Commonwealth of Virginia

Zimmerman, Ann <ann.zimmerman@deq.virginia.gov>

Shenandoah Crossing BLM

1 message

Beth Thompson <beth@btsolutionssc.com> Tue, Feb 8, 2022 at 3:53 PM
To: "Whitehurst, David" <david.whitehurst@deq.virginia.gov>, Ann Zimmerman <ann.zimmerman@deq.virginia.gov>, Bryant Thomas <bryant.thomas@deq.virginia.gov>, Kennedy John ika95442 <john.kennedy@deq.virginia.gov>, Robertson Tish msf11012 <tish.robertson@deq.virginia.gov>
Cc: Melanie Baker <melanie.baker@bluegreenvacations.com>

David,

I am pleased to submit the final report for the Shenandoah Crossing Copper BLM study. This is being submitted in fulfillment of the Progress Report for copper compliance due February 10, 2022. Attached to this email you will find a cover letter, the final report, and supporting appendices.

Please let me know if you need any hard copies sent, and how many. I'll be happy to get that to you this week. As stated in the cover letter, I am available for an in-person or conference call to discuss the report. Thank you; as always it has been a pleasure working with you.

Warmest Regards,

BethA

Beth Thompson

BT Solutions, LLC

336 Cobbleview Drive,

Lexington, SC 29072

803-447-8471

BTSolutionsSC.com

3 attachments

- **Shenandoah STP BLM Final Report February 2022 Cover Letter.pdf** 531K
- **Shenandoah STP BLM Final Report February 2022.pdf** 1009K
- **Shenandoah STP BLM Final Report February 2022 APPENDICES.pdf** 17123K

SOLUTIONS, LLC

336 Cobbleview Drive, Lexington, South Carolina 29072

February 8, 2022

David Whitehurst
Virginia Department of Environmental Quality
P.O. Box 1105
Richmond, Virginia 23218

Dear Mr. Whitehurst:
On behalf of Leisure Capital Corporation, I am pleased to provide the final report for a Copper Biotic Ligand Model (CuBLM) study for the Shenandoah Crossing Resort Sewage Treatment Plant (STP). We submit this report for the development of dissolved copper site-specific criteria as provided in 9VAC25-260.140. G. This study was conducted in accordance with the study plan approved by VADEQ on December 18, 2020.

The existing permit rationale states that a copper limit is needed for protection of aquatic life at the chronic level, therefore, the BLM-generated criterion continuous concentration (CCC) will most likely be used. The study resulted in a geometric mean of all BLM-generated CCC values of 11.74 µg/L The chronic FMB is 10.84 µg/L. We respectfully request that the geometric mean of 11.74 µg/L be used as the site-specific water quality criterion since there was a low correlation between dissolved copper concentration and the BLM-generated dissolved criteria (R=0.18). In discussions with the software developer, we have been told that the FMB is an appropriate indicator for water quality criteria when the dissolved copper to BLM-generated CCC/CMC correlation is high. In this case, it is not.

Thank you for all your assistance throughout this project. I am available for an in-person meeting or conference call if any aspect of the study needs to be discussed.

Warmest Regards,

Elizabeth W. Thompson

Elizabeth W. Thompson
Owner/Consultant

cc: Ann Zimmerman
John Kennedy
Tish Robertson
Bryant Thomas

SOLUTIONS, LLC

DEVELOPMENT OF SITE-SPECIFIC COPPER LIMITS FOR THE SHENANDOAH CROSSING SEWAGE TREATMENT PLANT

THE COPPER BIOTIC LIGAND MODEL
FINAL REPORT
FEBRUARY 2022

REPORT SUBMITTED TO:

LEISURE CAPITAL CORPORATION
SHENANDOAH CROSSING
174 Horseshoe Circle
Gordonsville, Virginia 22942

REPORT SUBMITTED BY:

Elizabeth D. Thompson 2/1/2022

BT SOLUTIONS, LLC.
336 Cobbleview Drive
Lexington, South Carolina 29072

DEVELOPMENT OF SITE-SPECIFIC COPPER LIMITS FOR THE SHENANDOAH CROSSING SEWAGE TREATMENT PLANT

THE COPPER BIOTIC LIGAND MODEL
FINAL REPORT
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Section 1: Executive Summary

Leisure Capital Corporation (LLC) operates the Shenandoah Crossing Sewage Treatment Plant (SCSTP, VA0076678) which discharges treated and disinfected effluent into Lickinghole Creek. The creek enters Lake Izac and exits as the spillway from Lake Izac in Louisa County, Virginia. SCSTP was issued a VPDES permit effective July 1, 2019, which includes a Total Recoverable Copper limit of 11 µg/L (monthly and weekly average), and a Schedule of Compliance with a required completion date of June 30, 2023. Once the Schedule of Compliance has been completed, the permit limit will decrease to 8.7 µg/L Total Copper (monthly and weekly average), unless an alternate limit has been approved.

To derive a permit limit for copper representative of site conditions, LLC contracted with BT Solutions, LLC., to conduct the EPA-approved Biotic Ligand Model (BLM). A biotic ligand is a theoretical representation of the gill or gill structure of an aquatic organism, where the toxic effect of dissolved metals occurs. The BLM is a tool used to predict the toxicity of a metal such as copper to aquatic organisms based on measured site-specific water characteristics. The copper BLM takes user input of site water chemical measurements and predicts water quality criteria based on the effect copper would have in that specific water sample on the biotic ligand. The model works by taking into account the speciation of the copper as well as interactions of other chemical and physical properties of the water. Some of these interactions have a mitigating effect on copper toxicity and others have an additive effect.

EPA's 2007 copper criteria document (EPA-822-R-07-001) describes the BLM method, and the Commonwealth of Virginia adopted the BLM to derive copper limits in 9VAC25-260-140G, effective June 27, 2017. To conduct BLM study for SCSTP, effluent samples were collected at the outfall and analytical procedures conducted. The test samples consisted of 100% final effluent, which reflects critical-flow conditions (7Q10 and 1Q10 of 0 MGD). The following analytical data were collected for each effluent sample: temperature, pH, DOC, dissolved copper, dissolved calcium, dissolved magnesium, dissolved sodium, dissolved potassium, sulfate, chloride, and alkalinity. The results were entered into BLM software (Windward Environmental, LLC, version 3.41.2.45) and the program set for copper Water Quality Criteria (WQC) output. Each sample entered produced instantaneous water quality criteria (IWQC) in the form of a criterion continuous concentration (CCC) and a criterion maximum concentration (CMC). Fixed monitoring benchmarks (FMBs) were also generated for the entire data set.

All data gathered from January – December 2021 were entered into the BLM software which resulted in a set of thirteen (13) samples. From the data set, the BLM calculated a CMC geometric mean of 18.90 µg/L

and a geometric mean acute FMB of 17.28 µg/L. The BLM also calculated a CCC geometric mean of 11.74 µg/L and a geometric mean chronic FMB of 10.84 µg/L.

Effluent sample collection was conducted by SCSTP personnel. Samples collected January-March 2021 were analyzed by Pace Laboratories (VELAP #460132 and #110033) and the samples collected April-December 2021 were analyzed by James R. Reed & Associates, Newport News, Virginia (VELAP #460013). Data analysis using the BLM and final report preparation were conducted by BT Solutions, LLC., of Lexington, South Carolina.

Section 2: Site and Sample Description

LCC operates the Shenandoah Crossing WWTP in Louisa County, Virginia (VPDES# VA0076678). The facility's design flow is 0.1 MGD, and final effluent discharges to Lickinghole Creek in the York River Basin. The 1Q10 and 7Q10 of Lickinghole Creek are both 0 MGD. A facility map is provided in Section 10.

The site for the copper BLM study was defined to be a location representative of critical-flow conditions. Since Lickinghole Creek has both 1Q10 and 7Q10 values of 0 MGD, the critical-flow condition is 100% final effluent. Lickinghole Creek enters Lake Izac and leaves the lake at the dam spillway on the property of Shenandoah Crossing Resort. The samples collected and submitted for BLM characterization consisted of 100% SCSTP final effluent collected after the last treatment process and before the discharge enters Lickinghole Creek at the base of the dam spillway. Final effluent samples were collected prior to entering Lickinghole Creek; no dilution with receiving stream water was allowed.

Section 3: Sampling Procedures and Frequency

3.1 Sampling Conditions and Sample Acceptance

A minimum of twelve (12) monthly sampling events occurred with the frequency of one (1) sample collected in every calendar month. An extra sampling event occurred in February 2021, due to a concern of laboratory analysis error. After further review, however, both February 2021 samples provided data valid for use in the BLM so both sets were included. Each month/season was represented in the final data set.

Plant operating conditions were considered prior to each sampling event. If the STP was not operating normally as reported by STP operators, the sampling event was postponed until normal operations resumed.

Table 1 provides the current permitted specifications for SCSTP and the conditions during each sampling event. Total copper exceeded the permitted limit of 11 µg/L five (5) out of the thirteen (13) sampling

events. There was one exceedance of TSS (week of 6/21/2021) and one exceedance of TKN (week of 11/15/2021). These exceedances did not cause the BLM to produce CCC or CMC values that would be considered outliers.

