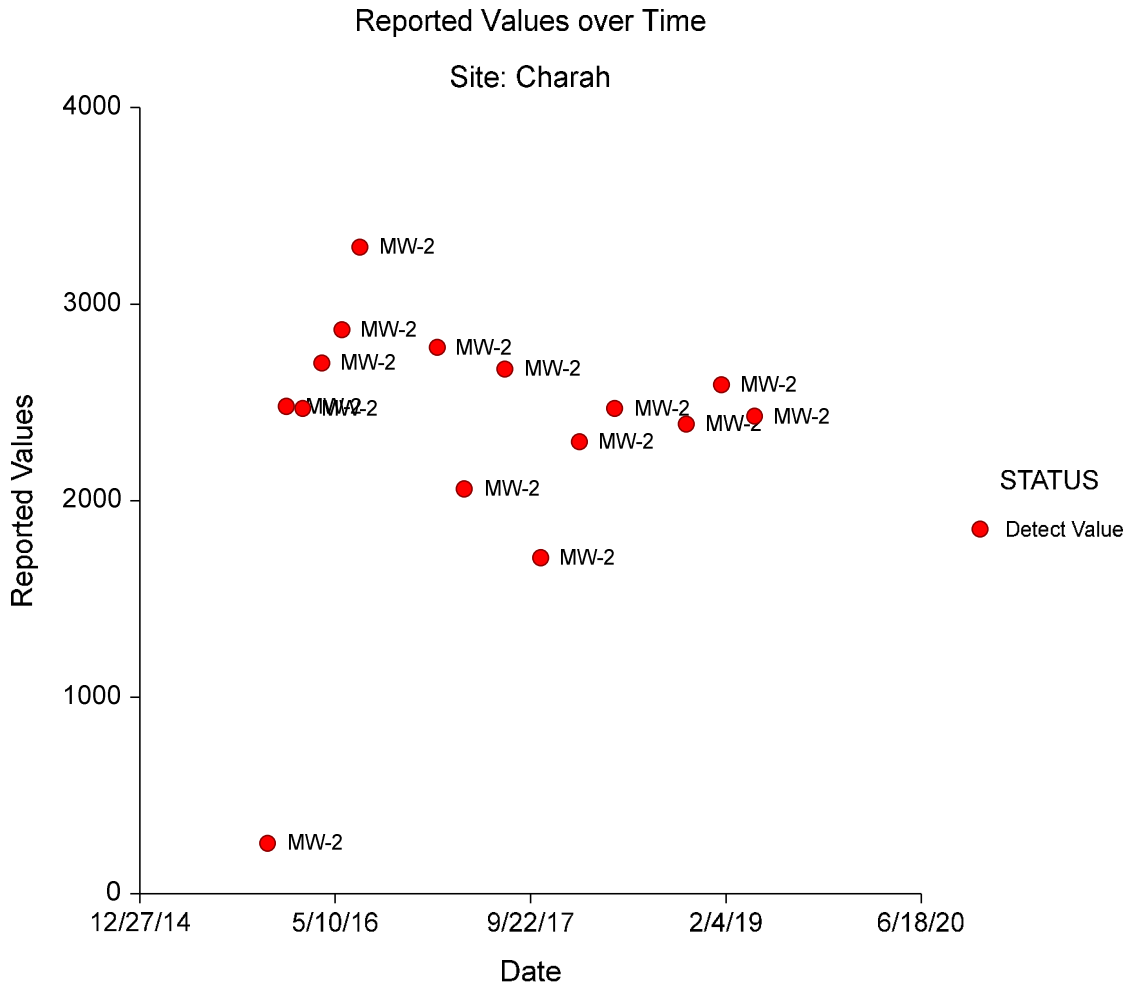


Figure 6: Calcium (ug/L) vs. Time (MW-2)

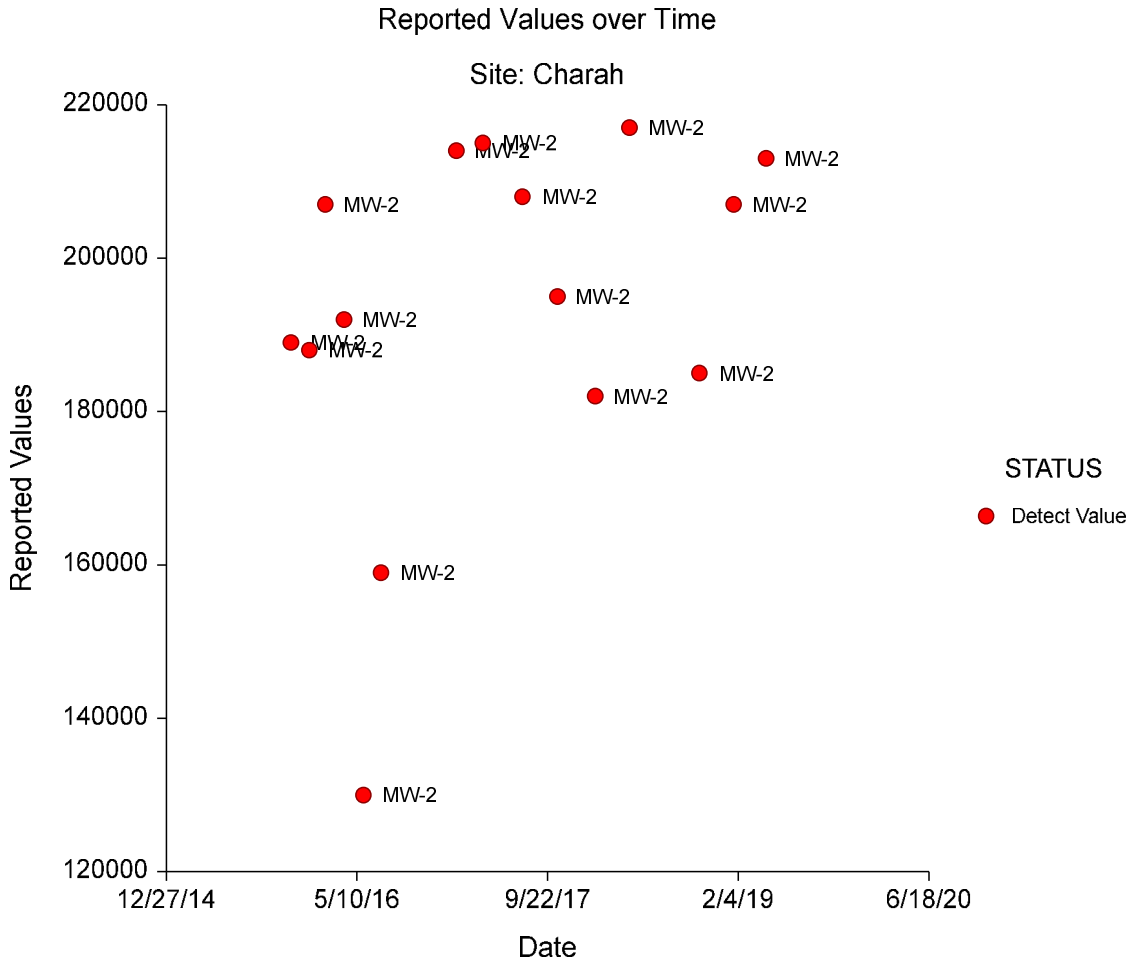


Figure 7: Lithium Concentrations (ug/L) vs. Time (MW-3)

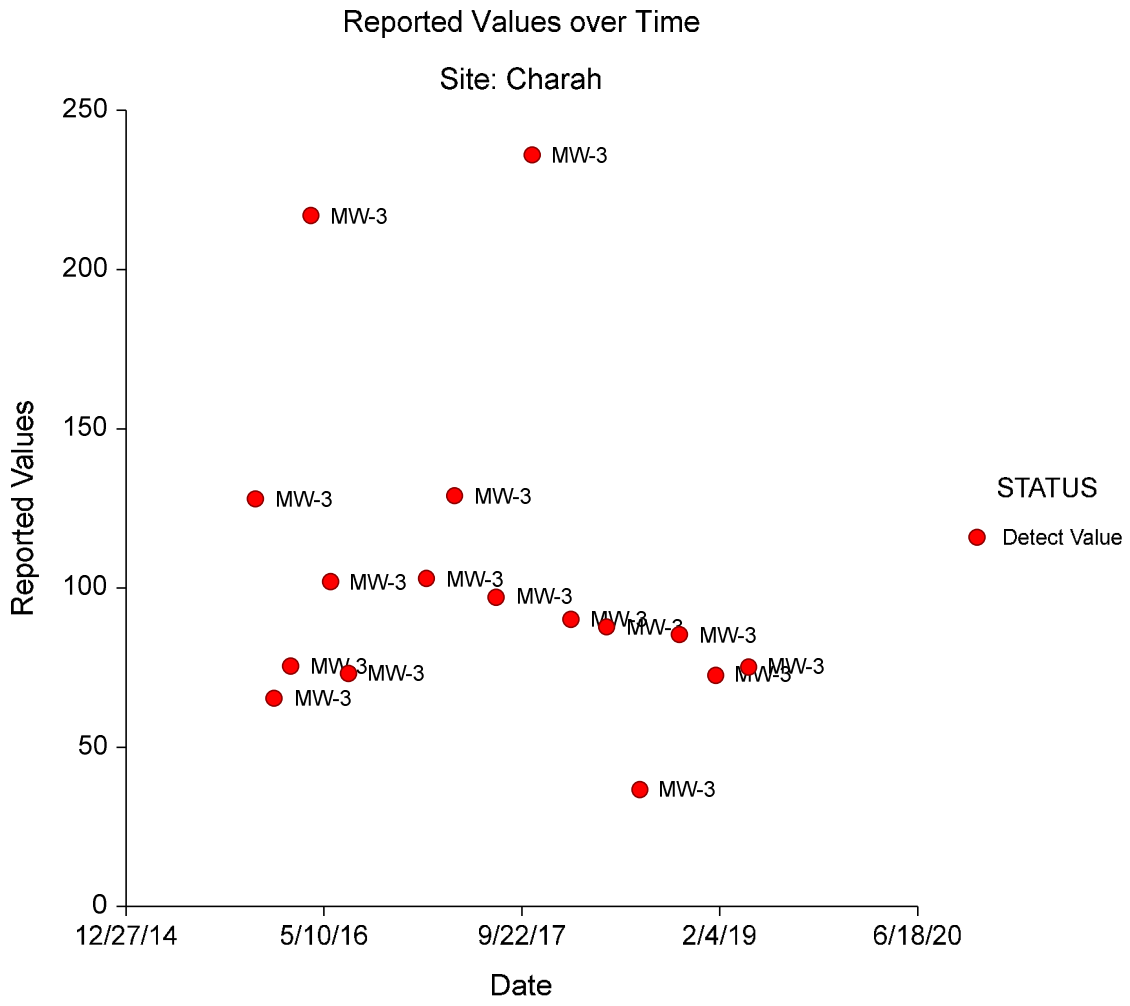


Figure 8: Boron Concentrations (ug/L) vs. Time (MW-4)

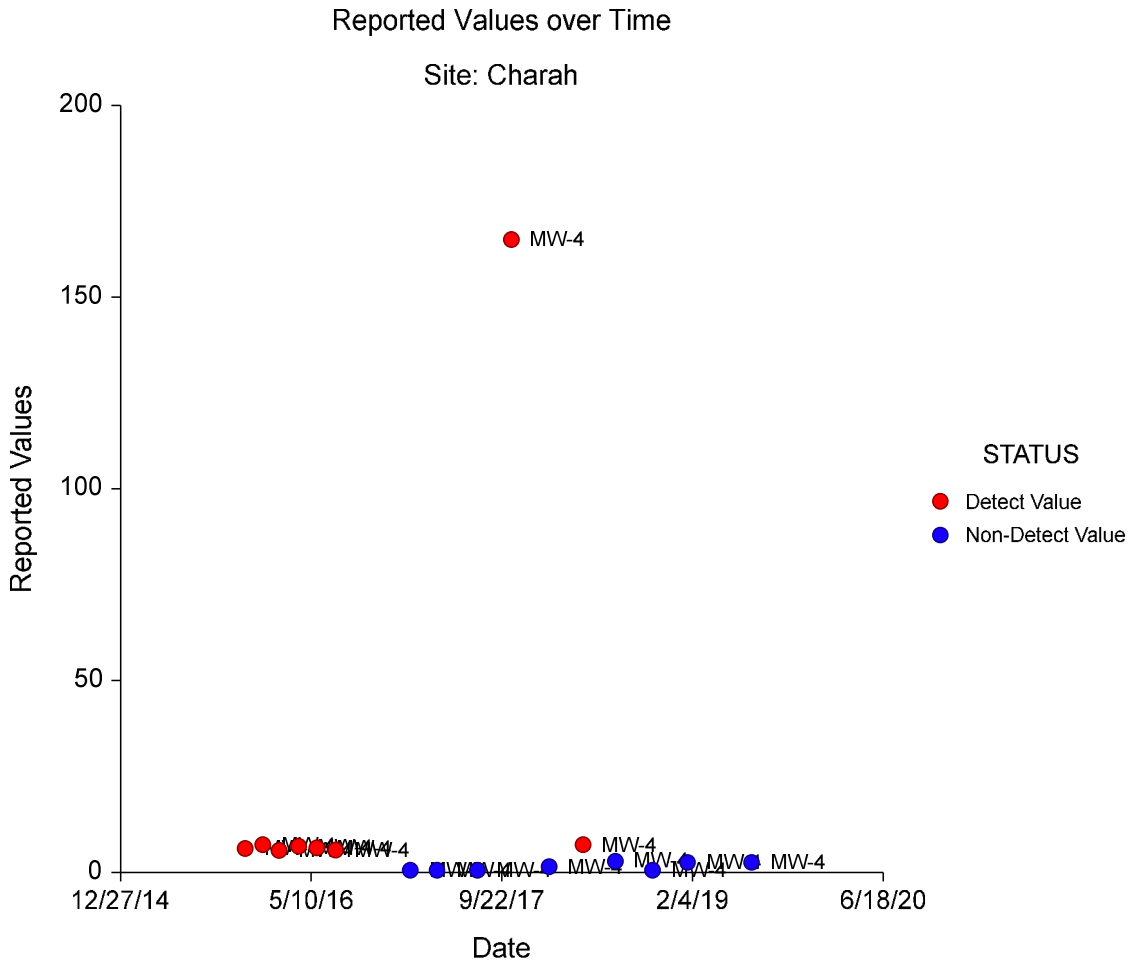


Figure 9: Boron Concentrations (ug/L) vs. Time (MW-5)

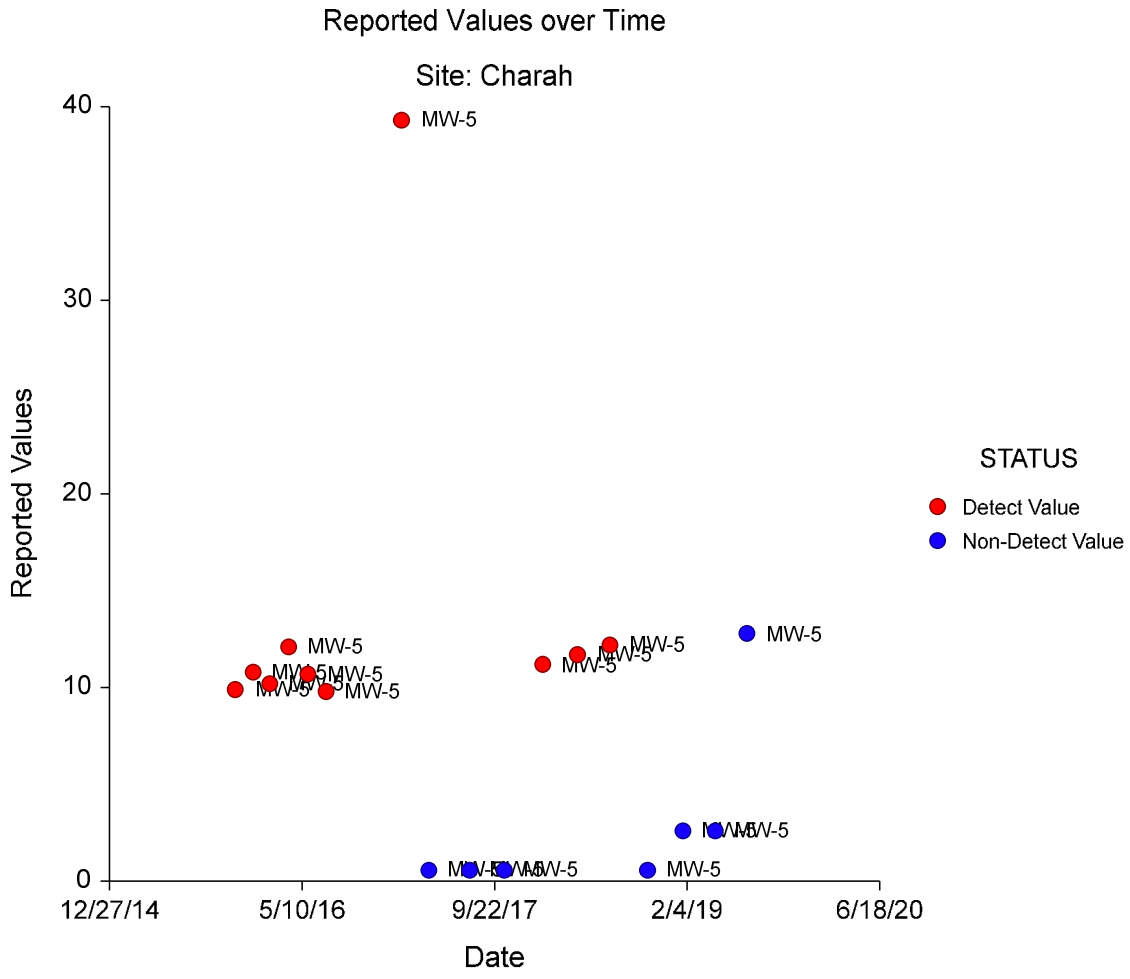


Figure 10: Total Dissolved Solids Concentrations (mg/L) vs. Time (MW-5)

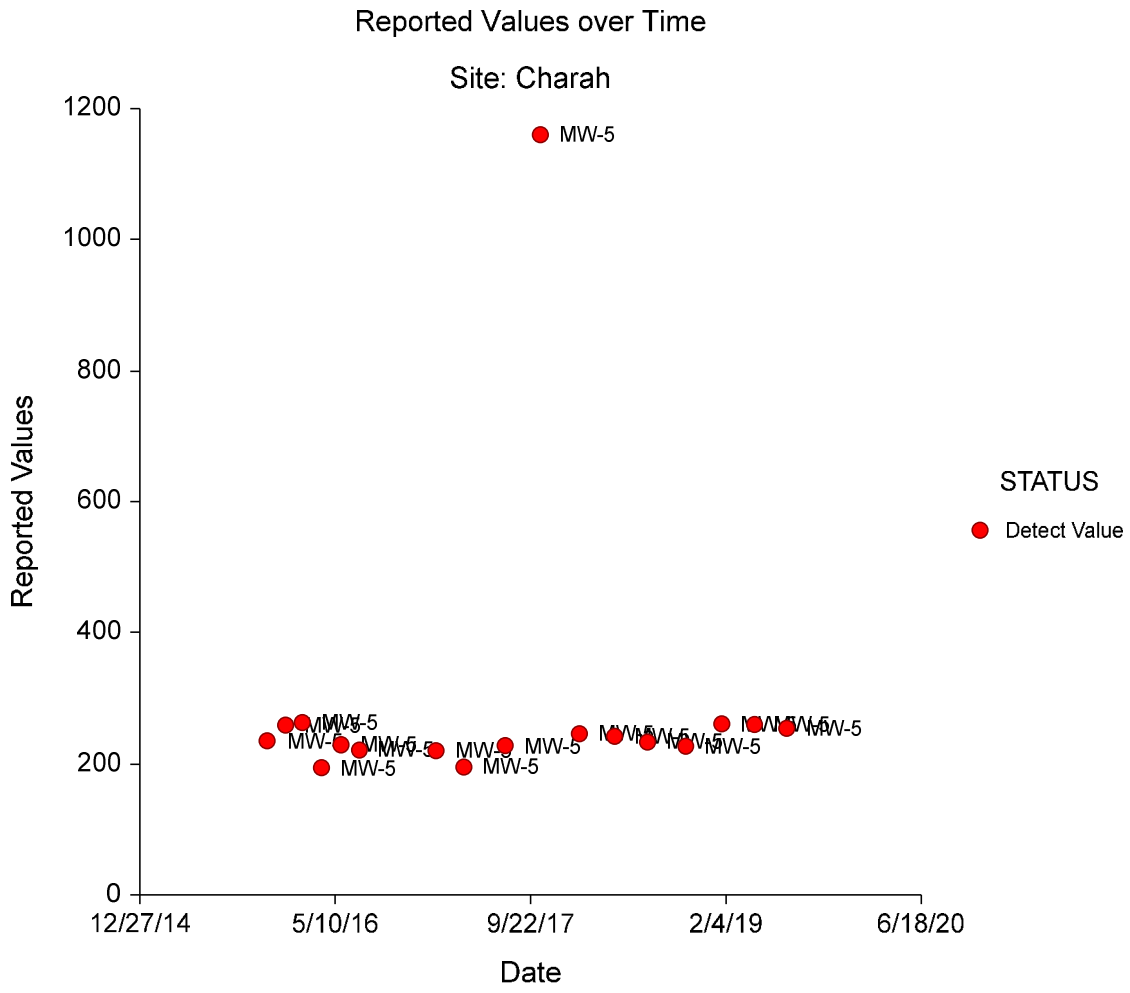


Figure 11: pH (Field) (S.U.) vs. Time (MW-5)

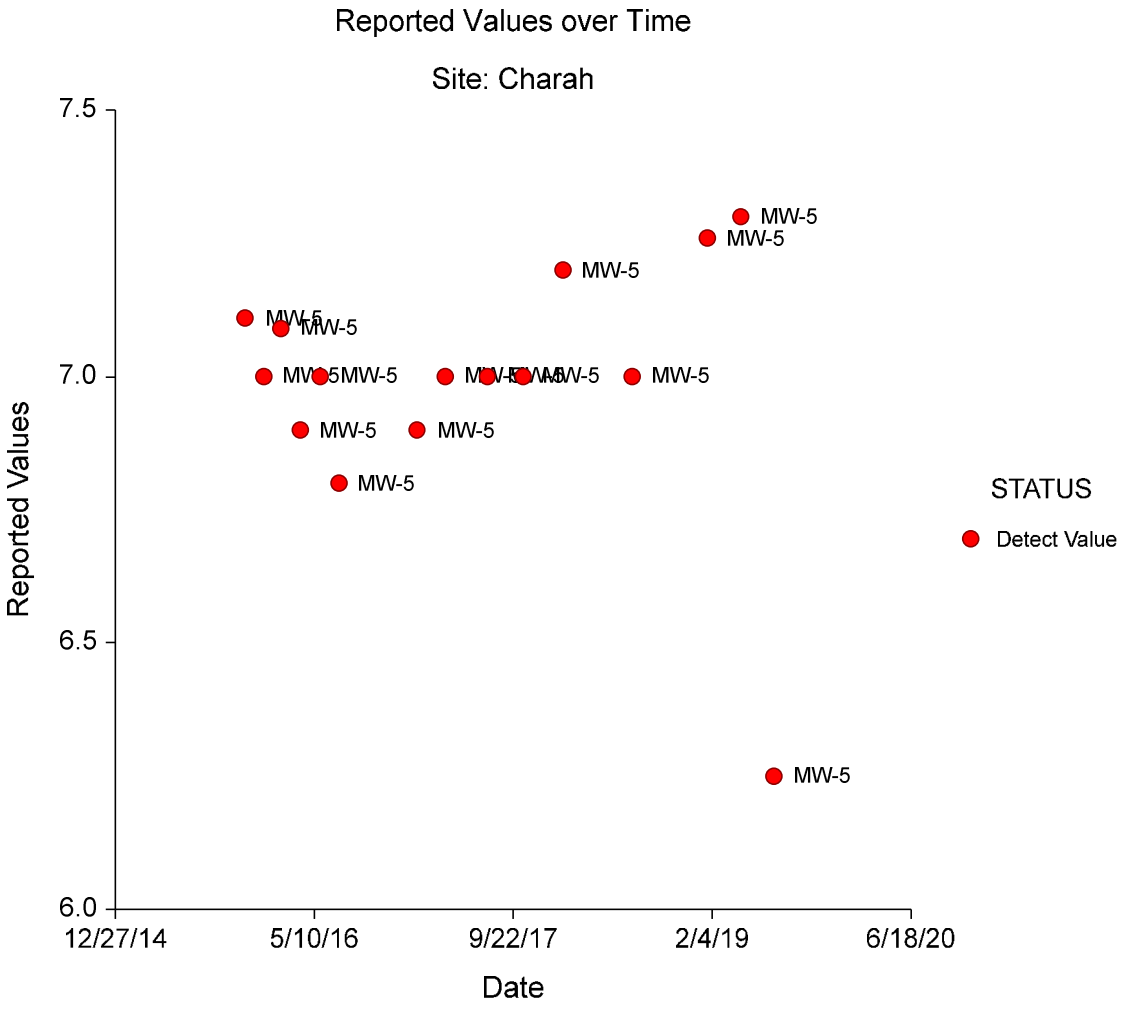


Figure 12: Chloride Concentrations (mg/L) vs. Time (MW-6)

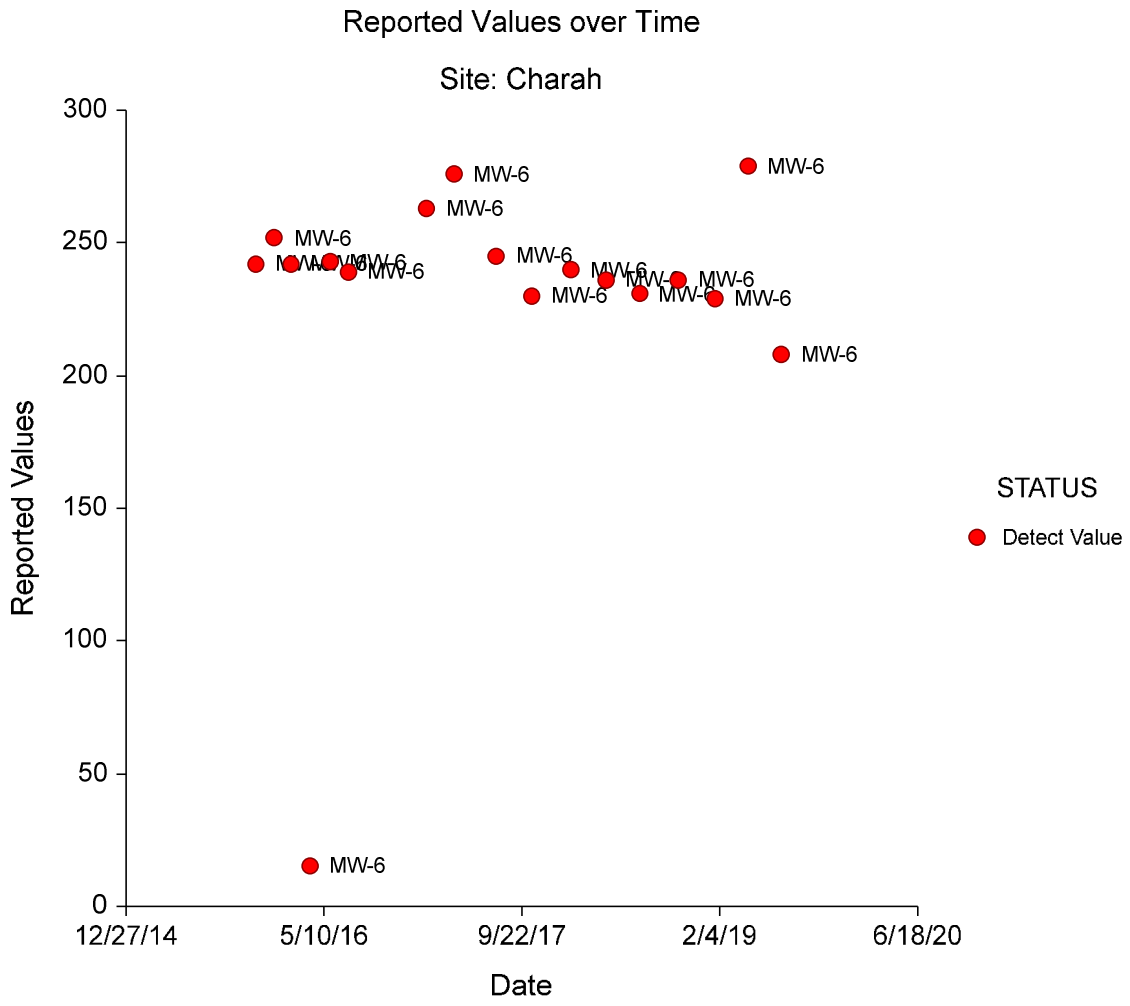


Figure 13: Fluoride (mg/L) vs. Time (MW-7R)