Table 1: Shenandoah Crossing WWTP Permit Specifications and Sampling Conditions

	Average Limit														
PARAMETER	Monthly	Weekly	1/18/2021	2/15/2021	2/25/2021	3/15/2021	4/20/2021	5/22/2021	6/22/2021	7/20/2021	8/17/2021	9/21/2021	10/20/2021	11/16/2021	12/21/2021
FLOW (MGD)	Design=	0.1 MGD	0.056	0.062	0.059	0.048	0.05	0.05	0.05	0.044	0.048	0.033	0.047	0.042	0.049
pH (su)	6.0 - 9.0		7.5	7.3	7.3	7.1	7.3	7.5	7.4	7.1	7.4	7.6	7.6	7.2	7.5
CBOD(mg/L)	10	**15**	2	4	7	2	2	3	14	2	2	3	3	2	2
TSS (mg/L)	10	**15**	3.7	1.8	3.8	2.3	1.0	1.0	22.0	1.0	1.3	1.0	2.1	1.5	2.1
TKN(mg/L)	3.0	**4.5**	0.5	0.69	1.2	0.89	0.84	2.1	0.5	0.5	0.5	0.5	0.83	10.2	0.52
Dissolved Copper (ug/L)			8.93	7.12	5.85	19.7	9	9	6	9	14	11	11	14	10
Total Copper (ug/L)	11.0		11.4	7.03	5.35	18.6	10	9	6	9	15	12	11	15	11
Out of compliance?			copper			copper			TSS		copper	copper		copper, TKN	

Local weather conditions were monitored throughout the project using data from a weather station located at the Gordonsville, Virginia, MUNI Station (KGVE). A weather summary is provided in Appendix A, and includes daily high temperature, low temperature, average temperature, measured precipitation, and notations of significant weather events.

3.2 Sampling Process

Final effluent was collected as grab samples, as required by the client's permit for compliance monitoring of copper. Final effluent flow, *in-situ* temperature, and *in-situ* pH were recorded at the time of sample collection. A copy of the signed sample collection training procedure is included at the beginning of in Appendix B.

The effluent sample was transferred to an on-site laboratory where it was filtered, if required, and preserved for testing. Aliquots intended for the analysis of calcium, magnesium, sodium, potassium, copper, and dissolved organic carbon were filtered within fifteen (15) minutes of collection. Sulfate, chloride, and alkalinity samples were not filtered, but were thermally preserved. Hardness was not filtered but was preserved with nitric acid.

The samples were transported on ice to the laboratory for chemical analysis of the required parameters. Samples collected January through March 2021 were shipped to Pace Analytical and samples collected April through December 2021 were shipped to JR Reed, & Associates.

Section 4: Analytical Procedures

The following parameters were measured on each sample: temperature, pH, dissolved organic carbon (DOC), dissolved calcium, dissolved magnesium, dissolved sodium, dissolved potassium, dissolved copper, sulfate, chloride, and alkalinity. Table 2 provides the test procedures and minimum quantification limits intended to be used for the analyses. The only parameter that had results below detection was alkalinity. For the samples collected February through March, Pace Analytical provided a quantitation limit of 20 mg/L, and all three of the samples were reported as <20 mg/L. In the BLM software, these were entered

as ½ the reporting level. Beginning in April, all samples were analyzed by JR Reed & Associates, and the alkalinity reporting limit was 1 mg/L, as requested. Analytical reports are provided in Appendix B.

The following are notes regarding each parameter measured:

- Temperature was measured *in-situ* at the beginning of sample collection and was reported by the facility.
- pH was measured *in-situ* at the beginning of sample collection.
- Metals (copper, calcium, magnesium, sodium, and potassium), DOC, sulfate, chloride, and alkalinity were measured on grab samples as dissolved fractions.
- The recommendation of entering a near-zero concentration of sulfide into the BLM software was followed (Windward 2019); therefore, sulfide was not measured.
- The recommended humic acid value of 10% was entered into the BLM spreadsheet (Windward 2019).
- Hardness was measured on grab samples to compare the actual effluent hardness with the hardness used to derive the permitted copper limit.

Table 2: Test Procedures and Minimum Detection Limits Requested for Chemical Analyses

Parameter	Method	Preservation	Reporting Limit	Units
Temperature (*in-situ*)	SM 2550B	N/A	--	C
pH (*in-situ*)	SM 4500HB	N/A	--	SU
DOC	SM 5310B	Filtered, ≤6°C	0.5	mg/L
Dissolved Calcium	200.7	Filtered, HNO_3 to pH<2	0.05	mg/L
Dissolved Magnesium	200.7	Filtered, HNO_3 to pH<2	0.05	mg/L
Dissolved Sodium	200.7	Filtered, HNO_3 to pH<2	0.05	mg/L
Dissolved Potassium	200.7	Filtered, HNO_3 to pH<2	0.05	mg/L
Dissolved Copper	200.7	Filtered, HNO_3 to pH<2	0.001	mg/L
Chloride	300.0	≤6°C	0.5	mg/L
Hardness	SM 2340B	HNO_3 to pH<2	0.331	mg/L
Sulfate	300.0	≤6°C	1	mg/L
Alkalinity	SM 2320B	≤6°C	1*	mg/L

***** Pace Analytical reported to a detection limit of 20 mg/L.

Section 5: Quality Control Procedures

Copper blanks were collected from the filtration equipment used to process each sample for dissolved measurements. All blanks resulted in <0.001 mg/L dissolved copper. The result for each blank analyzed is included with each sample's analytical report.

Analytical procedures on samples collected January-March 2021 were conducted at Pace Analytical, located in Mt. Juliet, Tennessee, (VELAP ID #460132 or #110033). Laboratory QA/QC procedures were followed as documented in the Pace Analytical Manual and Standard Operating Procedures (SOP).

Analytical procedures on samples collected April-December 2021 were conducted at JR Reed and Associates, located in Newport News, Virginia (VELAP ID #460013). Laboratory QA/QC procedures were followed as documented in the JR Reed Quality Manual and Standard Operating Procedures (SOP).

Section 6: Application of the Biotic Ligand Model Software

6.1 Biotic Ligand Model Version

The BLM software was developed by Windward Environmental, LLC, and the version used was 3.41.2.45. This version generates IWQC's and provides FMBs as a part of the *USEPA WQC* mode output.

6.2 Biotic Ligand Input

The *BLM User's Guide and Reference Manual* (3.41.2.45) recommends sulfide be entered as a near-zero value (i.e., 1.0E-10 mg/L) instead of a measured value. It also recommends humic acid content be entered as 10% instead of a measured value. All other data values entered were measured.

An Excel data file was created exclusively for SCSTP BLM data. The *File Name* and *Description* was 'Shenandoah Crossing', the *Site Name* was 'SCSTP Effluent', and the *Sample Name* was the prefix 'SC' followed by the collection date of each water sample (e.g., SC011821). The full *Site Chemistry* tab was selected.

Under the *Inputs* menu the correct units for the input chemical parameters were selected to reflect the units provided by JR Reed and Associates, and the program was set to measure inorganic carbon with alkalinity input. The analytical results for a single sampling event were entered on one (1) line by the appropriate *Sample Name*. Figure 1 provides the completed BLM spreadsheet.

Description: Shenandoah Crossing BLM

Current Selections

Prediction Mode: Toxicity Metal: Cu Water Type: Freshwater

Organism/Test Info: US EPA WQC calculation

Site Chemistry | Simplified Site Chemistry

	Site Name	Sample Name	Temp.	pH	Cu	DOC	HA	Ca	Mg	Na	K	SO4	Cl	Alkalinity	S
			C		ug/L	mg C/L	%	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L CaCO3	mg/L
1	SCSTP Effluent	SC011821	7.4	7.5	8.93	5.16	10	31	6.05	60.8	8.52	73.4	38.1	31	1E-010
2	SCSTP Effluent	SC021521	9.8	7.3	7.12	4.98	10	30.3	5.18	37.2	6.68	18	47.4	10	1E-010
3	SCSTP Effluent	SC022521	9.2	7.3	5.85	4.61	10	26.8	5.04	60.4	8.69	40.9	46	10	1E-010
4	SCSTP Effluent	SC031521	12.4	7.1	19.7	5.93	10	24.9	5.05	58.9	8.48	47.1	27.3	10	1E-010
5	SCSTP Effluent	SC042021	15	7.3	9	3.6	10	27.9	5.5	53.1	11.2	39.1	42.6	26	1E-010
6	SCSTP Effluent	SC052221	15.8	7.5	9	3.5	10	25.3	5.66	56.2	13.9	26.3	35.8	42	1E-010
7	SCSTP Effluent	SC062221	22.9	7.4	6	3.6	10	35.2	6.82	52.8	16	45	59.2	22	1E-010
8	SCSTP Effluent	SC072021	24.9	7.1	9	4.2	10	37.9	6.76	80.8	17.4	36.6	69.3	37	1E-010
9	SCSTP Effluent	SC081721	25.4	7.4	14	4.2	10	46.2	8.13	59.4	17.5	52.8	59.1	6	1E-010
10	SCSTP Effluent	SC092121	22.5	7.6	11	4	10	32.6	6.37	80.2	16.9	31.1	54.3	43	1E-010
11	SCSTP Effluent	SC102021	17.1	7.3	11	4.4	10	27.7	6.05	84.2	18.3	41.7	45.6	46	1E-010
12	SCSTP Effluent	SC111621	11.9	7.3	14	5.9	10	28.4	5.68	86.5	16.6	56	55.5	108	1E-010
13	SCSTP Effluent	SC122121	10.6	7.3	10	7.2	10	31.5	6.11	73	15.1	32.6	52.3	86	1E-010

Figure 1: Input Fields for the Shenandoah Crossing STP 2021 Biotic Ligand Model Study

6.3 Biotic Ligand Execution

6.3.1 Metal/Organism Selection

After the data sets were entered, the appropriate operational parameters were selected to obtain the required result output. The *BLM Parameter File* selected was *USEPA WQC* (Figure 2). This option provides freshwater dissolved acute and chronic copper IWQC's for each row of input according to procedures in the USEPA 2007 copper WQC document. The *USEPA WQC* option also provides acute and chronic toxic units (TU's) computed as the ratio of measured dissolved copper to the chronic and acute IWQC generated for each row of input.