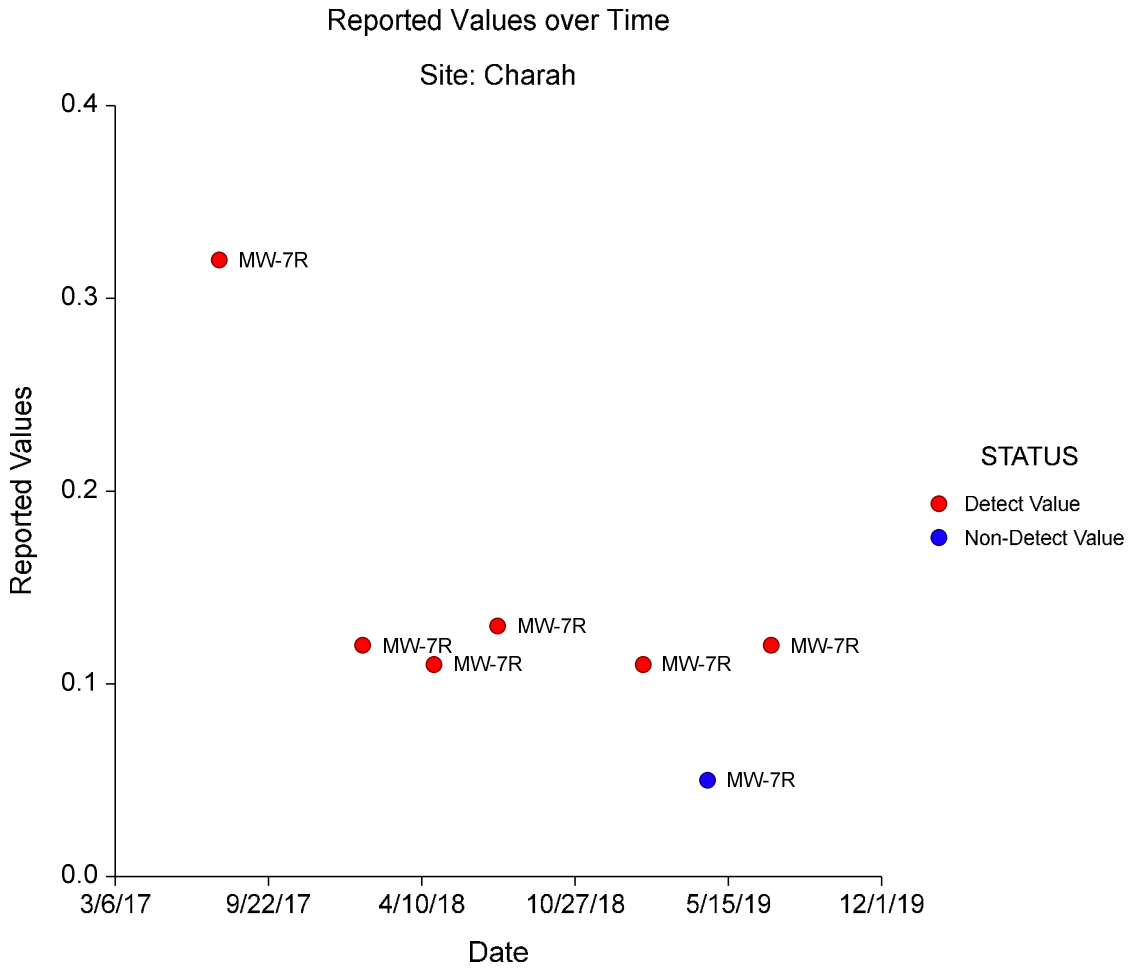


Figure 14: pH (Field) Concentrations (S.U.) vs. Time (MW-7R)

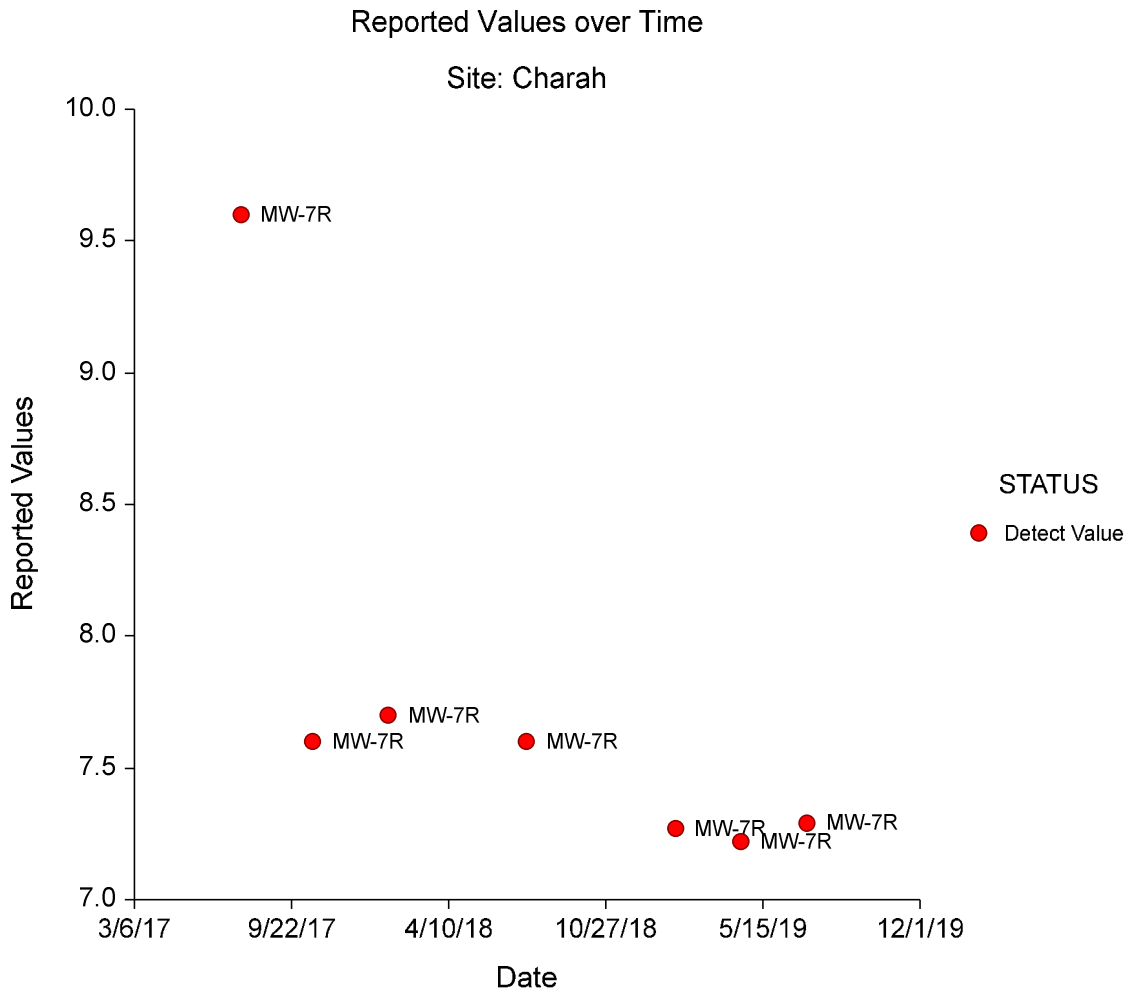


Figure 15: Sulfate Concentrations (mg/L) vs. Time (MW-7R)

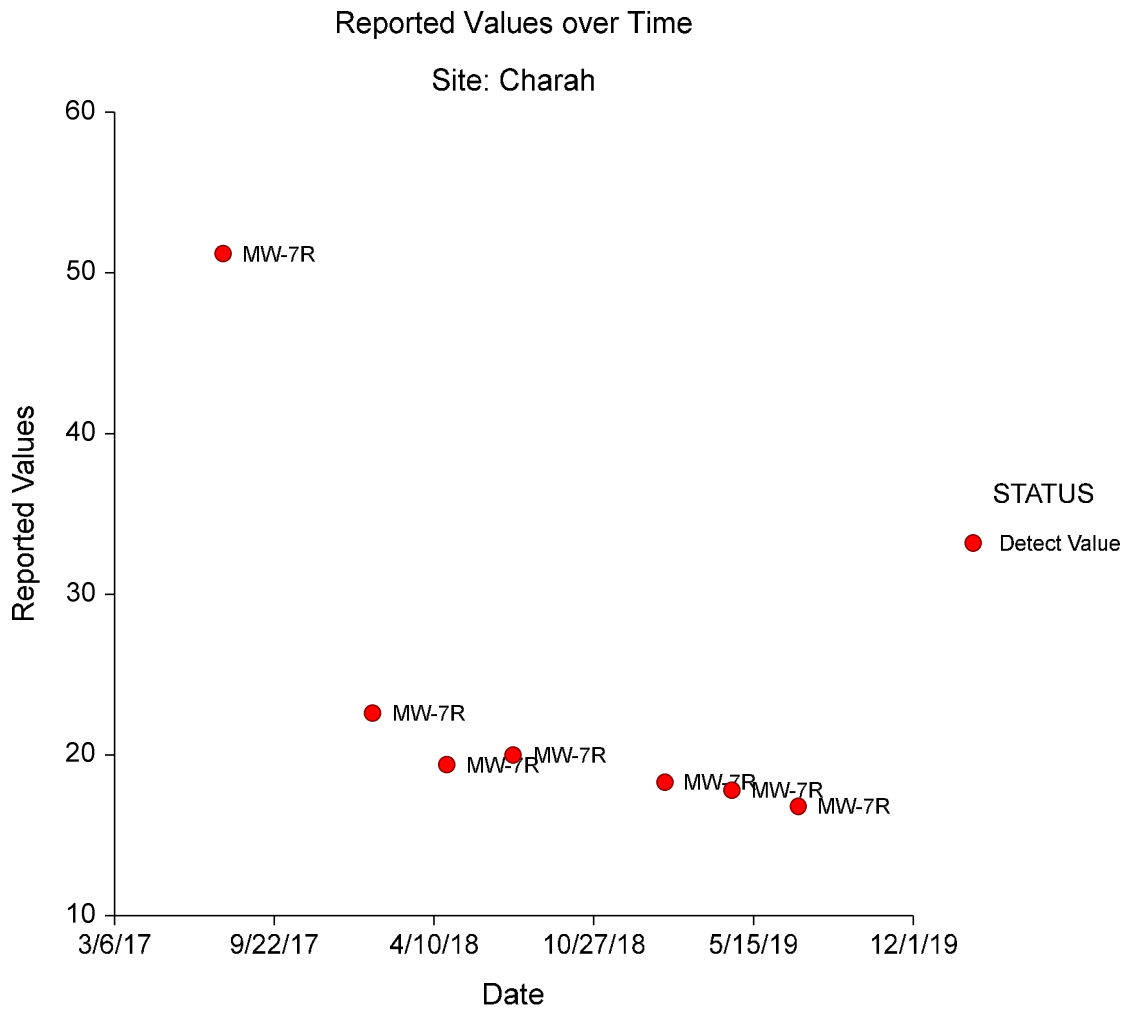


Figure 16: Nickel Concentrations (ug/L) vs. Time (MW-7R)

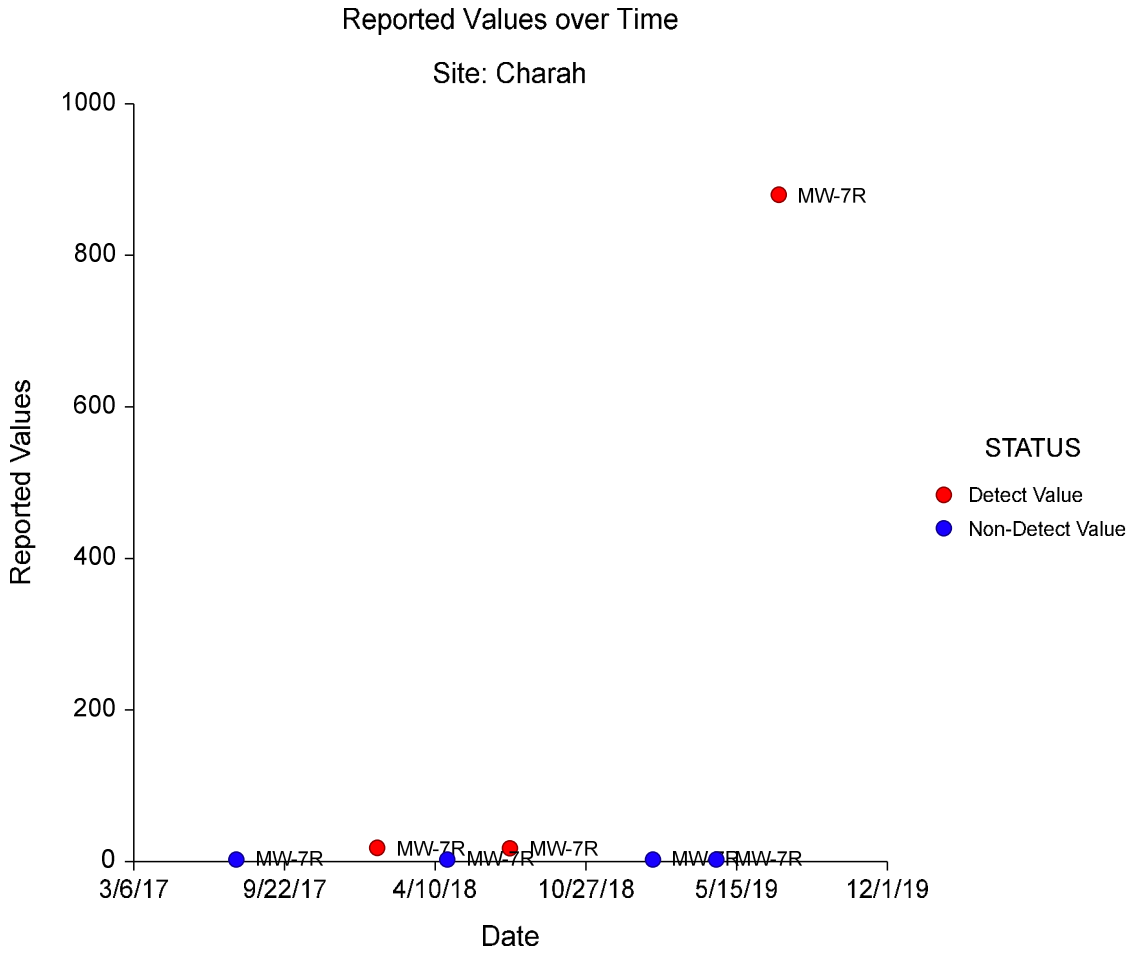


Figure 17: Chromium Concentrations (ug/L) vs. Time (MW-7R)

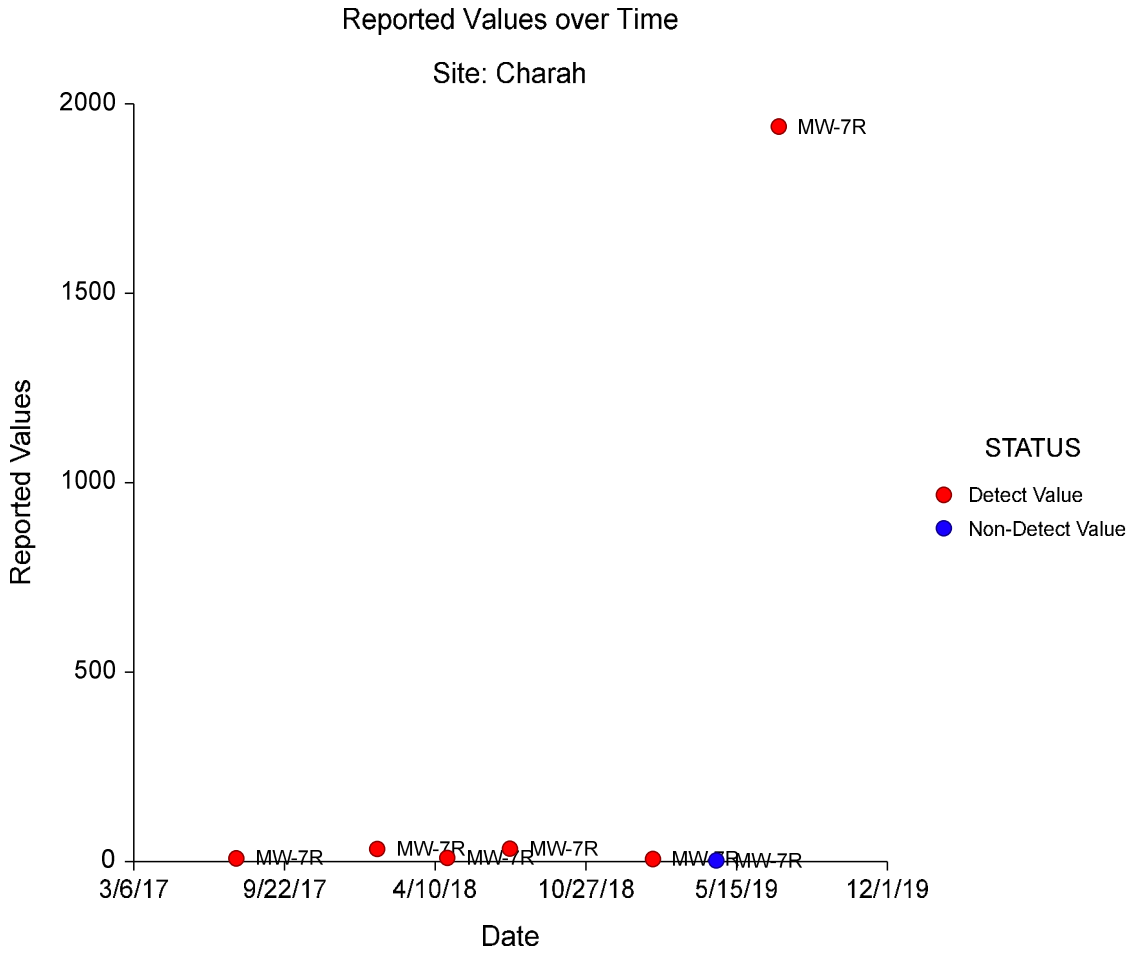
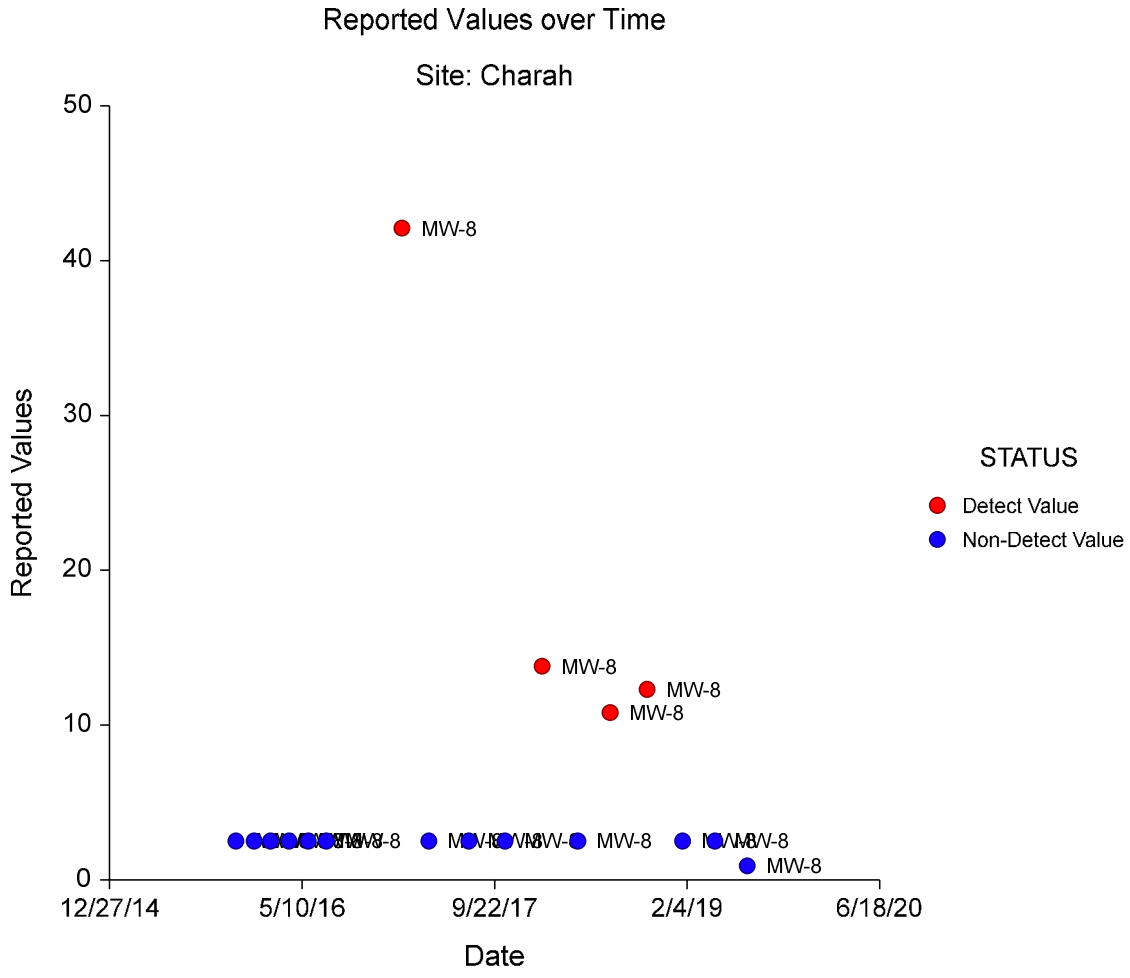


Figure 18: Nickel Concentrations (ug/L) vs. Time (MW-8)



7 References

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[2] NCSS 9 Statistical Software (2013). NCSS, LLC. Kaysville, Utah, USA, ncss.com/software/ncss.

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[4] IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.

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C

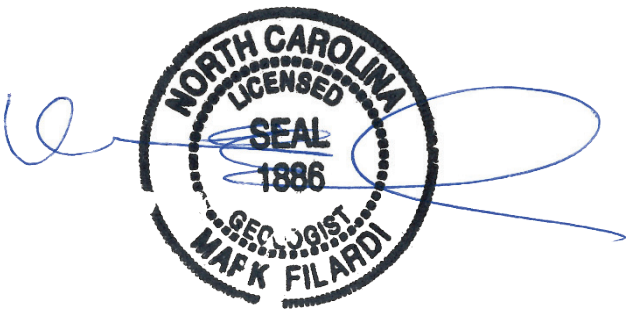
Attachment C – Groundwater and Surface Water Assessment Work Plan

Groundwater and Surface Water Assessment Work Plan

Brickhaven No. 2 Mine Track "A" Structural Fill

1910-STRUC-2015

Moncure, Chatham County, North Carolina
August 16, 2019



Mark P. Filardi, L.G. #1886

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Contents

Tables

Figures

1 Introduction

1.1 Purpose

On behalf of Charah Solutions, Inc. (Charah), HDR Engineering, Inc. of the Carolinas (HDR) has prepared this Groundwater and Surface Water Assessment Work Plan (Plan) to evaluate the nature and extent of exceedances of groundwater and surface water quality criteria at the Brickhaven No. 2 Mine Tract "A" Structural Fill site (Site) in Moncure, Chatham County, North Carolina.

The work proposed herein were designed to obtain additional geologic, hydrogeologic, and water quality data to advance the current understanding of the site-specific conceptual site model (CSM); supplement the Alternate Source Demonstration (ASD) of exceedances that was previously submitted to the NCDEQ on March 29, 2019; and to respond to the request of the North Carolina Department of Environmental Quality (NCDEQ) dated June 21, 2019.

1.2 Regulatory Compliance

In accordance with the Water Quality Monitoring Plan[1] (WQMP) approved by the North Carolina Department of Environment and Natural Resources (NCDENR) in 2014, and operating under Facility Permit #1910-STRUT-2015, Charah is required to monitor groundwater and surface water quality at 11 monitoring wells (MW-1 through MW-8, BG-1, and BG-2) and two surface water locations (SW-1 and SW-2). Groundwater samples are analyzed for constituents listed in NCDEQ Solid Waste Appendix I and II, 40 CFR 257 Appendix III, and 40 CFR 257 Appendix IV.

Charah began monitoring groundwater and surface water quality in August 2015, prior to placement of coal combustion products (CCP) into the lined structural fill. One additional sampling event was conducted in October 2015 prior to commencement of CCP placement in November 2015. Subsequent to the October 2015 event, Charah conducted six additional background sampling events. From January 2017 through July 2019, Charah conducted five semi-annual detection monitoring events. On June 21, 2019, Charah received correspondence from the NCDEQ Solid Waste Section that requests Charah submit this Plan in accordance with 15A NCAC 02L .0106 and 15A NCAC 02B .0211 and .0216. NCDEQ cited exceedances of groundwater quality standards for barium, chloride, chromium, cobalt, total dissolved solids (TDS), and vanadium, and exceedances of surface water quality standards for arsenic, cobalt, copper, lead, TDS, and zinc as cause for needing the Plan.

[1] Design Hydrogeologic Report – Addendum, Revision 2. Brickhaven Mine Reclamation Structural Fill Site. 1315 Moncure-Flatwood Road, Moncure, North Carolina. Buxton Environmental, Inc. March 6, 2015.

Pursuant to 15A NCAC 02L .106(g), and 15A NCAC 2B.0211 and 0216, this site assessment is designed to:

- Evaluate whether placement of structural fill or generation of leachate is the cause of exceedances;
- Evaluate imminent hazards to public health and safety and actions taken to mitigate them in accordance with Paragraph (f) of this Rule;
- Identify receptors and significant exposure pathways;
- Evaluate the extent of groundwater and surface water impacts and significant factors affecting constituent transport; and,
- Identify geological and hydrogeological features influencing the movement, chemical, and physical character of constituents.

The work proposed in this plan will provide the information sufficient to satisfy the requirements of the rule. However, uncertainties may exist due, in part, to the following factors:

- Contaminants of concern are known to be naturally occurring in soil and groundwater throughout the Piedmont Physiographic Provence, which encompasses the Site;
- The natural variations and the complex nature of the geological and hydrogeological characteristics involved with the movement, chemical, and physical character of the contaminants;
- Use of the Site by General Shale Brick, Inc. (General Shale) and its predecessor companies as a clay mine for brick production from 1985 until the mine permit was transferred to Green Meadows, LLC in 2015 and potential geochemical changes that these activities may have imparted on soil and groundwater; and,
- Potential geochemical impacts on the surface water from the wastewater discharge from: 1) General Shale under National Pollutant Discharge Elimination System (NPDES) permit to the unnamed tributary (east) of the Site and 2) the farm pond south of the Site. Both discharges are upstream of surface water sample location SW-1.

Charah submits this workplan without any admission that its activities have been the cause of any detected exceedances.

1.3 Site Location and Operation

The Site is located in Chatham County, approximately four miles southeast of Moncure, North Carolina (**Figure 1**). The owner of the Site is Green Meadow, LLC (Green Meadow). Charah is responsible for the operation and maintenance of the Structural Fill. The mine property is approximately 301 acres in total; of which 145 acres is permitted for structural fill placement of CCP in a lined storage facility.

The property located within the Structural Fill area was previously owned by General Shale, which operated the Site and an adjacent property as a clay mine beginning in 1985 for their off-site brick manufacturing facility. Mined clay was stockpiled and then transported approximately 3.5 miles south to Brickhaven, North Carolina for brick manufacturing.

The area immediately surrounding the Site primarily consists of rural residential (approximately 2,500 feet east, 1,000 feet southeast, and 1,000 feet southwest), commercial, industrial, wooded and agricultural properties. According to information obtained from the Chatham County GIS website (October 2015), municipal water is available to the surrounding area.

Charah began CCP placement in the first composite liner containment system (Cell 1, Sub Cell 1A) on October 23, 2015. CCP placement has occurred in Cell 1, Cell 2, Cell 6A, Cell 6B, and Cell 6C. Charah has placed just over 7.3 million tons of CCP material in the structural fill at the time of this report. CCP materials (including fly ash, bottom ash, boiler slag, and/or flue gas desulfurization materials) were initially brought to the site by truck from October 2015 until transportation was changed to rail in January 2016. The CCP originated from the Duke Energy Carolinas (DEC) Riverbend Steam Station and Duke Energy Progress (DEP) L.V. Sutton Energy Complex (Sutton Plant).

Leachate (i.e., product generated from the liquids present in the fill at the time of placement and/or stormwater that infiltrates the fill) is managed on-site through collection, storage, and disposal of the resultant liquid. Green Meadow has approved pump and haul permits to dispose of leachate at the City of Sanford's Big Buffalo Creek Wastewater Treatment Plant and the Town of Spring Lake's South Harnett Regional Wastewater Treatment Plant.

2 Site Setting

2.1 Site Topography and Geographical Setting

Based on review of the 1993 USGS topographic quadrangle (**Figure 2**) and GIS mapping, the topography of the site and immediately surrounding area can be characterized by moderately rolling hills, which are dissected by dendritic creeks. Prior to mining by General Shale, a topographic ridge was present within the site, extending from the northwestern corner of the present-day structural fill toward the southeast. Thus, historic drainage was to the north/northwest/west and to the northeast/east/southeast away from the ridge, as shown on **Figure 3**.

2.2 Geologic and Hydrogeologic Setting

2.2.1 Regional Geology

The site is located within the Piedmont physiographical province of North Carolina, which is a northeast-southwest trending region extending from New York to Alabama.