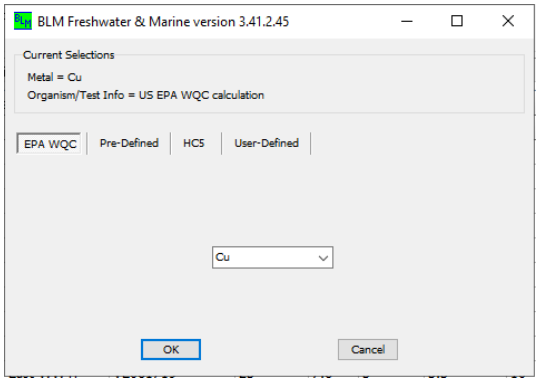


Figure 2: Options for Biotic Ligand Model Simulation

6.3.2 Prediction Mode

Since the *USEPA WQC* parameter file was selected, the application was in toxicity mode. *Prediction Mode: Toxicity* was displayed in the *Current Selection Display* area (Figure 3).

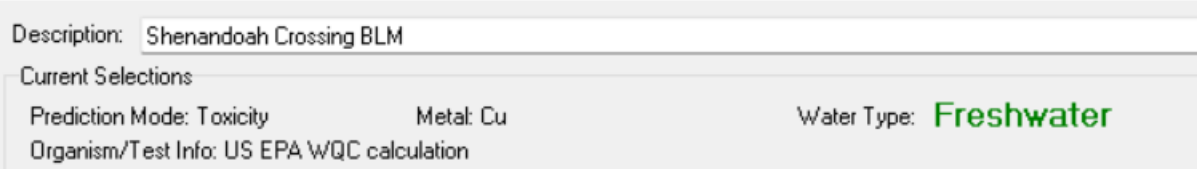


Figure 3: BLM Software Current Selection Display

6.3.3 FMB Calculation

Under the *Options* menu, *Calculate FMB* was checked. The default target exceedance frequency of once in three (3) years was used. The BLM software was executed using the geometric mean FMB calculation.

6.3.4 Check Inputs

The input measurements for the SCSTP site were compared to published ranges to analyze how well the data fit the model parameters. The BLM provides this input check and compares the measured values to the published ranges provided in Table 3 (BLM Users Guide 2019). The BLM may still be used if parameters fall outside of these ranges (USEPA Training Materials of Copper BLM).

Table 3: Water Chemistry Input Ranges for the Development and Calibration of the Copper BLM.

Parameter	Lower Bound	Upper Bound	Units
Temperature	10	25	C
pH	4.9	9.2	SU
DOC	0.05	29.65	mg/L
Calcium	0.204	120.24	mg/L
Magnesium	0.024	51.9	mg/L
Sodium	0.16	236.9	mg/L
Potassium	0.039	156	mg/L
Chloride	0.32	279.72	mg/L
Sulfate	0.096	278.4	mg/L
Alkalinity	1.99	360	mg/L

Once the *Input Check* was selected, the BLM provided a summary table to describe how well the entered data fit the expected ranges of the parameters. Figure 4 provides the input check report for the SCSTP data. The only parameter noted as out of range is sulfide, which was entered as a near-zero value as recommended by the BLM User's Guide (2019). After the data sets were evaluated for goodness-of-fit, BLM analysis was conducted by selecting the *Run BLM* icon and the output files saved.

Figure 4: Shenandoah Crossing STP BLM Input Check Report

Section 7: Biotic Ligand Model Data Reports

The Biotic Ligand Model generates three (3) report files: the water quality report (.wqc), a simple version of the model output (.sim), and a detailed version (.det) of the model output. All three (3) of these reports are available in Appendix C.

7.1 Water Quality Report (.wqc)

The WQC report provides the EPA 2007 freshwater dissolved acute and chronic IWQC generated for each row of input. IWQC is a designation which encompasses both the Criterion Continuous Concentration (CCC, also known as the chronic criterion) and the Criterion Maximum Concentration (CMC, also known as the acute criterion).

To calculate the IWQC, the program generated a BLM-based Final Acute Value (FAV) for each row of data. The CMC was calculated for each row of data as ½ the FAV, and the CCC was calculated by dividing the FAV by the Final Acute-Chronic Ratio (FACR) (EPA 2007).

The calculated acute and chronic toxic units (TU's) for each row of data was also provided on the BLM (.wqc) report. The acute and chronic TUs (TU_a and TU_c) were calculated as the measured dissolved copper concentration divided by the CCC (TU_c) or CMC (TU_a).

Using the BLM version 3.41.2.45, FMB's were generated as a part of the BLM report. The program used the acute and chronic TU values for each row of data to calculate recommended acute and chronic copper benchmarks that the facility would potentially exceed only once every three (3) years. Acute and chronic FMB's were provided for the entire twelve (12) month data set.

7.2 Simple Output File (.sim)

The simple output file includes the following: site and sample names, BLM chosen mode, pH, dissolved copper concentration in mol/L, free copper concentration in mol/L, concentration of copper and copper hydroxide bound to DOC in mol/L, concentration of copper on the biotic ligand(s) in nmol/g, DOC in mg/L, percent humic acid, and other input water chemistry in mol/L.

7.3 Detailed Output File (.det)

The detailed output file contains all chemical species accounted for in the BLM.

Section 8: Biotic Ligand Model Study Results

8.1 IWQC and FMB Results

The BLM reports are provided in Appendix C. Table 4 provides a summary of the following for each data set: BLM-derived FAV (final acute value), CCC, CMC, Acute TU, Chronic TU, and the measured dissolved copper. The table also includes summary statistics values. The BLM-generated CCC values ranged from 8.09 to 18.20 µg/L with a mean of 12.09 µg/L. The CCC FMB was 10.84 µg/L. The CMC values ranged from 13.11 to 29.30 µg/L with a mean of 19.47 µg/L. The CMC FMB was 17.28 µg/L.

Table 5 provides the acute and chronic FMB values.

Table 4: Summary of Shenandoah Crossing BLM Results

Date	BLM CMC (µg/L)	BLM CCC (µg/L)	FAV	Acute TU	Chronic TU	Dissolved Copper (µg/L)
1/18/2021	24.94	15.49	49.89	0.36	0.58	8.93
2/15/2021	17.46	10.84	34.92	0.41	0.66	7.12
2/25/2021	17.73	11.01	35.46	0.33	0.53	5.85
3/15/2021	17.66	10.97	35.33	1.12	1.80	19.7
4/20/2021	13.03	8.09	26.05	0.69	1.11	9
5/22/2021	16.54	10.28	33.09	0.54	0.88	9
6/22/2021	16.44	10.21	32.88	0.36	0.59	6
7/20/2021	13.11	8.14	26.21	0.69	1.11	9
8/17/2021	18.71	11.62	37.42	0.75	1.20	14
9/21/2021	25.54	15.86	51.08	0.43	0.69	11
10/20/2021	17.71	11.00	35.41	0.62	1.00	11
11/16/2021	24.99	15.52	49.98	0.56	0.90	14
12/21/2021	29.30	18.20	58.60	0.34	0.55	10
Geometric Mean	18.90	11.74				
Average	19.47	12.09				
10^{th} Percentile	13.06	8.11				
Coefficient of Variation	26.0	26.0				

Table 5: Shenandoah Crossing STP BLM-derived FMB Values

Center Statistic Used	Acute FMB (µg/L)	Chronic FMB (µg/L)
Geometric Mean	17.28	10.84
Median	16.65	10.39

8.2 IWQC Trends

Figure 5 shows the BLM-derived CCC values produced using SCSTP data for January – December 2021. To provide a comparison, the CCC from which the current SCSTP copper limits were derived (6.8 µg/L) is provided on the chart. This CCC value was derived using the hardness-based equation and a site hardness for SCSTP of 73 mg/L. This chart shows that the BLM-derived CCC values are all higher than the default CCC value used to derive the SCSTP permit limit.

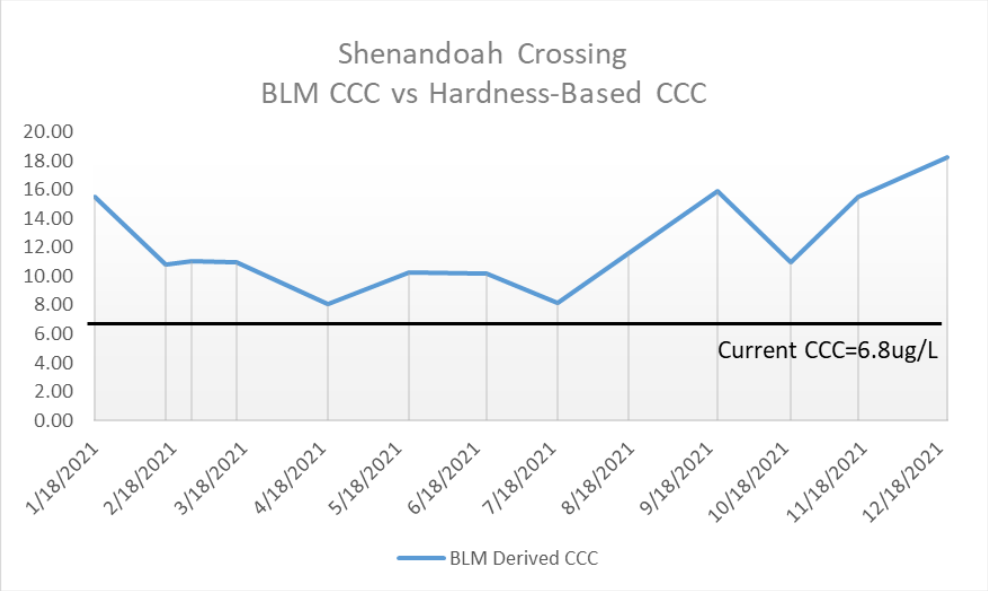


Figure 5: Shenandoah Crossing STP BLM-Derived CCC Values

Figure 6 shows the BLM-derived CMC values produced using SCSTP data for January – December 2021. To provide a comparison, the CMC from which the current SCSTP copper limits were derived (10 µg/L) is provided on the chart. This CMC value was derived using the hardness-based equation and a site hardness for SCSTP of 73 mg/L. This chart shows that the BLM-derived CMC values are all higher than the default CMC value.

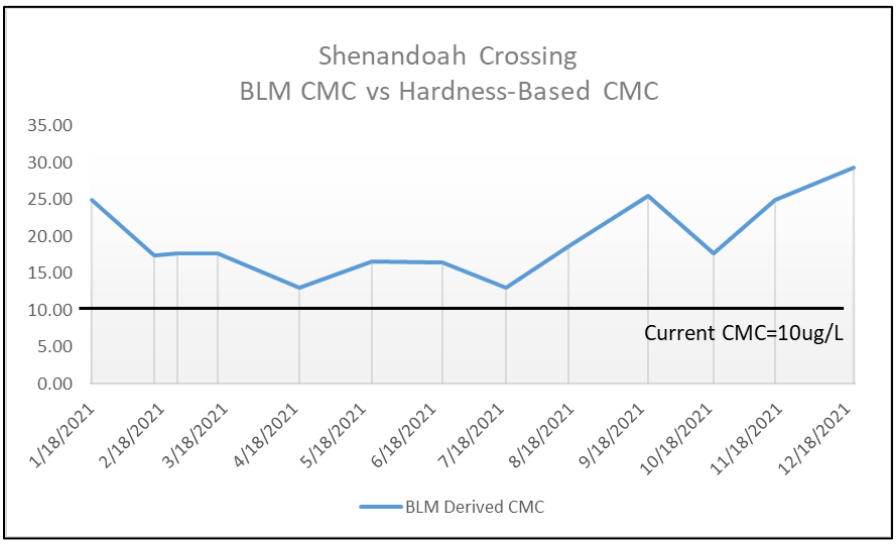
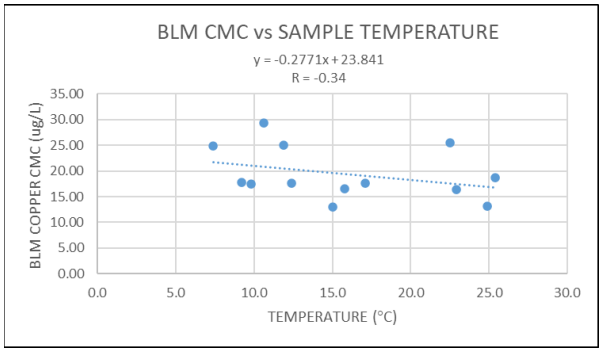
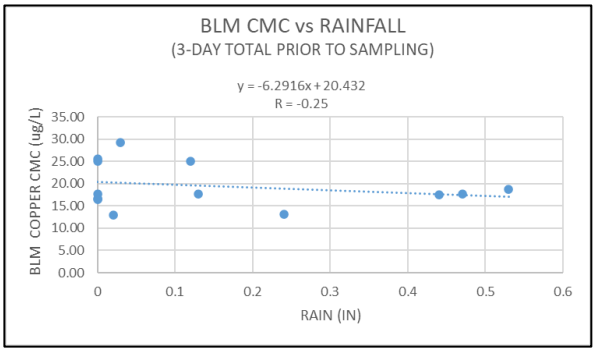


Figure 6: Shenandoah Crossing STP BLM-Derived CMC Values

8.2.1 IWQC Results as a Function of Sampling Conditions

To determine *how* environmental conditions during the sampling event impacted the final BLM-derived IWQC, the CMC values were plotted as a function of effluent temperature, three (3) day rainfall, and STP flow. It appears that the CMC decreases somewhat with increased temperatures and increased rain. These follow the typical trends that copper toxicity is inversely related to temperature (Pereira et al. 2017) and to increasing dilution from rainwater, which is generally of a low hardness and organic composition. Higher flows from SCSTP also produced lower BLM-derived CMC values.





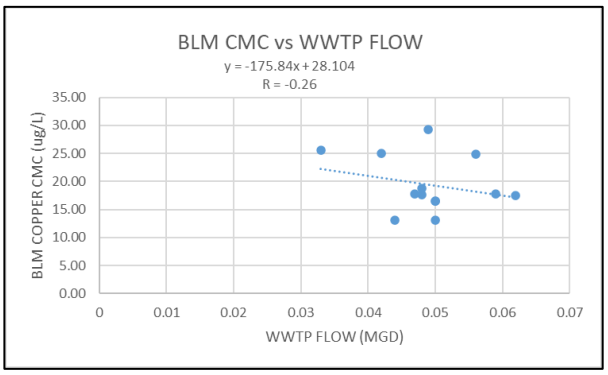
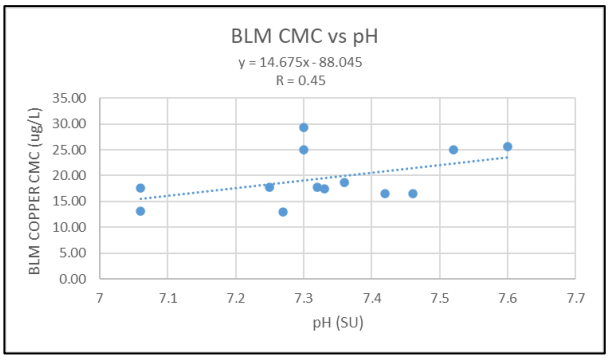


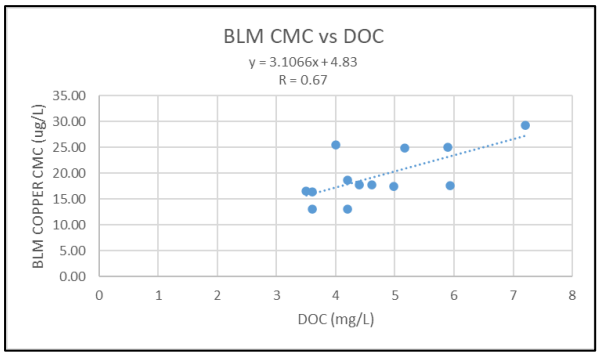
Figure 9: BLM CMC as a Function of WWTP Flow

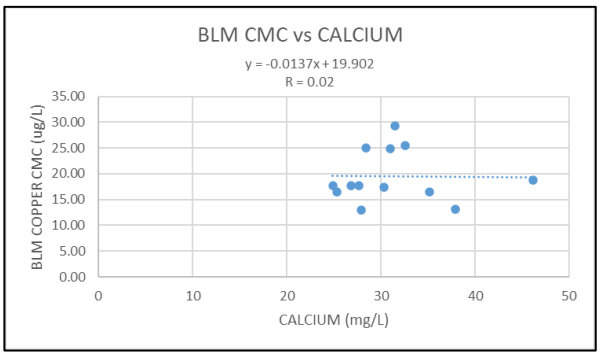
8.2.2 IWQC Results as a Function of BLM Parameter Values

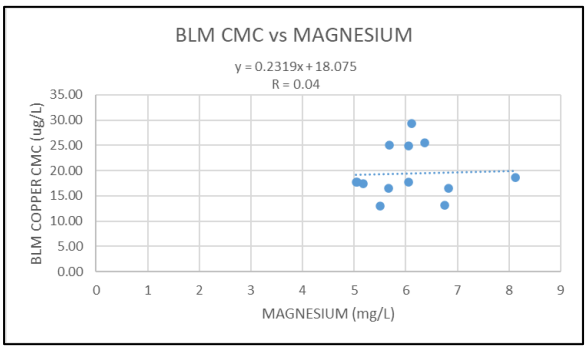
The model for predicting the BLM takes into account over ten (10) different parameters. An individual parameter would not be expected to drive the model, but its impact may be higher or lower than other parameters. Analyzing these impacts can provide insight into how local conditions affect the toxicity of copper in site water. The parameters expected to have a high impact are pH, DOC, alkalinity, calcium, magnesium, sodium, and chloride (Santore 2006).

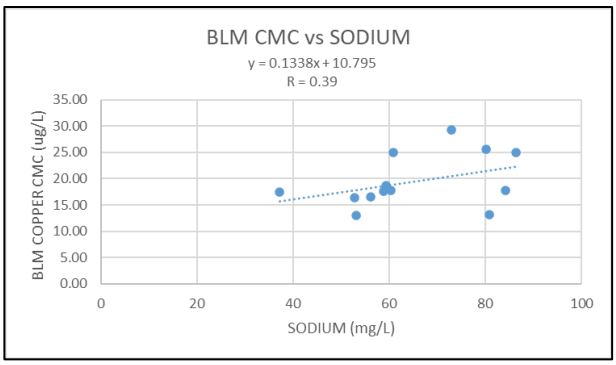
In order to determine how each BLM parameter impacted the BLM-derived IWQC values, the CMC values were plotted as a function of pH, DOC, dissolved calcium, dissolved magnesium, dissolved sodium, dissolved potassium, chloride, sulfate, and alkalinity. pH, DOC, sodium, potassium, and alkalinity displayed the higher correlations with BLM-derived CMCs.