According to the 1985 North Carolina Geologic Map prepared by the North Carolina Geological Survey, the site is located in the Triassic Basin Belt of the Piedmont physiographic province. The basement rocks of the Triassic Basin Belt include conglomerate, sandstone, mudstone, limestone, coal, and shale. The majority of the subject property is located within the Sanford Formation which contains conglomerate, fanglomerate, sandstone, and mudstone. The far western portion of the site is located in the Cumnock Formation which contains sandstone, mudstone, gray and black coal, and carbonaceous shale. The Triassic Basin is bounded by felsic metavolcanic rock within the Carolina Slate Belt approximately 6.5 miles to the northwest; and is contacted by metamorphosed granite and biotite gneiss and schist of the Raleigh Belt along a normal fault approximately 2.5 miles to the southeast. The Triassic Basin formations have been intruded by north northwest-south southeast trending igneous diabase dikes during the Jurassic Period (~144 to 208 Ma), and contain northeast-southwest trending normal faults. However, none of these faults were indicated to exist at the subject site on the 1985 geologic map (NCDENR, 1985).

In the Piedmont, the bedrock is typically overlain by a mantle of weathered rock (residuum/saprolite), which has an average thickness of approximately 25 feet. The residuum/saprolite consists of varying amounts of unconsolidated clays, silts, and sands, with lesser amounts of rock fragments. Due to the range of the parent rock composition and the variable susceptibility to weathering of each rock type, the residuum/saprolite range widely in color, texture, and thickness. Generally, the residuum/saprolite is thickest near inter-stream divides (ridges) and thins toward stream beds. In profile, the residuum/saprolite normally grades from clayey soils near the land surface to sandier, partially weathered rock above competent bedrock (Buxton, 2014).

2.2.2 Site Geology

The geology of the site can be subdivided into six units which include fill, flood plain, soil horizon, residuum, partially weathered rock, and layered rock. These units generally grade downward from a soil horizon, to residuum, to partially weathered rock and finally layered rock. Fill materials were limited to the road bed and berm located around the east and west sides of MW-4. Flood plain sediments were only identified at MW-4 on the southeast corner of the site. The following summary of site-specific units is based on boring logs originally included in the *Design Hydrogeologic Report* (Buxton, March 2016).

2.2.2.1 FILL

Fill materials were primarily identified in the road bed and berm located around the east and west sides near MW-4 and generally consisted of mottled reddish yellow, orange, brown, and light gray sandy silty clay with quartz and brick gravel.

2.2.2.2 FLOOD PLAIN

Flood plain sediments were only located adjacent to MW-4 on the southeast corner of the site. Sediments were associated with a former adjacent intermittent tributary creek and can be generally characterized as mottled light gray fine sandy silty clay. The flood plain sediments were approximately 5 feet thick in this area and had been deposited above residuum. Based on geotechnical laboratory data, the flood plain sediments were identified as lean clay (CL) under the Unified Soil Classification System (USCS).

2.2.2.3 SOIL HORIZON

The soil horizon is characterized as mottled yellowish, brown, orange, and red silty clay and clayey silt. Root structures were common. The soil horizon at the site is formed from the continued weathering and biologic reworking of residuum, and ranges from 2 to 15 feet in thickness, when present. Based on geotechnical laboratory data, the soil horizon consisted of clayey sand (SC), elastic silt (MH), and lean clay (CL) and had a hydraulic conductivity of 2.86 x 10^{-7} cm/sec.

2.2.2.4 RESIDUUM

Residuum is characterized as mottled (black and gray) red and reddish brown sandy silty clay with infrequent quartz gravel and cobbles. Residuum is characteristically fissile, often breaking in horizontal sheets. Residuum generally retains the remnant texture, structure and mineral content of the rock from which it was formed, and ranges from 5 to 15 feet in thickness. Residuum has a Standard Penetration Resistance (N) of less than 100 blows per foot. Based on geotechnical laboratory data, the residuum consisted of lean clay (CL) with hydraulic conductivity ranging from 7.69 x 10^{-8} cm/sec to 3.69 x 10^{-9} cm/sec.

2.2.2.5 PARTIALLY WEATHERED ROCK

Partially weathered rock is characterized as mottled (light green and purple) brown, reddish gray, and weak red silty clay and weathered mudstone, which are often fissile. Partially weathered rock generally retains the remnant texture, structure, and mineral content of the rock from which it was formed, and ranges from 5 to 40 feet in thickness. Partially weathered rock has an N-value of 100 blows per foot or greater and can generally be drilled with standard hollow-stem auger drilling technology. Based on geotechnical laboratory data, partially weathered rock consisted of lean clay (CL). Hydraulic conductivity ranged from 2.433 x 10^{-4}

cm/sec to 7.154 x 10^{-8} cm/sec, according to slug or recovery test data (for wells screened solely in partially weathered rock).

2.2.2.6 LAYERED ROCK

Based on rock coring activities conducted near MW-7/MW-7R and visual inspection of the layered rock exposed on the north side of the MW-4 area, layered rock at the site is primarily composed of reddish to light tan gray mudstone, cross-bedded muddy sandstone, and muddy sandy conglomerate (rounded quartz gravel and cobbles). Layered rock generally occurs as horizontally oriented and relatively thin intermittent layers (especially within the upper 15 feet of contacting layered rock) across the site, based on rock coring and the horizontal fissile nature of residuum and partially weathered rock. Layered rock contained horizontal to near vertical fracturing. Large fractures were observed in weathered mudstone to the immediate northeast near MW-8. The occurrence of layered rock at the site was generally defined by auger refusal.

2.2.3 Regional Hydrogeology

The hydrogeologic regime in the Triassic Basin is characterized by fractured, bedded sedimentary sequences underlying soil and saprolite. Groundwater may occur under both unconfined, water table conditions (similar to most Piedmont crystalline sites) and confined conditions. Controls of groundwater flow are a combination of the interaction of factors including topography, stratigraphic sequence and lithology, distribution and intensity of fractures, presence of diabase intrusions (both dams and sills), basalt flows, and weathering processes of the bedrock (Venkatakrishnan and Gheorghiu 2003).

Groundwater flow has both local and regional components with shallow groundwater discharging locally to nearby streams (and some movement downward into the deeper flow system) and deeper groundwater flow toward points of regional discharge, that are generally higher order stream courses (Venkatakrishnan and Gheorghiu 2003). Both shallow and deep groundwater systems generally flow in a direction similar to the topographic gradient.

Although the Site is not underlain by metamorphic and/or igneous rocks, the conceptual groundwater system for fractured crystalline rocks developed by Heath (1980), Harned and Daniel (1992), and LeGrand (1988, 1989, 2004) is applicable based on review of the available data from previous studies and investigations.

The groundwater system is a two-medium system generally restricted to the local drainage basin. The groundwater occurs in a system composed of two interconnected layers: residual soil/saprolite and weathered rock (TZ) overlying fractured sedimentary rock. The systems are separated by the TZ portion of the residual soil, saprolite, and weathered rock. Typically, the residual soil/saprolite is partially saturated and the water table fluctuates within it. Water movement is generally preferential through the weathered/fractured and fractured bedrock of the TZ (i.e., enhanced permeability zone). The character of such aquifers results from the combined effects of the rock type, fracture system, topography, and weathering. Topography exerts an influence on both weathering and the opening of fractures, while the weathering of the crystalline rock modifies both transmissive and storage characteristics.

Under natural conditions, the general direction of groundwater flow can be approximated from the surface topography (LeGrand 2004).

Groundwater recharge in the region is derived entirely from infiltration of local precipitation. Groundwater recharge occurs in areas of higher topography (i.e., hilltops) and groundwater discharge occurs in lowland areas bordering surface water bodies, marshes, and floodplains (LeGrand 2004). Average annual precipitation contributing to recharge in the Piedmont ranges from 42 to 46 inches. Mean annual recharge in the Piedmont ranges from 4.0 to 9.7 inches per year (Daniel 2001).

2.2.4 Site Hydrogeology

Site hydrogeology was assessed by Buxton Environmental, Inc. (Buxton) during completion of the Design Hydrogeological Report, dated November 6, 2014 and revised on December 31, 2014 and March 6, 2015. A chronological summary of field activities, as they pertain to development of the current conceptual site model (CSM), are provided in **Table 1**.

Table 1 - Chronology of Subsurface Exploration

Date	Investigation Phase	Work Completed
August 5 – 14, 2014	Design Hydrogeologic Report	• Installation of 15 shallow and intermediate depth piezometers (PZM-1, PZM-3, PZM-4, PZM-5, PZM-6, PZM-8, PZM-10, PZM-11, PZM-12, PZM-13, PZM-15, PZM-16, PZM-18, PZM-19 and PZM-20). • Installation of 4 nested shallow and intermediate piezometer pairs (PZM-7s/PZM-7, PZM-9s/PZM-9, PZM-14s/PZM-14, and PZM-17s/PZM-17). • Installation of 1 nested intermediate and deep piezometer pair (PZM-2/PZM-2D). • Collection and select testing of 154 split-spoon Standard Penetration Tests (SPT) and five Shelby Tube samples. • Completion of 6 water level gauging events in piezometers PZM-1 through PZM-18) on August 21, September 3, September 18, October 1, October 14, and October 31, 2014. • Completion of slug tests in piezometers PZM-1, PZM-2, PZM-2D, PZM-5, PZM-8, PZM-12, PZM-13, PZM-15 and PZM-17.
November 24 – December 2, 2014	Design Hydrogeologic Report – Addendum, Revision 1	• Installation of 8 shallow and intermediate piezometers (PZM-21, PZM-22, PZM-24, PZM-25, PZM-26, PZM-27, PZM-28, and PZM-29). • Installation of 1 nested shallow and intermediate piezometer pair (PZM-23s/PZM-23). • Collection of 67 SPT samples.
March 6, 2015	Design Hydrogeologic Report – Addendum, Revision 2	• Updated Water Quality Monitoring Plan (WQMP) as follows: o Proposed compliance monitoring network to consist of 1 up-gradient well (MW-1) and 7 cross- or down-gradient wells (MW-2 through MW-8); Four piezometers (PZM-1 [MW-4], PZM-22 [MW-5], PZM-27 [MW-7], and PZM-28 [MW-8]) installed during the Design Hydrogeologic investigation were to be converted from piezometers to permanent compliance monitoring wells. o Proposed 2 surface water sampling locations: 1 collected at a tributary creek of Gulf Creek which crosses Moncure-Flatwood Rd. approximately 2,000 feet south of the site (SW-1); and one surface water sample will be collected along Shaddox Creek approximately 2,000 feet west of the site (SW-2). o Proposed 1 composite leachate sample be collected from the above-ground holding tank. o Identified that only 1 sampling event would be conducted prior to CCP placement, as agreed upon with Ms. Elizabeth Werner of NCDEQ on February 20, 2015.
September 17, 2015	Compliance Well Installation / Abandonment	• Summarized abandonment of PZM-28 (dry), which was proposed to be converted to compliance monitoring well MW-8. A deeper replacement well (MW-8) was installed adjacent to PZM-28.
August 13 – December 2, 2014	Compliance Well Installation	• Conversion of piezometers PZM-1, PZM-22, and PZM-27 to monitoring wells MW-4, MW-5, and MW-7, respectively.

Date	Investigation Phase	Work Completed
June 19 – 30, 2015	Compliance Well Installation / Piezometer Abandonment	• Installation of monitoring wells MW-1, MW-2, MW-3, MW-6, MW-8, and BG-1. • Slug testing of wells MW-1 through MW-8 and BG-1. • Abandonment of piezometers PZM-5, PZM-10, PZM-11, PZM-12, PZM-13, PZM-15, PZM-16, PZM-18, PZM-29, PZM-2/2D, PZM-7s/7, PZM-14s/14, and PZM-17S/17.
July 30, 2015	Piezometer Abandonment	• Abandonment of PZM-9s and PZM-9
February 8 – 9, 2016	Piezometer Abandonment	• Abandoned piezometers PZM-21, PZM-23s, PZM-23, PZM-24, PZM-25, and PZM-26
April 18 – 19, 2017	Compliance Well Installation / Piezometer Abandonment	• Abandoned piezometers PZM-3, PZM-4, PZM-6, PZM-8, PZM-19 • Installed monitoring well MW-7R
December 26, 2018	Compliance Well Installation	• Installation of additional background well BG-2

Evaluation of geologic and hydrogeologic data obtained during the above-referenced activities and published data sources (e.g., 1993 USGS Moncure, NC topographic quadrangle) indicate the historic presence of two topographic highs in the north-central and south-central portions of the Site prior to development by General Shale. Accordingly, high groundwater elevations were regularly recorded in piezometers PZM-14s (north-central) and PZM-16, -23s, and -25 (south-central), resulting in radial flow from these areas. As piezometers have been abandoned during development of the Structural Fill and compliance monitoring wells have been installed, similar high groundwater elevations have regularly been recorded in wells MW-1 (north-central), and MW-5 and MW-6 (south-central). Since piezometers within the limits of the Structural Fill liner have since been abandoned, shallow groundwater has been interpreted to flow east and west from the former north-south trending topographic ridge, as shown on the most recent potentiometric surface map drawn using groundwater elevations calculated for the January 2019 semi-annual sampling event (**Figure 2**).

Hydraulic conductivities calculated from slug test data in piezometers during the Design Hydrogeologic investigation ranged from 1.597×10^{-4} centimeters per second (cm/sec) to 3.817×10^{-8} cm/sec.

Vertical hydraulic gradients were calculated in nested piezometers during three gauging events, as presented in **Table 2**.

Table 2 – Vertical Hydraulic Gradients

Well Pair	Date	Vertical Gradient (ft/ft)	Direction
PZM-2 and PZM-2D	August 21, 2014	0.29	↓
	December 21, 2014	0.24	↓
PZM-14s and PZM-14	October 31, 2014	0.006	↓
	December 21, 2014	0.19	↓
PZM-23s and PZM-23	December 21, 2014	0.48	↓

Average linear groundwater flow velocities were calculated during the Design Hydrogeologic investigation at piezometers PZM-1, PZM-2, PZM-2D, PZM-5, PZM-8, PZM-10, PZM-12, PZM-13, PZM-15, and PZM-17 using the Darcy equation. Average linear groundwater velocities ranged from 0.0000072 ft/day (0.0026 ft/year) at piezometer PZM-10 to 1.84 ft/day (671.60 ft/year) at piezometer PZM-15. Average linear flow velocity along the eastern side of the Site,

near compliance wells MW-2 and MW-3, were calculated at 0.51 ft/year in piezometer PZM-2 and 0.47 ft/year at piezometer PZM-8.

Since 2014, HDR has calculated seepage velocities between well pairs installed roughly perpendicular to the inferred direction of groundwater flow and presented these data in semi-annual monitoring reports. In the most recent semi-annual monitoring report (January 2019), seepage velocities were calculated at 10.0 ft/year between wells MW-1 and MW-2 and 5.2 ft/year between wells MW-5 and MW-4.