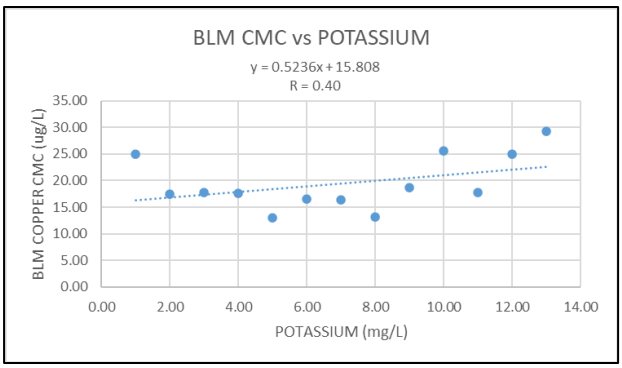


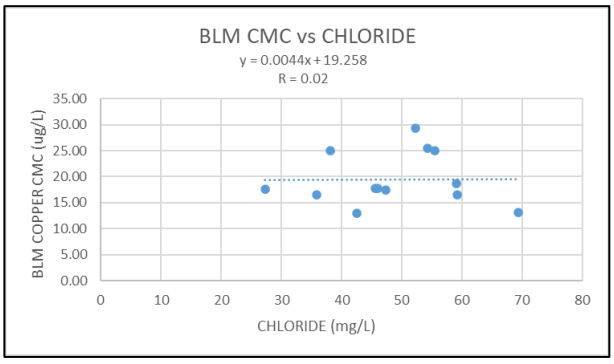


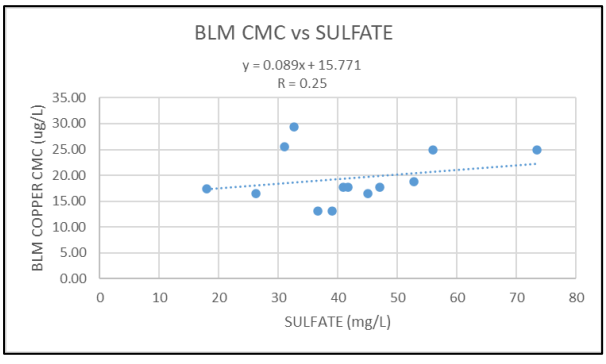

BLM CMC vs CALCIUM
y = -0.0137x + 19.902
R = 0.02
BLM COPPER CMC (ug/L)
CALCIUM (mg/L)

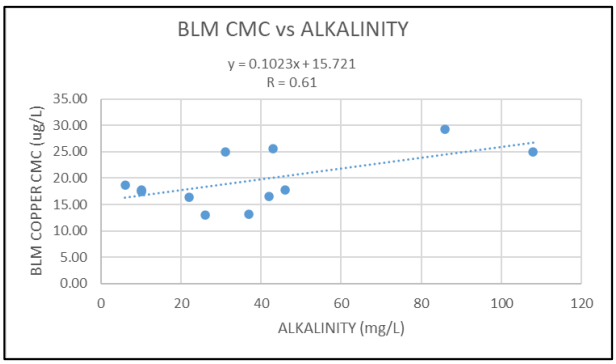

BLM CMC vs MAGNESIUM
y = 0.2319x + 18.075
R = 0.04
BLM COPPER CMC (ug/L)
MAGNESIUM (mg/L)


BLM CMC vs SODIUM
y = 0.1338x + 10.795
R = 0.39
BLM COPPER CMC (ug/L)
SODIUM (mg/L)


BLM CMC vs POTASSIUM
y = 0.5236x + 15.808
R = 0.40
BLM COPPER CMC (ug/L)
POTASSIUM (mg/L)


BLM CMC vs CHLORIDE
y = 0.0044x + 19.258
R = 0.02
BLM COPPER CMC (ug/L)
CHLORIDE (mg/L)


BLM CMC vs SULFATE
y = 0.089x + 15.771
R = 0.25
BLM COPPER CMC (ug/L)
SULFATE (mg/L)



8.2.3 IWQC Results Compared to Dissolved Copper and Hardness Values

CMC values were also plotted as a function of the effluent dissolved copper measurements and hardness. These parameters did not correlate well with the resulting BLM-derived CMC values.

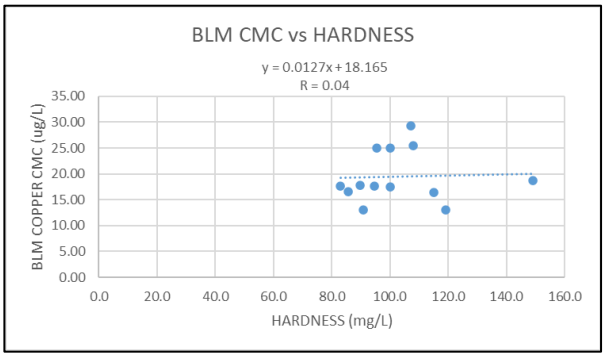


Figure 19: BLM CMC as a Function of Hardness

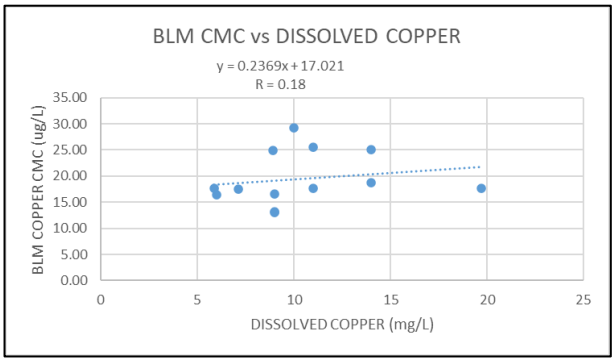


Figure 20: BLM CMC as a Function of Dissolved Copper

8.3 Hardness-Derived Criteria

The hardness equation used to determine water quality copper criteria is provided below (9 VAC 25-260, 2017). The conversion factor (CF) used to calculate a dissolved copper criterion is 0.96 (USEPA 2009). The default WER value is '1'. The in-stream hardness value used was 73 mg/L. It is notable that the hardness values measured during this study averaged 102 mg/L, which would have provided a higher CCC.

Freshwater acute criterion (µg/l)

$$\text{WER } [e^{\{0.9422[\ln(\text{hardness})]-1.700\}}] (CF_a)$$

Freshwater chronic criterion (µg/l)

$$\text{WER } [e^{\{0.8545[\ln(\text{hardness})]-1.702\}}] (CF_c)$$

Using the hardness-based equation, the acute WQC (CMC) at the permit hardness of 73 mg/L is 10 µg/L, the chronic criterion (CCC) is 6.8 µg/L. The SCSTP limit was given based on the need for chronic protection, therefore, the CCC was used to derive the permit limit. Based on this criterion, the monthly and weekly average limits in the permit (Effective Date 7/1/2019) were initially both 11 µg/L but were to be lowered to 8.7 µg/L at the completion of the Schedule of Compliance for Total Recoverable Copper.

Section 9: Conclusions

Using the hardness-based equation, the acute WQC at the permit hardness of 73 mg/L is 10 µg/L, the chronic criterion is 6.8 µg/L. The monthly and weekly average limits in the permit (Effective Date 7/1/2019) are currently both 11 µg/L but will be lowered to 8.7 µg/L at the completion of the Schedule of Compliance for Total Recoverable Copper, as designated by the permit. At a limit of 8.7 µg/L total copper, SCSTP would have had violations for ten (10) out of the thirteen (13) total copper samples analyzed during this BLM study.

While the BLM does not promise to provide higher copper limits than those based on the hardness-equation, it is expected to produce a more accurate value for the local conditions than the equation based only on hardness. The SCSTP limits issued in the 2019 VPDES permit were based on the need for a chronic limit, therefore, it is expected that the BLM-CCC values would apply. The BLM-derived CCC values for the SCSTP range from 8.14 to 18.20 µg/L, all of which are greater than the chronic WQC of 6.8 µg/L. The geometric mean of the BLM-CCC values is 11.74 µg/L, and the chronic FMB is 10.84 µg/L. These summary values are presented in Tables 4 and 5, above.

The Iowa Department of Natural Resources (DNR) published “Implementation Procedures for the Site-Specific Application of Copper Biotic Ligand Model (BLM)”, (Iowa 2017). In this guidance document, the criteria derivation decision process is defined as the flow chart provided below. According to the implementation chart published by the Iowa DNR, FMB values should be used as the criteria in deriving final limits for the Shenandoah Crossing STP.