2.3 Receptor Information

In 2014, Buxton conducted a water supply well survey within 300 feet of the fill boundary of the Structural Fill. One on-site water supply well was identified adjacent to a small pond near the equipment parking and maintenance building, approximately 300 feet east of the former location of PZM-1. No additional water supply wells were identified during the survey; however, Buxton did note that the surrounding area has historically been used for rural residences and agriculture. Thus, the potential for water supply wells beyond the 300-foot perimeter of the fill boundary exists.

3 Proposed Assessment Plan

The activities proposed herein were designed to obtain additional geologic, hydrogeologic, and water quality data to advance the current understanding of the site-specific CSM. Based on readily available Site data and dependent upon accessibility, HDR anticipates collecting the following samples during implementation of the assessment workplan:

- Soil samples from areas within the former General Shale mine, but beyond the area of CCP placement by Charah
- Groundwater samples from proposed and existing monitoring wells
- Surface water samples from proposed and existing locations
- Leachate samples from the designated leachate sampling location

Existing surface water and groundwater quality data from compliance monitoring activities will be used to supplement data obtained from this assessment work. In addition, existing leachate data will be used in the evaluation of data obtained from this assessment work. A summary of the proposed exploration plan including estimated sample quantities and estimated depths of soil borings and monitoring wells is presented in **Table 3**. Proposed sampling locations are shown on **Figure 3**.

Table 3 – Proposed Assessment Plan

	Soil Samples	Regolith Monitoring Wells	Bedrock Monitoring Wells	Surface/Free Water Samples
Quantity	10	3	1	7
Depth (ft. bgs)	0-2'	20 – 40	60	Surface
Type	Grab	Type II	Type III	Grab
Casing Depth	NA	NA	40	NA

Data collected during this assessment, in addition to existing data, will be used to evaluate site-specific geochemical and groundwater flow and transport conditions via three-dimensional groundwater modeling.

3.1 Ash Evaluation

Duke Energy is required to provide results of laboratory testing of ash from sources shipped to the Structural Fill. Between 2012 and 2019, Charah received annual laboratory results from Duke Energy from testing of ash at the Riverbend Steam Station and L.V. Sutton Plant facilities. Laboratory analyses varied by sampling date, but generally consisted of the following:

- Select pesticides using Solid Waste Method SW-846 Method 8081B
- Leachable (TCLP) semi-volatile organic compounds (SVOCs) using SW-846 Method 8270
- Chlorinated herbicides using SW-846 Method 8151A
- Volatile organic compounds using SW-846 Method 8260
- Leachable (TCLP) RCRA Metals using United States Environmental Protection Agency (USEPA) Methods 200.7 or SW-846 Method 1311/6010C; mercury was analyzed using USEPA Method 245.1 or SW-846 Method 1311/7470A
- Polychlorinated biphenyls (PCBs) using SW-846 Method 8082

- Sulfate using USEPA Method 9056

In addition, in-place ash samples have been collected by Charah and Chatham County since 2016. Laboratory analyses have generally included leaching potential of inorganics, volatile organic compounds, semi-volatile compounds, pesticides, and herbicides using TCLP methods; reactive cyanide and sulfide; corrosivity; and ignitability. HDR will compare the existing laboratory data for ash samples to laboratory data for groundwater and surface water samples collected during detection monitoring events to evaluate the Structural Fill as a potential source. The results of this evaluation will be used in the ASD portion of work described further in **Section 4** of this Plan.

3.2 Groundwater

3.2.1 Monitoring Well Installation

The current compliance groundwater monitoring network consists of two background wells (BG-1 and BG-2) and eight cross- or down-gradient monitoring wells (MW-1 through MW-7R and MW-8). Each well was installed within the uppermost aquifer underlying the Structural Fill with well screens set to bracket the water table at the time of installation. Based on the results of semi-annual groundwater monitoring, HDR proposes to install additional monitoring wells to obtain additional geologic, hydrogeologic, and groundwater quality data. Proposed monitoring well locations are shown on **Figure 3**.

3.2.1.1 REGOLITH MONITORING WELLS

Regolith monitoring wells are defined as wells that are screened wholly within the regolith zone and set to bracket the water table surface at the time of installation.

HDR proposes to install two regolith monitoring wells (MW-9 and MW-10) along the southern boundary of CCP placement. If the Structural Fill is closed prior to reaching its permitted capacity, these wells would become new compliance wells at the limit of waste for this portion of the fill. The proposed locations will provide groundwater quality data closer to the anticipated limit of CCP placement and would allow for early detection of a potential release from the Structural Fill.

HDR proposes to install one regolith monitoring well (MW-11) at a location south of Sediment Basin #6 and adjacent the unnamed tributary (west) that traverses the Site property in this area. The well will be installed to evaluate whether the stream is a gaining or losing stream and to compare groundwater geochemistry leaving the Site to observed concentrations in surface water sample location SW-1.

Regolith monitoring wells will be installed using hollow stem auger drilling techniques. At each monitoring well location, a regolith well will be constructed with a 2- inch diameter, Schedule 40 polyvinyl chloride (PVC) screen and casing. Each of these wells will have a 10-foot to 15-foot pre-packed well screen having manufactured 0.010-inch slots.

3.2.1.2 BEDROCK MONITORING WELL

Bedrock monitoring wells are defined as wells that are screened within the partially weathered (PWR)/fractured bedrock below the regolith.

HDR proposes to install one bedrock well (MW-2D) adjacent to monitoring well MW-2, the well with most frequent 2L Standard exceedances to obtain geologic and hydrogeologic data from the PWR/fractured bedrock groundwater flow layer. Groundwater quality data obtained from samples collected from the proposed bedrock well will be compared to analytical results from well MW-2 to evaluate variations in constituent concentrations with depth.

The bedrock monitoring well will be installed using hollow stem augers and air rotary drilling techniques. A double-cased well will be constructed with a 6-inch-diameter PVC outer casing and a 2-inch-diameter PVC inner casing and well screen.

The purpose of installing the cased well is to prevent possible connection of flow zones within the shallow and deeper portions of the unconfined aquifer during well installation. The outer well casing (6-inch casing) will be advanced to auger refusal and set approximately 1 foot into PWR (if present). Note that location-specific subsurface geology will dictate the actual casing depth. The annulus between the borehole and casing will be grouted to the surface using the tremmie grout method. After the grout has been allowed to cure for a period of 24 hours, the borehole will be extended via air rotary drilling approximately 10 feet to 15 feet into transition zone rock. A 2-inch-diameter well with a 5-foot pre-packed well screen will be set at least 2 feet below the bottom of the outer casing.

3.2.1.3 WELL COMPLETION AND DEVELOPMENT

As described above, pre-packed screens will be installed to reduce turbidity during sample collection. The pre-packed screens will consist of environmental grade sand contained within a stainless steel wire mesh cylinder. The sand gradation in the pre-packed screen will be made in advance anticipating a wide range of site conditions; however, HDR believes that the sand will typically be 20/40 mesh silica sand. Additional #2 sand will be placed in the annulus between the pre-packed screen and the formation, extending a minimum of two feet above the top of the well screen. A minimum one-foot to two-foot thick bentonite seal hydrated with potable water will be placed above the sand pack. Cement grout will be placed in the annular space between the PVC casing and the borehole above the bentonite seal and extending to the ground surface. Each well will be finished at the ground surface with a 2-foot square concrete well pad and new 4-inch steel above-grade lockable covers. Following completion, wells will be locked with a keyed pad lock.

WELL DEVELOPMENT

Newly installed monitoring wells will be developed to create an effective filter pack around the well screen and to remove fine particles within the well from the formation near the borehole. Based on site-specific conditions per 15A NCAC 02C .0108(p), appropriate measures (e.g., agitation, surging, pumping, etc.) will be used to stress the formation around the screen and the filter pack so that mobile fines, silts, and clays are pulled into the well and removed.

Water quality parameters (specific conductance, pH, temperature, oxidation reduction potential [ORP], and turbidity) will be measured and recorded during development and should stabilize before development is considered complete. Development will continue until development water is visually clear (< 10 Nephelometric Turbidity Units [NTU] Turbidity) and sediment free. If a well cannot be developed to produce low turbidity (< 10 NTU) groundwater samples after three

hours of development, development will be considered complete and turbidity conditions will be noted.

Following development, sounding the bottom of the well with a water level meter should indicate a “hard” (sediment-free) bottom. If a sediment-free bottom is not achieved, development should continue until the well is free of sediment, or for one hour, whichever occurs first. Development records will be prepared and will include development method(s), water volume removed, and field measurements of temperature, pH, conductivity, and turbidity.

SLUG TESTS

Hydraulic conductivity (slug) tests will be conducted in each newly installed monitoring well in accordance with the requirements of the NCDENR Memorandum titled “Performance and Analysis of Aquifer Slug Tests and Pumping Tests Policy” dated May 31, 2007. Water level change during the slug tests will be recorded by a data logger. The slug test will be performed for no less than 10 minutes or until such time as the water level in the test well recovers 95 percent of its original pre-test level, whichever occurs first. Slug tests will be terminated after 2 hours even if the 95 percent pre-test level is not achieved. Slug test field data will be analyzed using the Aqtesolv (or similar) software using the Bouwer and Rice method.

3.2.2 Groundwater Sampling and Analysis

Subsequent to monitoring well installation and development, newly installed wells will be sampled during the next semi-annual groundwater monitoring event using low-flow sampling techniques in accordance with USEPA Region 1 Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells (revised September 19, 2017).

During low-flow purging and sampling, groundwater is pumped into a flow-through chamber at flow rates that minimize or stabilize water level drawdown within the well. Indicator parameters are measured over time (usually at 5-minute intervals). When parameters have stabilized within ±0.2 pH units and ±10 percent for temperature, conductivity, and dissolved oxygen (DO), and ±10 millivolts (mV) for ORP over three consecutive readings, representative groundwater is being captured for sampling. Turbidity levels of 10 NTU or less will be targeted prior to sample collection. Purging will be discontinued and groundwater samples will be collected if turbidity levels of 10 NTU or less are not obtained after 2 hours of continuous purging. Groundwater samples will be analyzed by a North Carolina certified laboratory for the constituents listed in the site-specific WQMP and in **Table 4**. Sample collection, handling and storage will be conducted in general accordance with accepted protocol, including chain-of-custody documentation. Quality assurance and quality control (QA/QC) samples (e.g., field blanks) will be collected and analyzed in accordance with the requirements of the WQMP during the semi-annual sampling event.

Groundwater sample results will be compared to Class GA Standards as found in 15A NCAC 02L .0202 Groundwater Quality Standards, last amended on April 1, 2013 (2L Standards) and statistically-derived site-specific background concentrations.

Table 4 – Groundwater and Surface Water Quality Parameters and Constituent Analytical Methods

PARAMETER	UNITS	METHOD
Field parameters		
pH	SU	Field water quality meter
Specific Conductance	µS/cm	Field water quality meter
Temperature	ºC	Field water quality meter
Dissolved Oxygen	mg/L	Field water quality meter
Oxidation Reduction Potential	mV	Field water quality meter
Turbidity	NTU	Field turbidity meter
40 CFR Part 257, Appendix III Constituents		
Boron	µg/L	EPA Method 6020B
Calcium	µg/L	EPA Method 6010D
Chloride	µg/L	EPA Method 300.0
Fluoride	µg/L	EPA Method 300.0
pH	SU	EPA Method 9040B (or similar)
Sulfate	µg/L	EPA Method 300.0
TDS	µg/L	SM 2540C
40 CFR Part 258, Appendix IV Constituents		
Antimony	µg/L	EPA Method 6010D
Arsenic	µg/L	EPA Method 6010D
Barium	µg/L	EPA Method 6010D
Beryllium	µg/L	EPA Method 6010D
Cadmium	µg/L	EPA Method 6010D
Chromium	µg/L	EPA Method 6010D
Cobalt	µg/L	EPA Method 6010D
Fluoride	µg/L	EPA Method 300.0
Lead	µg/L	EPA Method 6010D
Lithium	µg/L	EPA Method 6020B
Mercury	µg/L	EPA Method 7470A
Molybdenum	µg/L	EPA Method 6010D
Selenium	µg/L	EPA Method 6010D
Thallium	µg/L	EPA Method 6020B
Radium 226	pCi/L	EPA Method 903.1
Radium 228	pCi/L	EPA Method 904.0
Total Radium	pCi/L	Total Radium Calculation
40 CFR Part 258 Appendix I Metals		
Copper	µg/L	EPA Method 6010D
Nickel	µg/L	EPA Method 6010D
Silver	µg/L	EPA Method 6010D
Vanadium	µg/L	EPA Method 6010D
Zinc	µg/L	EPA Method 6010D

Note: SU – Standard Units; µS/cm – microSiemen per centimeter; ºC – degrees Celsius; mg/L – milligrams per liter; mV – millivolt; NTU – nephelometric turbidity units; µg/L – micrograms per liter; pCi/L – picoCuries per liter.

3.3 Surface Water

As previously mentioned, concentrations of arsenic, cobalt, copper, lead, TDS, and zinc that exceeded 2B Standards have been reported in surface water samples collected from the SW-1 sample location, located approximately 3,000 feet south of the southern-most permitted waste boundary and approximately 4,800 feet south/southeast of the current limit of CCP waste placed in Cell 6C. Under ambient conditions, this sample location has the potential to receive discharge from two unnamed streams and an approximate 0.75-acre farm pond, as well as permitted NPDES discharges from the Site and adjacent mine operated by General Shale. The purposes of the surface water assessment proposed herein are to evaluate the potential for groundwater to discharge to surface water and to evaluate other potential sources of constituents observed in samples collected at the SW-1 location.

3.3.1 Baseflow Evaluation

HDR proposes to evaluate the origin of flow into the two unnamed streams that flow through or adjacent to the Site through completion of the following:

- Comparison of groundwater elevations in existing regolith monitoring wells to surveyed elevations of the streambeds at accessible locations;
- Comparison of groundwater elevations in existing regolith monitoring wells to the surveyed elevation of the bottom of the Mine Pond; and,
- Identification of seeps at accessible locations.

Results of the baseflow evaluation will enable Charah to estimate contribution of flow from NPDES discharge points versus groundwater baseflow into the streams. Further, this evaluation will inform decisions regarding sampling locations that may be more indicative of Charah's potential contribution to water quality, rather than locations that could represent multiple off-site sources of constituents.

3.3.2 Surface Water Flow Measurements

Low-flow stream flow measurements can be used both to estimate groundwater recharge and as calibration targets for groundwater flow modeling. Gulf Creek to the east and Shaddox Creek to the west of the Structural Fill receive groundwater from the area where groundwater modeling is proposed. Measurements of these streams during low-flow periods (e.g., late September when there has been no precipitation for several days or weeks) can be used to estimate these key parameters for the groundwater modeling effort. Stream flows should be measured where the largest amount of flow is integrated. Both of these streams pass under Corinth Road just before they discharge to the Cape Fear River. Measurements at these locations, if accessible, will provide needed information for the model. A more focused measurement can be made in the tributary to Gulf Creek that leaves the Site and crosses beneath Moncure-Flatwood Road. The smaller stream's flow can be used to estimate groundwater recharge and discharge near the Site to create a refined water budget. Note that known wastewater discharges to these streams will be accounted for in the stream flow estimates. Stream flow measurement will follow the appropriate USGS stream flow measurement method for the size and depth of these creeks at the measurement locations. The best locations to measure the flows will be determined in the field.