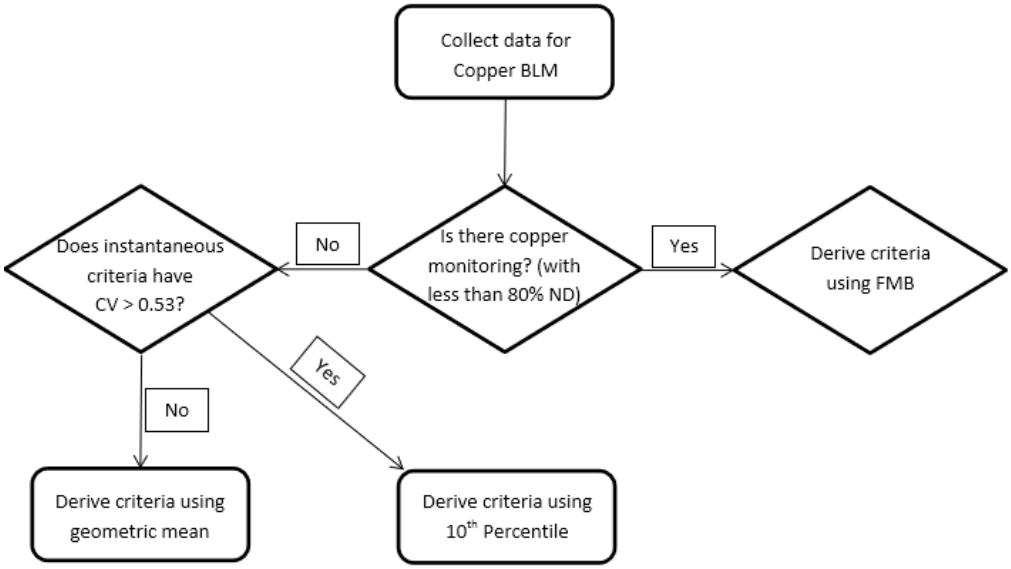


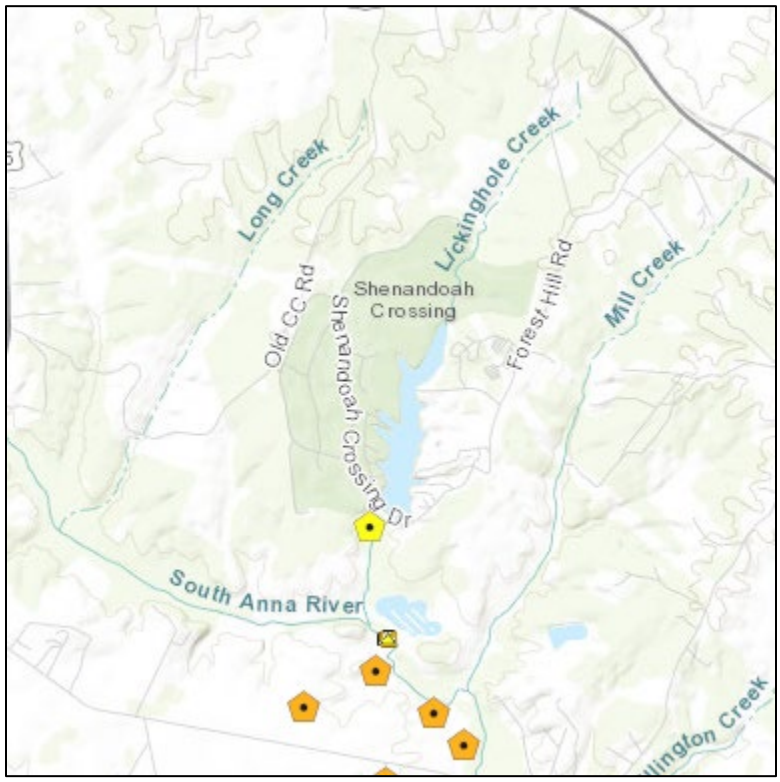
Figure 21: Criteria Derivation Decision Process (Iowa 2017)

There is no BLM implementation guidance published by the Virginia DEQ. Whether the BLM-CCC mean of 11.74 µg/L or the FMB of 10.84 µg/L is used to derive the site-specific copper limit for SCSTP, a higher limit than the anticipated 8.7 µg/L should be the result.

The use of the FMB relies on a positive correlation between IWQC's and dissolved copper concentrations. A strong relationship between the BLM-derived WQC and dissolved copper concentration does not appear to exist for this data set (Figure 20). According to the software developer, if the copper concentration does not correspond well with the BLM-derived WQC, the FMB would not be the best basis for the development of a final limit (Personal communication with Bob Santore, 2019).

While preliminary calculations with the FMB and BLM-derived CCC indicate that a total copper limit in the range of 14-16 µg/L may be expected, the study will require approval from Virginia DEQ and the final limits officially calculated.

Section 10: Facility Maps



Section 11: References

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SOLUTIONS, LLC

DEVELOPMENT OF SITE-SPECIFIC COPPER LIMITS FOR THE SHENANDOAH CROSSING SEWAGE TREATMENT PLANT

THE COPPER BIOTIC LIGAND MODEL
FINAL REPORT
FEBRUARY 2022

APPENDICES

APPENDIX A:

WEATHER MONITORING REPORTS

WEATHER DATA SUMMARY
JANUARY 2021
FACILITY: Shenandoah Crossing WTF
SOURCE: Louisa County Station / KLKU

Date	Avg Temp (F)	Low Temp (F)	High Temp (F)	Precip (IN)	Conditions
1/1/2021	25.6	32.2	39.5	0.57	Showers
1/2/2021	45.7	34.3	63.0	0.00	Sunny
1/3/2021	40.0	38.4	41.3	0.21	Cloudy
1/4/2021	39.0	33.9	43.1	0.01	Cloudy
1/5/2021	38.0	32.9	44.3	0.00	Cloudy
1/6/2021	34.0	25.8	46.9	0.00	Cloudy
1/7/2021	31.8	22.7	45.7	0.00	Sunny
1/8/2021	33.9	29.5	43.2	0.00	Cloudy
1/9/2021	33.5	22.0	47.1	0.00	Sunny
1/10/2021	33.7	22.9	51.1	0.00	Sunny
1/11/2021	30.5	21.6	39.3	0.01	Cloudy
1/12/2021	33.3	23.2	49.0	0.00	Sunny
1/13/2021	33.9	21.3	52.0	0.00	Sunny
1/14/2021	35.9	21.5	53.5	0.00	Sunny
1/15/2021	36.6	22.7	51.2	0.11	Foggy
1/16/2021	33.3	27.0	42.9	0.01	Cloudy
1/17/2021	35.0	27.8	45.2	0.00	Cloudy
*1/18/2021	35.1	28.2	41.7	0.00	Cloudy
1/19/2021	36.6	26.1	50.8	0.00	Sunny
1/20/2021	36.4	23.1	46.8	0.00	Sunny
1/21/2021	37.7	22.3	52.6	0.00	Sunny
1/22/2021	38.2	26.0	52.5	0.00	Sunny
1/23/2021	26.9	18.3	38.8	0.00	Sunny
1/24/2021	28.5	15.8	38.8	0.00	Cloudy
1/25/2021	35.2	31.6	38.9	0.37	Cloudy
1/26/2021	35.2	31.4	39.6	0.10	Cloudy
1/27/2021	38.6	32.9	48.3	0.00	Foggy
1/28/2021	30.2	22.0	38.4	0.01	Sunny
1/29/2021	23.6	13.2	35.1	0.00	Sunny
1/30/2021	25.5	12.1	38.1	0.00	Sunny
1/31/2021	29.1	26.6	31.8	0.47	Snow

*Sampling Date

WEATHER DATA SUMMARY
FEBRUARY 2021
FACILITY: Shenandoah Crossing WTF
SOURCE: Louisa County Station / KLKU

Date	Avg Temp (F)	Low Temp (F)	High Temp (F)	Precip (IN)	Conditions
2/1/2021	29.4	26.6	33.8	0.00	Cloudy
2/2/2021	33.7	31.1	37.4	0.01	Cloudy
2/3/2021	35.9	25.6	46.4	0.00	Sunny
2/4/2021	36.2	18.9	52.8	0.00	Sunny
2/5/2021	43.6	34.5	54.2	0.03	Cloudy
2/6/2021	39.9	28.9	49.7	0.00	Sunny
2/7/2021	35.0	24.3	44.5	0.65	Cloudy
2/8/2021	27.9	18.3	39.2	0.00	Sunny
2/9/2021	39.8	24.2	60.0	0.00	Sunny
2/10/2021	35.3	31.0	39.0	0.00	Cloudy
2/11/2021	32.9	28.9	35.8	0.27	Rain
2/12/2021	28.2	25.7	30.2	0.20	Wind
2/13/2021	28.3	27.1	30.5	0.24	Snow
2/14/2021	31.5	27.3	35.8	0.00	Cloudy
*2/15/2021	33.9	31.9	36.4	0.02	Wind
2/16/2021	39.3	26.8	51.6	0.00	Cloudy
2/17/2021	28.7	23.5	37.5	0.00	Sunny
2/18/2021	27.7	25.9	29.8	0.62	Rain
2/19/2021	31.6	27.1	40.6	0.00	Sunny
2/20/2021	27.3	20.2	33.8	0.00	Sunny
2/21/2021	27.6	13.3	39.8	0.00	Sunny
2/22/2021	32.0	28.4	39.5	0.47	Cloudy
2/23/2021	41.7	28.3	61.5	0.00	Sunny
2/24/2021	47.8	27.8	66.2	0.00	Sunny
*2/25/2021	46.4	32.9	56.9	0.00	Sunny
2/26/2021	36.5	27.5	47.8	0.15	Rain
2/27/2021	41.0	33.3	51.3	0.15	Cloudy
2/28/2021	45.5	43.2	46.8	0.36	Rain

*Sampling Date

WEATHER DATA SUMMARY
MARCH 2021
FACILITY: Shenandoah Crossing WTF
SOURCE: Louisa County Station / KLKU

Date	Avg Temp (F)	Low Temp (F)	High Temp (F)	Precip (IN)	Conditions
3/1/2021	47.7	34.2	55.4	0.19	Sunny
3/2/2021	35.9	28.2	45.9	0.00	Sunny
3/3/2021	42.4	25.7	60.3	0.00	Sunny
3/4/2021	43.1	31.2	58.5	0.00	Cloudy
3/5/2021	34.1	21.9	46.3	0.00	Sunny
3/6/2021	36.7	25.3	50.5	0.00	Sunny
3/7/2021	32.7	19.1	48.7	0.00	Sunny
3/8/2021	37.1	19.2	58.1	0.00	Sunny
3/9/2021	48.6	28.4	69.4	0.00	Sunny
3/10/2021	52.0	31.2	72.8	0.00	Sunny
3/11/2021	61.9	47.7	75.9	0.00	Sunny
3/12/2021	59.3	50.0	65.7	0.00	Sunny
3/13/2021	50.4	33.2	60.3	0.00	Sunny
3/14/2021	47.2	27.1	64.2	0.00	Sunny
*3/15/2021	41.1	32.6	48.4	0.01	Sunny
3/16/2021	38.3	34.6	42.2	0.03	Cloudy
3/17/2021	43.2	39.8	46.7	0.00	Cloudy
3/18/2021	47.3	43.5	51.3	0.55	Cloudy
3/19/2021	40.3	31.0	49.2	0.04	Sunny
3/20/2021	38.7	25.3	55.1	0.00	Sunny
3/21/2021	44.8	24.4	64.4	0.00	Sunny
3/22/2021	44.8	24.4	64.4	0.00	Sunny
3/23/2021	50.5	34.3	62.1	0.00	Cloudy
3/24/2021	54.1	49.6	56.9	0.15	Rain
3/25/2021	56.4	47.4	69.0	0.03	Rain
3/26/2021	67.8	47.9	80.2	0.01	Sunny
3/27/2021	55.1	37.6	71.5	0.02	Rain
3/28/2021	58.9	47.8	70.0	0.43	Cloudy
3/29/2021	48.1	35.8	62.0	0.00	Sunny
3/30/2021	49.6	29.0	68.7	0.00	Sunny
3/31/2021	57.2	45.8	61.6	0.92	Rain