3.3.3 Surface Water Sampling

To further delineate the nature and source of constituents in surface water, HDR proposes to collect surface water samples from the locations specified in **Table 5**. Proposed sample locations are shown on **Figure 2**.

Table 5 – Proposed Surface and Free Water Sample Locations

Sample ID	Location
SW-1	Existing SW-1 location ~3,000 feet south of permitted waste boundary on Gulf Creek Tributary
SW-2	Existing SW-2 location south of confluence of Shaddox Creek and Shaddox Creek Tributary
SW-3	Proposed location on Shaddox Creek Tributary ~1,700 feet west of permitted waste boundary
SW-4	Proposed location adjacent to proposed regolith well MW-11 and south of Sediment Basin #6; on unnamed tributary (west)
FW-1	Proposed location in Mine Pond
FW-2	Proposed location in Sediment Basin #7
FW-3	Proposed location in Sediment Basin #6

Notes:
1. SW – surface water
2. FW – free water

At each location, one sample will be collected close to the surface (i.e., 0 foot to 1 foot from surface) of the water body. Prior to sampling, the depth of the water body will be measured by slowly lowering a measuring stick or tape until the bottom surface is encountered, being careful to avoid suspending sediment. The depth to bottom will be noted, and a sampler will be slowly lowered to the desired depth to collect the sample. The sample will be retrieved and transferred into laboratory-provided sample containers. Surface and free water samples will be analyzed for the same constituents as groundwater samples (Table 5). Given the potential for sediment to artificially bias laboratory results high, unfiltered and field-filtered samples will be collected at each location and analyzed for total and dissolved concentrations, respectively.

3.4 Geochemical Evaluation

The geochemistry of the constituents that have been detected in groundwater samples can provide information about their sources and fate and transport processes through the environment. Evaluations of the suites of constituents detected can help differentiate groundwater that originates at the Structural Fill from groundwater that originates elsewhere. Much of the data needed to evaluate the geochemistry is already being collected during the semi-annual monitoring program; however, some additional sampling and analyses will be necessary make the geochemical evaluations more comprehensive and conclusive.

Prior to CCP placement in the Structural Fill, groundwater sampling was conducted during two events in August and October 2015, representing pre-ash groundwater conditions. Constituent concentrations in pre-ash groundwater samples collected from monitoring wells within the former General Shale mine are consistently higher than those reported in background well BG-1 collected during the same events or in BG-2 collected in 2018 and 2019; both BG-1 and BG-2 are located outside of the former General Shale mine boundary.

HDR proposes to evaluate the potential effects historic earthwork may have had on pre-ash soil and groundwater via collection and analysis of 10 surficial soil samples from the southern portion of the permitted Structural Fill and select background locations, as follows:

1. Low-detection level analyses of the constituents detected in the groundwater and surface water:
    - Antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, lead, lithium, molybdenum, selenium, and thallium using USEPA Method 200.8 (or similar); and,
    - Mercury using USEPA Method 245.1.
2. Synthetic Precipitation Leaching Procedure (SPLP) testing of three of soil samples (chosen after the low-detection level analyses) for the constituents detected in groundwater (note that chemical analyses of leachate samples generated by the SPLP testing needs to be at detection levels that can be compared to the detected concentrations in the groundwater):
    - Antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, lead, molybdenum, and selenium using USEPA Method 6010D;
    - Boron, lithium, and thallium using USEPA Method 6020B;

- Mercury using USEPA Method 7470A;
- Total dissolved solids using Standard Method (SM) 2540C;
- pH using USEPA Method 9040C;
- Fluoride and sulfate using USEPA Method 300.0; and,
- Chloride using SM 4500-Cl-E-2011

3. Analyses of soil samples for organic carbon and other geochemical properties that affect constituent transport.

When the data above is collected and combined with existing (semi-annual monitoring) and proposed (see **Sections 3.1 through 3.3**), it will be used to evaluate the occurrence (e.g., boron) or absence (e.g., antimony) of constituents and which constituents and parameters are correlated. These evaluations will include comparison of ratios between analytes with reference to potential sources, balancing cations and anions, and comparison to water parameters such as oxygen-reduction potential (ORP), dissolved oxygen (DO) and pH. This information will be used to differentiate groundwater chemistry at individual wells and to help prepare for potential constituent fate and transport modeling.

3.5 Groundwater Modeling

Groundwater modeling can be used to demonstrate groundwater movement patterns in the subsurface near the Structural Fill and to simulate the fate and transport of the constituents detected during groundwater monitoring. The model predictions can be used in conjunction with other information, such as geochemical analyses, to identify potential sources of the constituents. The model and model report will be developed in general accordance with the guidelines found in the memorandum Groundwater Modeling Policy, NCDENR DWQ, May 31, 2007. Modeling will be conducted in two parts: 1) groundwater flow modeling and 2) groundwater fate and transport modeling. In general, the groundwater flow modeling will consist of the following steps:

1. *Data compilation/Conceptual model development* – Data from site investigations and from regional and national sources such as NOAA, and the USGS will be compiled into a 3-dimensional database to develop a digital conceptual site model (CSM). This digital CSM will focus on the materials that make up, and stress on, the groundwater flow system in the vicinity of the Site.
2. *Model set up* – The digital CSM will be used as the basis for the numerical groundwater model. A model grid will be discretized within the identified model domain and initial hydrogeologic properties will be assigned to geologic material identified within the domain. Existing water sources and sinks will be added to the domain. An initial model will be created and run and compared to the measured data from the Site. The model will be updated as new information is derived from the field activities.
3. *Model calibration* – Parameters used in the model will be adjusted to evaluate the best combination that matches parameter constraints and simulates measured conditions. Water levels and stream flows predicted by the model will be compared with measured data to create a model that simulates the Site conditions within acceptable

uncertainty. The model will be calibrated to existing data, but may be refined in the future as additional data are collected, if necessary.

4. *Sensitivity Analyses* – The importance of parameters used in the model to the uncertainty of the model prediction will be tested through sensitivity analyses. This will allow the uncertainty in the model to be quantified, which will put the predictive simulations into context.
5. *Predictive Modeling, Particle Tracing* – The calibrated model will be used to predict where water originating at the Structural Fill will ultimately discharge and which monitoring wells are in that path (forward particle tracking). A reverse approach can also be done where particles are placed at monitoring wells and the location where the water enters the aquifer can be identified (reverse particle tracking). These analyses can also predict the time of travel for the water from one location to another given the average groundwater gradients.

Once the flow model is calibrated and particle tracking have been completed, simulations of the fate and transport of constituents will be conducted using the following steps:

1. *Model Calibration* – Parameters used in the fate and transport model will be adjusted to determine the best combination that matches parameter constraints and simulates measured concentrations of constituents. Constituent concentrations predicted by the model will be compared with measured data to create a model that simulates Site conditions within acceptable uncertainty. The model will be calibrated to existing data, but may be refined in the future as additional data are collected, if necessary.
2. *Sensitivity Analyses of Fate and Transport Model* – The importance of parameters used in the model to the uncertainty of the model prediction will be tested through sensitivity analyses. This will allow the uncertainty in the model to be quantified, which will put the predictive simulations into context.
3. *Predictive Modeling, Constituent Fate and Transport* – The possibility of alternative sources for constituents can be tested using the calibrated fate and transport model. This evaluation will be undertaken in conjunction with the geochemical evaluation described in Section 3.4 above.

4 Reporting

Subsequent to the conclusion of groundwater modeling, HDR will prepare an Assessment Monitoring Report (AMR) to summarize the activities proposed herein. The AMR will, in part, supplement the Alternate Source Demonstration (ASD) of exceedances that was previously submitted to the NCDEQ on March 29, 2019. The AMR will consist of the following components:

- Executive Summary
- Site History and CCP Characterization
- Receptor Information
- Regional Geology and Hydrogeology
- Site Geology and Hydrogeology
- Soil Sampling Results
- Groundwater Sampling Results
- Geochemical Evaluation
- Groundwater Modeling Results
- Conclusions and Recommendations
- Figures
- Tables
- Appendices

The AMR will provide the results of one iterative assessment phase. No off-site assessment or access agreements are anticipated to be utilized during this phase of work.

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Figures

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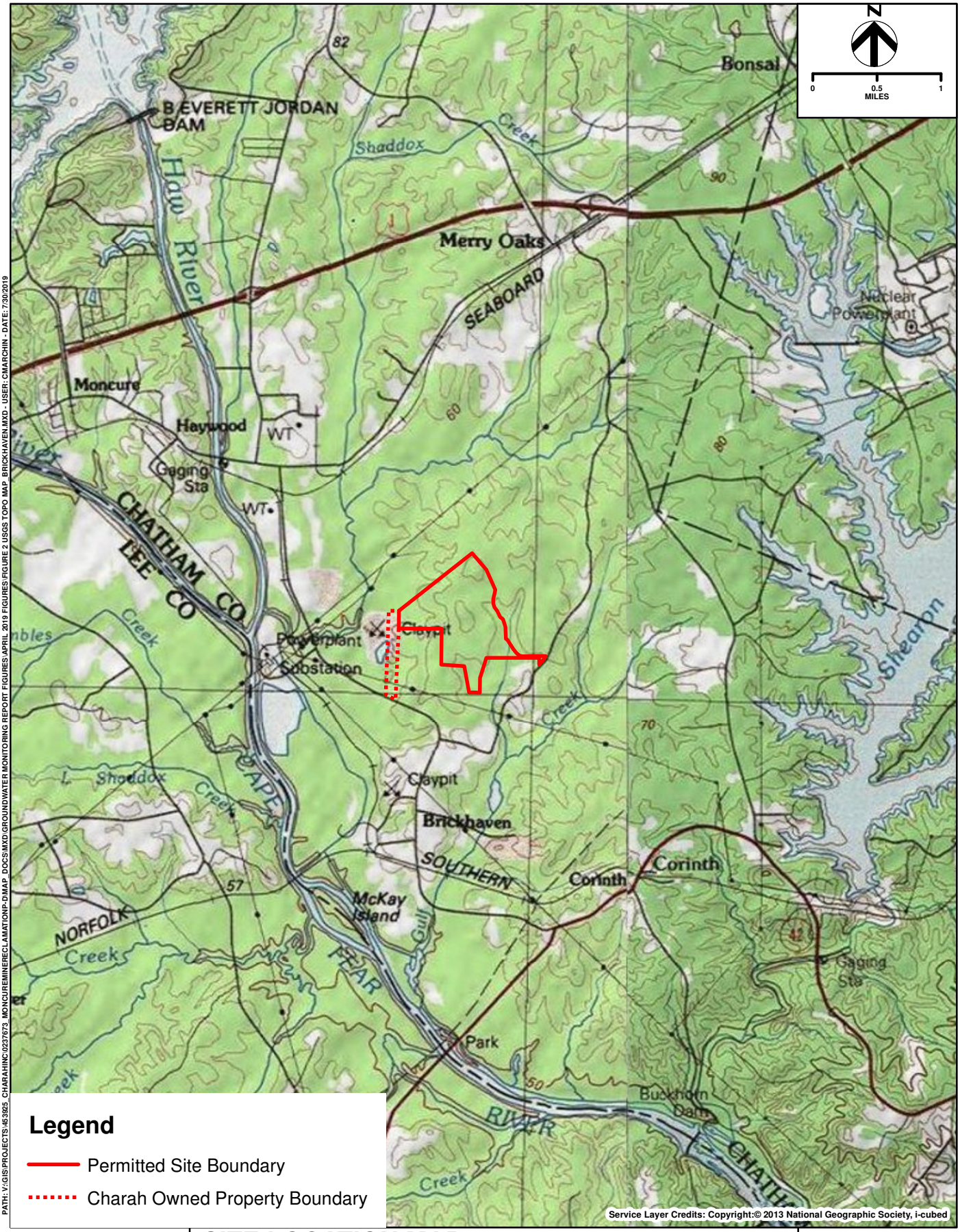

Legend

- Permitted Site Boundary
- Charah Owned Property Boundary

PATH: V:\GIS\PROJECTS\463925_CHARAHINC\0237673_MONCUREMINERECLAMATIONP-D\MAP_DOCS\MXD\GROUNDWATER MONITORING REPORT FIGURES\APRIL 2019 FIGURES\FIGURE 2 USGS TOPO MAP_BRICKHAVEN.MXD - USER: CMARCHIN - DATE: 7/30/2019

SITE LOCATION MAP
CHARAH SOLUTIONS, INC
MONCURE, NORTH CAROLINA

BRICKHAVEN NO. 2 MINE TRACT "A"