*Sampling Date

WEATHER DATA SUMMARY
APRIL 2021
FACILITY: Shenandoah Crossing WTF
SOURCE: Louisa County Station / KLKU

Date	Avg Temp (F)	Low Temp (F)	High Temp (F)	Precip (IN)	Conditions
4/1/2021	42.9	33.1	55.7	0.98	Cloudy
4/2/2021	38.7	25.8	45.1	0.00	Cloudy
4/3/2021	43.7	21.1	56.6	0.00	Sunny
4/4/2021	53.1	31.8	74.8	0.00	Cloudy
4/5/2021	53.7	33.6	74.5	0.00	Sunny
4/6/2021	57.8	37.4	80.8	0.00	Cloudy
4/7/2021	61.3	40.8	83.1	0.00	Cloudy
4/8/2021	59.3	44.7	73.1	0.00	Sunny
4/9/2021	56.8	51.3	68.5	0.19	Cloudy
4/10/2021	60.5	50.3	73.1	0.17	Cloudy
4/11/2021	64.7	54.1	76.2	0.10	Cloudy
4/12/2021	58.0	45.9	67.2	0.02	Cloudy
4/13/2021	55.4	43.2	69.2	0.02	Sunny
4/14/2021	53.4	40.9	66.4	0.19	Sunny
4/15/2021	54.9	42.4	65.3	0.07	Cloudy
4/16/2021	48.8	32.4	66.4	0.00	Cloudy
4/17/2021	50.0	33.0	63.4	0.00	Cloudy
4/18/2021	52.5	35.7	64.9	0.02	Cloudy
4/19/2021	56.5	36.6	73.0	0.00	Sunny
*4/20/2021	56.5	36.6	73.0	0.00	Sunny
4/21/2021	54.8	37.3	68.4	0.01	Sunny
4/22/2021	41.5	27.7	54.3	0.00	Cloudy
4/23/2021	47.8	28.9	62.0	0.00	Sunny
4/24/2021	46.3	30.2	61.1	0.57	Rain
4/25/2021	53.8	43.1	67.2	0.12	Cloudy
4/26/2021	53.2	35.5	72.8	0.00	Sunny
4/27/2021	64.6	39.7	84.3	0.00	Sunny
4/28/2021	74.5	66.1	83.1	0.00	Sunny
4/29/2021	74.5	66.1	83.1	0.00	C
4/30/2021	64.8	48.0	73.6	0.03	Sunny

*Sampling Date

WEATHER DATA SUMMARY
MAY 2021
FACILITY: Shenandoah Crossing WTF
SOURCE: Louisa County Station / KLKU

Date	Avg Temp (F)	Low Temp (F)	High Temp (F)	Precip (IN)	Conditions
5/1/2021	53.0	33.4	69.8	0.00	Sunny
5/2/2021	65.8	45.9	82.4	0.00	Sunny
5/3/2021	66.6	60.3	75.6	0.12	Cloudy
5/4/2021	69.1	58.8	84.7	0.33	Rain
5/5/2021	52.8	39.9	64.9	0.00	Cloudy
5/6/2021	52.8	39.9	64.9	0.00	Sunny
5/7/2021	46.9	36.3	60.1	0.04	Cloudy
5/8/2021	50.3	34.9	66.7	0.00	Sunny
5/9/2021	55.9	37.6	70.3	0.00	Sunny
5/10/2021	55.9	37.6	70.3	0.00	Sunny
5/11/2021	55.9	37.6	70.3	0.00	Cloudy
5/12/2021	55.9	37.6	70.3	0.00	Sunny
5/13/2021	55.9	37.6	70.3	0.00	Sunny
5/14/2021	55.9	37.6	70.3	0.00	Cloudy
5/15/2021	55.9	37.6	70.3	0.00	Sunny
5/16/2021	55.9	37.6	70.3	0.00	Cloudy
5/17/2021	55.9	37.6	70.3	0.00	Sunny
5/18/2021	64.0	44.6	82.7	0.00	Cloudy
5/19/2021	64.0	44.6	84.7	0.00	Sunny
5/20/2021	67.6	45.5	87.5	0.00	Sunny
5/21/2021	64.1	44.7	81.8	0.00	Sunny
*5/22/2021	68.3	49.1	87.0	0.00	Sunny
5/23/2021	73.4	60.5	90.1	0.00	Sunny
5/24/2021	66.1	58.0	74.5	0.00	Cloudy
5/25/2021	67.5	57.3	82.3	0.00	Cloudy
5/26/2021	82.3	66.9	91.0	0.00	Sunny
5/27/2021	78.1	67.9	85.2	0.00	Cloudy
5/28/2021	71.7	59.0	84.0	0.19	Sunny
5/29/2021	55.2	48.0	67.9	0.35	Cloudy
5/30/2021	51.7	46.5	59.0	0.12	Cloudy
5/31/2021	58.8	42.9	73.9	0.00	Cloudy

*Sampling Date

WEATHER DATA SUMMARY
MAY 2021
FACILITY: Shenandoah Crossing WTF
SOURCE: Louisa County Station / KVALOUIS2

Date	Avg Temp (F)	Low Temp (F)	High Temp (F)	Precip (IN)	Conditions
6/1/2021	62.8	46.8	76.0	0.00	Sunny
6/2/2021	69.3	58.1	79.8	0.10	Sunny
6/3/2021	70.3	65.1	81.1	1.00	Rain
6/4/2021	71.2	63.6	81.6	0.57	Rain
6/5/2021	73.3	57.1	88.1	0.00	Sunny
6/6/2021	75.6	60.6	89.6	0.00	Cloudy
6/7/2021	75.7	66.7	85.9	0.00	Cloudy
6/8/2021	77.6	69.6	88.0	0.00	Sunny
6/9/2021	74.6	66.7	85.3	0.02	Rain
6/10/2021	74.5	67.5	85.7	1.66	Rain
6/11/2021	68.6	65.0	71.2	1.34	Rain
6/12/2021	65.7	61.8	71.1	0.08	Cloudy
6/13/2021	70.4	62.7	80.3	0.03	Cloudy
6/14/2021	73.8	61.7	87.2	0.00	Cloudy
6/15/2021	70.1	60.2	80.2	0.00	Sunny
6/16/2021	67.2	55.9	79.1	0.00	Sunny
6/17/2021	63.2	47.0	77.3	0.00	Sunny
6/18/2021	66.9	46.3	84.8	0.00	Sunny
6/19/2021	75.7	66.8	87.0	0.00	Sunny
6/20/2021	75.1	64.9	85.3	0.00	Sunny
6/21/2021	82.3	70.9	91.1	0.00	Sunny
*6/22/2021	66.7	58.1	71.7	0.49	Cloudy
6/23/2021	62.8	51.5	74.3	0.00	Cloudy
6/24/2021	62.0	45.2	76.5	0.00	Sunny
6/25/2021	65.7	48.0	79.8	0.00	Sunny
6/26/2021	74.1	67.4	84.5	0.00	Cloudy
6/27/2021	76.7	67.0	87.8	0.00	Sunny
6/28/2021	78.0	65.3	90.2	0.00	Cloudy
6/29/2021	77.3	66.2	89.7	0.00	Cloudy
6/30/2021	80	66	93	0.05	Cloudy

*Sampling Date

WEATHER DATA SUMMARY
JULY 2021
FACILITY: Shenandoah Crossing WTF
SOURCE: Louisa County Station / KVALOUIS2

Date	Avg Temp (F)	Low Temp (F)	High Temp (F)	Precip (IN)	Conditions
7/1/2021	73.8	69.2	88.2	0.79	Rain
7/2/2021	69.1	56.9	79.0	0.50	Rain
7/3/2021	65.5	51.7	79.7	0.00	Cloudy
7/4/2021	68.7	52.5	83.0	0.05	Cloudy
7/5/2021	74.1	61.2	87.1	0.00	Sunny
7/6/2021	76.8	62.9	90.4	0.00	Sunny
7/7/2021	76.4	68.5	88.9	0.00	Sunny
7/8/2021	72.2	66.7	80.7	0.19	Rain
7/9/2021	69.9	62.6	82.0	0.00	Cloudy
7/10/2021	76.3	63.5	84.9	0.00	Cloudy
7/11/2021	77.5	65.6	86.5	0.00	Sunny
7/12/2021	77.0	70.7	89.1	0.00	Sunny
7/13/2021	81.9	71.6	89.8	0.00	Sunny
7/14/2021	75.6	67.5	88.5	0.68	Rain
7/15/2021	76.3	64.6	89.3	0.00	Cloudy
7/16/2021	78.3	64.8	91.0	0.00	Sunny
7/17/2021	76.3	68.4	90.2	0.24	Rain
7/18/2021	74.0	64.2	85.6	0.00	Sunny
7/19/2021	71.4	63.1	83.8	0.00	Sunny
*7/20/2021	73.3	59.5	86.3	0.00	Sunny
7/21/2021	74.0	62.8	87.7	0.06	Rain
7/22/2021	69.3	58.9	81.0	0.00	Sunny
7/23/2021	70.3	59.7	83.2	0.00	Sunny
7/24/2021	71.7	61.2	84.9	0.47	Rain
7/25/2021	74.8	67.5	87.3	0.38	Rain
7/26/2021	76.5	66.8	88.3	0.05	Sunny
7/27/2021	76.5	66.0	91.0	0.00	Sunny
7/28/2021	78.2	66.5	89.7	0.00	Sunny
7/29/2021	76.2	65.3	87.4	0.00	Sunny
7/30/2021	78.5	65.2	90.3	0.00	Sunny
7/31/2021	69.7	60.2	81.4	0.02	Sunny