DATE

AUGUST 2019

FIGURE

1

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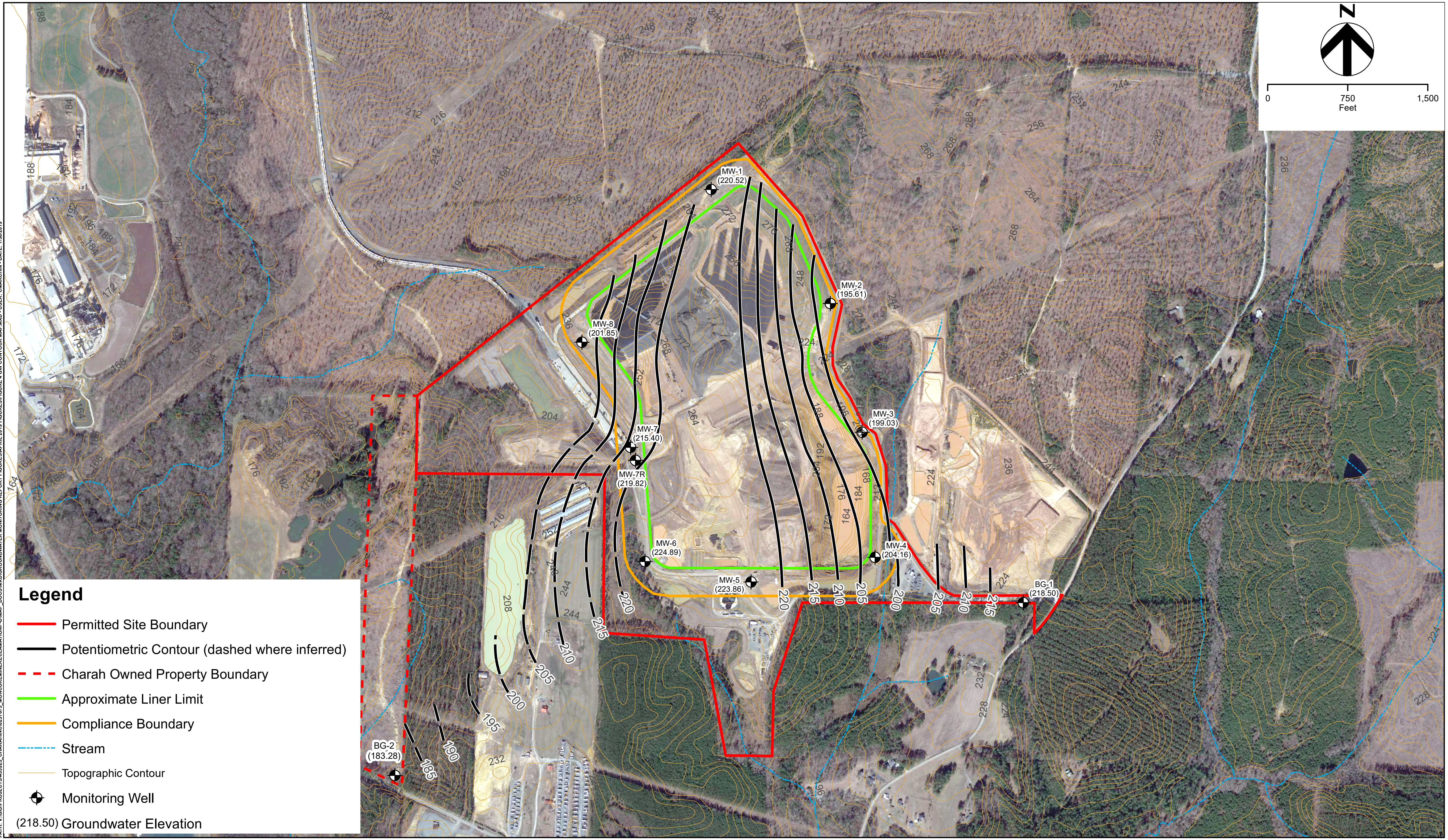


Note:
1. Groundwater elevations derived from depth to water measurements collected on January 21, 2019.
2. Topography data for the site was obtained from NCDOT Geographic Information System (GIS) website (Dated 2007).
3. Aerial photography was obtained from Google Earth dated 2018.

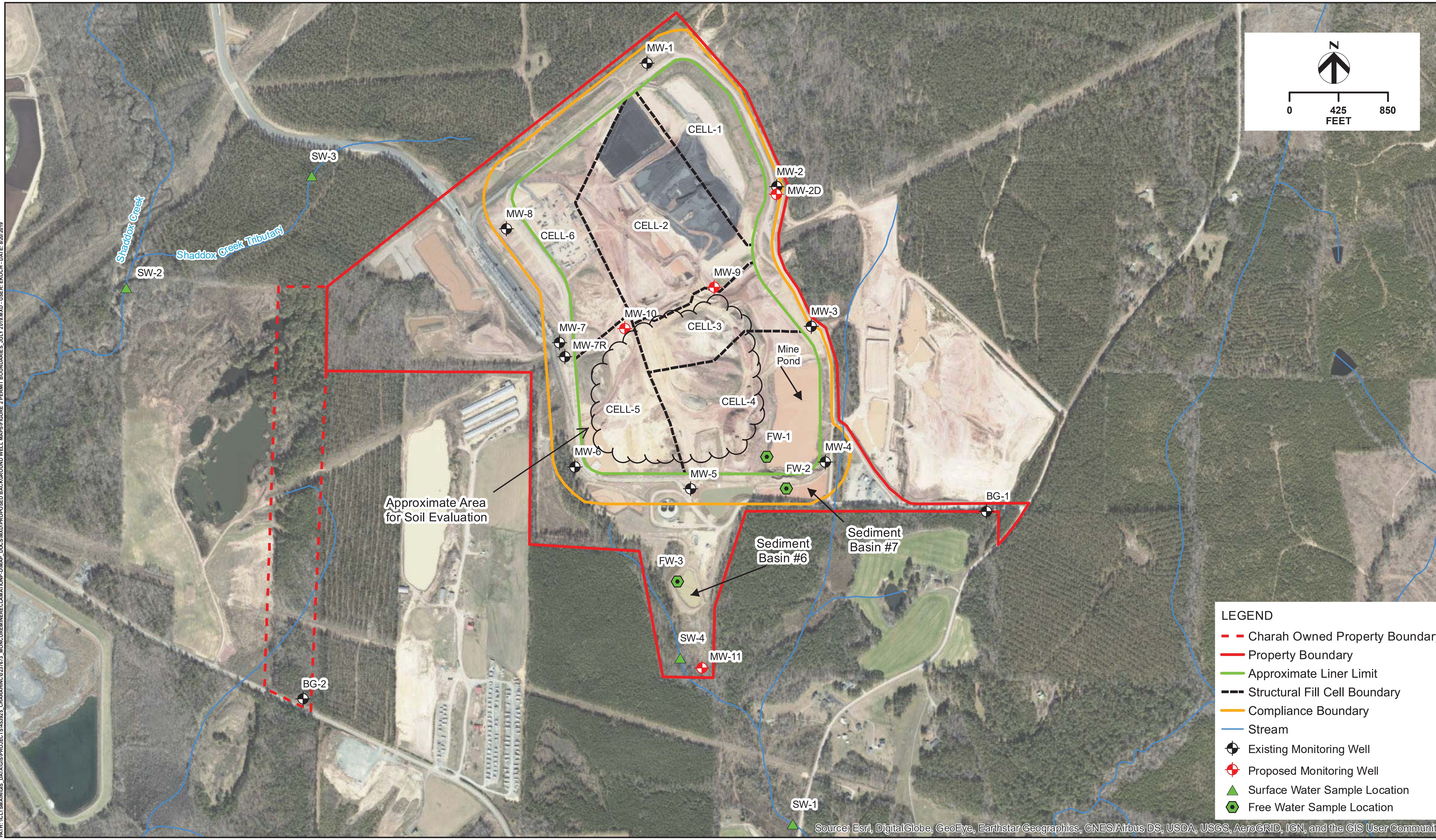
HDR

POTENTIOMETRIC SURFACE MAP - JANUARY 2019
CHARAH SOLUTIONS, INC.
MONCURE, NORTH CAROLINA

BRICKHAVEN NO. 2 MINE TRACT "A"

DATE
AUGUST 2019

FIGURE
2



PATH: \\CLTSMAIN\GIS_DATA\GIS\PROJECTS\453925_CHARAHINC\0237673_MONCUREMINERECLAMATIONP-D\MAP_DOCS\MXD\PROPOSED BACKGROUND WELL MAPS\FIGURE 2 PERMIT BOUNDARIES_JULY 2019.MXD - USER: EKOCH - DATE: 8/20/2019

HDR

SAMPLE LOCATION MAP
CHARAH SOLUTIONS, INC.
MONCURE, NORTH CAROLINA

BRICKHAVEN NO. 2 MINE "A"

DATE

AUGUST 2019

FIGURE

FIGURE 3

440 South Church Street, Suite 1000
Charlotte, NC 28205
704.338.6700

hdrinc.com

D

Attachment D – Assessment Work Plan Implementation Schedule

September 30, 2019

Ms. Elizabeth S. Werner, P.G. Via email elizabeth.werner@ncdenr.gov
Hydrogeologist
North Carolina Department of Environmental Quality
Division of Waste Management – Solid Waste Section
217 West Jones Street
Raleigh, North Carolina 27699

Re: Assessment Work Plan Implementation Schedule
Brickhaven No. 2 Mine Tract "A" Structural Fill
1910-STRUC-2015
Chatham County
FID 1358186

Dear Ms. Werner,

On behalf of Green Meadow, LLC (Owner), HDR Engineering, Inc. of the Carolinas (HDR) is pleased to provide the schedule for implementation of work proposed in the Groundwater and Surface Water Assessment Work Plan (Work Plan) prepared for the above-referenced site, dated August 16, 2019. The Work Plan was approved in correspondence from the North Carolina Department of Environmental Quality (NCDEQ) addressed to Mr. Norman Divers of Charah Solutions, Inc. on September 16, 2019. Per the approval letter, the Owner respectfully submits this schedule to satisfy the two week work schedule requirement.

Please do not hesitate to contact us at (704) 338-6700 or Mark.Filardi@hdrinc.com, if you have questions regarding this submittal.

Sincerely,
HDR Engineering, Inc. of the Carolinas

Mark Filardi, PG
Senior Geologist

Michael Plummer, PE
Project Manager

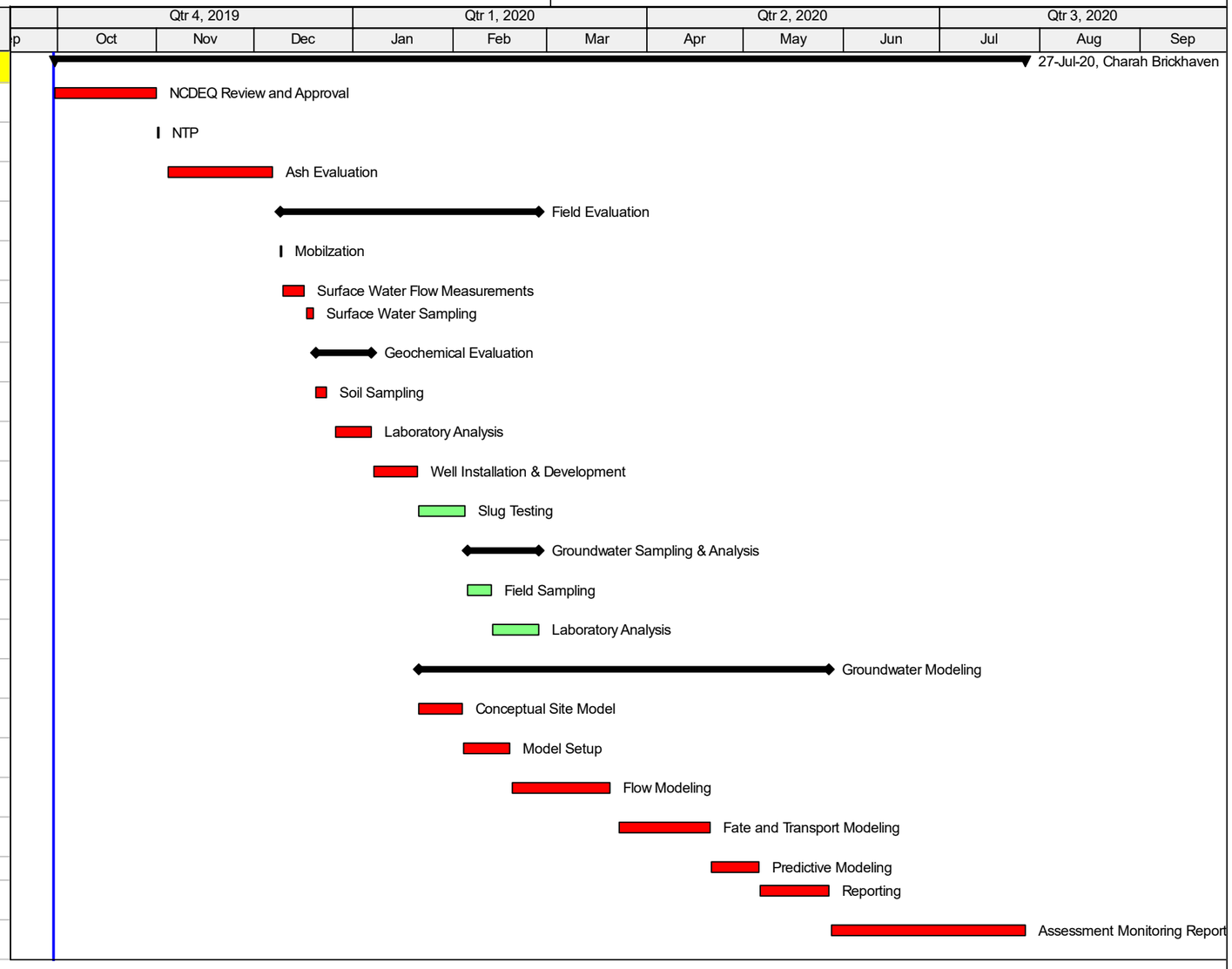
cc: Norman Divers, Charah Solutions, Inc.

Brickhaven No. 2 Mine Tract "A" Structural Fill
1910-STRUC-2015
Chatham County, NC

Schedule for Implementation of Groundwater & Surface Water Assessment Work Plan

September 30, 2019

#	Activity ID	Activity Name	Remaining Duration	Start	Finish
1		**Charah Brickhaven Schedule**	208d	30-Sep-19	27-Jul-20
2	1.0	NCDEQ Review and Approval	24d	30-Sep-19	31-Oct-19
3	2.0	NTP	1d	01-Nov-19	01-Nov-19
4	3.0	Ash Evaluation	23d	04-Nov-19	06-Dec-19
5	4.0	Field Evaluation	56d	09-Dec-19	27-Feb-20
6	4.1	Mobilzation	1d	09-Dec-19	09-Dec-19
7	4.2	Surface Water Flow Measurements	5d	10-Dec-19	16-Dec-19
8	4.3	Surface Water Sampling	3d	17-Dec-19	19-Dec-19
9	4.4	Geochemical Evaluation	9d	20-Dec-19	06-Jan-20
10	4.4.1	Soil Sampling	2d	20-Dec-19	23-Dec-19
11	4.4.2	Laboratory Analysis	7d	26-Dec-19	06-Jan-20
12	4.5	Well Installation & Development	10d	07-Jan-20	20-Jan-20
13	4.6	Slug Testing	11d	21-Jan-20	04-Feb-20
14	4.7	Groundwater Sampling & Analysis	17d	05-Feb-20	27-Feb-20
15	4.7.1	Field Sampling	6d	05-Feb-20	12-Feb-20
16	4.7.2	Laboratory Analysis	11d	13-Feb-20	27-Feb-20
17	5.0	Groundwater Modeling	90d	21-Jan-20	27-May-20
18	5.1	Conceptual Site Model	10d	21-Jan-20	03-Feb-20
19	5.2	Model Setup	11d	04-Feb-20	18-Feb-20
20	5.3	Flow Modeling	23d	19-Feb-20	20-Mar-20
21	5.4	Fate and Transport Modeling	20d	23-Mar-20	20-Apr-20
22	5.5	Predictive Modeling	11d	21-Apr-20	05-May-20
23	5.6	Reporting	15d	06-May-20	27-May-20
24	6.0	Assessment Monitoring Report	42d	28-May-20	27-Jul-20



Remaining Level of Effort | Remaining Work | Milestone
Actual Work | Critical Remaining Work | Summary

Data Date: 30-Sep-19
Charah Brickhaven

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