*Sampling Date

WEATHER DATA SUMMARY
AUGUST 2021
FACILITY: Shenandoah Crossing WTF
SOURCE: Louisa County Station / KVALOUIS2

Date	Avg Temp (F)	Low Temp (F)	High Temp (F)	Precip (IN)	Conditions
8/1/2021	68.6	65.5	74.5	0.67	Rain
8/2/2021	66.1	57.0	78.1	0.00	Cloudy
8/3/2021	71.2	60.0	77.3	0.00	Sunny
8/4/2021	66.5	56.8	79.2	0.00	Sunny
8/5/2021	68.3	52.7	84.6	0.00	Sunny
8/6/2021	72.0	57.8	86.3	0.00	Sunny
8/7/2021	64.5	60.8	67.4	0.63	Rain
8/8/2021	70.6	58.7	86.0	0.01	Sunny
8/9/2021	76.6	64.7	88.7	0.00	Cloudy
8/10/2021	75.3	68.2	89.8	0.11	Rain
8/11/2021	74.0	67.8	91.6	0.66	Rain
8/12/2021	85.2	65.8	92.0	0.00	Sunny
8/13/2021	76.6	68.6	92.4	1.09	Rain
8/14/2021	75.7	66.1	89.6	0.10	Sunny
8/15/2021	70.5	68.3	74.5	0.02	Cloudy
8/16/2021	73.1	68.7	82.5	0.41	Cloudy
*8/17/2021	73.2	67.5	83.2	0.06	Cloudy
8/18/2021	77.2	71.1	86.0	0.14	Cloudy
8/19/2021	76.0	68.9	89.0	1.63	Rain
8/20/2021	72.0	68.5	79.5	0.11	Rain
8/21/2021	74.2	64.2	87.1	0.00	Cloudy
8/22/2021	74.2	64.0	86.8	0.00	Cloudy
8/23/2021	77.3	66.2	89.6	0.00	Sunny
8/24/2021	77.6	66.3	91.4	0.00	Sunny
8/25/2021	76.3	66.7	90.9	0.00	Cloudy
8/26/2021	81.0	67.5	92.0	0.00	Sunny
8/27/2021	78.9	68.1	91.3	0.00	Cloudy
8/28/2021	78.2	68.2	92.0	0.90	Rain
8/29/2021	73.1	68.3	82.2	0.05	Cloudy
8/30/2021	73.9	52.7	92.4	6.59	Rain
8/31/2021	73.1	68.3	82.2	0.05	Rain

*Sampling Date

WEATHER DATA SUMMARY
SEPTEMBER 2021
FACILITY: Shenandoah Crossing WTF
SOURCE: Louisa County Station / KVALOUIS2

Date	Avg Temp (F)	Low Temp (F)	High Temp (F)	Precip (IN)	Conditions
9/1/2021	73.5	67.0	81.0	0.00	Rain
9/2/2021	65.9	54.0	77.0	0.00	Sunny
9/3/2021	62.3	51.0	76.0	0.00	Sunny
9/4/2021	65.5	52.0	79.0	0.00	Cloudy
9/5/2021	71.8	63.0	83.0	0.00	Cloudy
9/6/2021	72.2	59.0	83.0	0.00	Cloudy
9/7/2021	67.7	54.0	83.0	0.00	Sunny
9/8/2021	71.3	60.0	85.0	0.00	Cloudy
9/9/2021	68.4	58.0	77.0	0.01	Cloudy
9/10/2021	62.0	50.0	75.0	0.10	Cloudy
9/11/2021	63.0	49.0	78.0	0.00	Cloudy
9/12/2021	71.3	60.0	84.0	0.00	Sunny
9/13/2021	75.4	66.0	88.0	0.00	Sunny
9/14/2021	74.3	63.0	87.0	0.00	Sunny
9/15/2021	75.7	64.0	85.0	0.00	Sunny
9/16/2021	72.1	68.0	82.0	0.00	Cloudy
9/17/2021	71.7	65.0	81.0	0.00	Cloudy
9/18/2021	72.2	65.0	84.0	0.00	Sunny
9/19/2021	71.6	63.0	84.0	0.00	Sunny
9/20/2021	68.6	59.0	77.0	0.00	Cloudy
*9/21/2021	68.0	56.0	79.0	0.00	Cloudy
9/22/2021	71.3	69.0	77.0	0.07	Rain
9/23/2021	62.5	48.0	72.0	1.01	Rain
9/24/2021	52.3	n/r	73.0	0.01	Sunny
9/25/2021	57.8	44.0	73.0	0.00	Sunny
9/26/2021	59.2	46.0	73.0	0.00	Sunny
9/27/2021	62.8	46.0	78.0	0.00	Sunny
9/28/2021	67.5	59.0	79.0	0.00	Cloudy
9/29/2021	62.3	49.0	72.0	0.03	Rain
9/30/2021	58.9	45.0	75.0	0.00	Sunny

*Sampling Date

WEATHER DATA SUMMARY
OCTOBER 2021
FACILITY: Shenandoah Crossing WTF
SOURCE: Louisa County Station / KVALOUIS2

Date	Avg Temp (F)	Low Temp (F)	High Temp (F)	Precip (IN)	Conditions
10/1/2021	62.3	51.0	75.0	0.00	Sunny
10/2/2021	64.5	54.0	81.0	0.00	Sunny
10/3/2021	72.4	59.0	86.0	0.00	Sunny
10/4/2021	74.2	67.0	83.0	0.00	Cloudy
10/5/2021	70.5	64.0	83.0	0.01	Sunny
10/6/2021	70.5	64.0	83.0	0.01	Cloudy
10/7/2021	64.7	63.0	72.0	0.23	Rain
10/8/2021	65.9	61.0	72.0	0.00	Cloudy
10/9/2021	67.4	66.0	71.0	0.01	Cloudy
10/10/2021	64.9	64.0	73.0	0.02	Cloudy
10/11/2021	68.1	64.0	75.0	0.00	Cloudy
10/12/2021	66.3	64.0	72.0	0.00	Cloudy
10/13/2021	68.8	63.0	79.0	0.00	Sunny
10/14/2021	67.4	62.0	82.0	0.00	Sunny
10/15/2021	70.9	63.0	80.0	0.00	Sunny
10/16/2021	66.3	53.0	78.0	0.00	Rain
10/17/2021	57.5	50.0	66.0	0.13	Rain
10/18/2021	58.7	46.0	73.0	0.00	Sunny
10/19/2021	59.0	44.0	74.0	0.00	Sunny
*10/20/2021	61.8	50.0	76.0	0.00	Sunny
10/21/2021	65.0	47.0	80.0	0.00	Cloudy
10/22/2021	64.1	59.0	70.0	0.00	Cloudy
10/23/2021	58.9	52.0	70.0	0.00	Cloudy
10/24/2021	61.3	52.0	73.0	0.00	Sunny
10/25/2021	65.1	59.0	77.0	0.00	Rain
10/26/2021	59.4	54.0	67.0	0.93	Rain
10/27/2021	60.7	52.0	74.0	0.00	Sunny
10/28/2021	58.6	46.0	65.0	0.00	Cloudy
10/29/2021	60.3	57.0	71.0	0.94	Cloudy
10/30/2021	55.8	52.0	59.0	1.39	Rain
10/31/2021	56.4	48.0	71.0	0.01	Cloudy

*Sampling Date

WEATHER DATA SUMMARY
NOVEMBER 2021
FACILITY: Shenandoah Crossing WTF
SOURCE: Louisa County Station / KVALOUIS2

Date	Avg Temp (F)	Low Temp (F)	High Temp (F)	Precip (IN)	Conditions
11/1/2021	53.0	33.4	69.8		Cloudy
11/2/2021		42.0	48.0		Rain
11/3/2021	30.7	27.4	36.8	0.00	Sunny
11/4/2021					Sunny
11/5/2021	35.1	23.4	52.4	0.00	Cloudy
11/6/2021	39.4	22.1	55.8	0.00	Cloudy
11/7/2021	41.6	30.4	57.7	0.00	Sunny
11/8/2021	45.0	28.4	69.8	0.00	Sunny
11/9/2021	49.3	31.8	75.3	0.00	Sunny
11/10/2021	58.1	40.3	73.7	0.00	Sunny
11/11/2021	52.1	34.8	68.9	0.00	Sunny
11/12/2021	55.4	35.5	66.4	0.27	Rain
11/13/2021	41.0	26.7	55.4	0.00	Cloudy
11/14/2021	35.2	24.0	47.7	0.00	Cloudy
11/15/2021	39.6	28.6	51.7	0.00	Cloudy
*11/16/2021	37.0	26.5	54.9	0.00	Cloudy
11/17/2021	47.3	28.0	68.9	0.00	Cloudy
11/18/2021	59.7	45.9	73.0	0.00	Sunny
11/19/2021	38.0	24.5	49.4	0.00	Cloudy
11/20/2021	30.5	19.0	46.4	0.00	Cloudy
11/21/2021	39.0	24.0	51.0	0.00	Cloudy
11/22/2021	44.2	28.9	56.0	0.01	Sunny
11/23/2021	29.7	18.8	44.5	0.00	Cloudy
11/24/2021	29.7	16.2	48.9	0.00	Sunny
11/25/2021	44.5	25.3	63.0	0.01	Sunny
11/26/2021	41.6	26.8	48.3	0.05	Rain
11/27/2021	33.1	20.4	46.1	0.00	Sunny
11/28/2021	43.2	28.1	54.4	0.00	Cloudy
11/29/2021	35.6	22.2	47.5	0.00	Sunny
11/30/2021	39.3	23.7	55.8	0.00	Sunny

*Sampling Date

WEATHER DATA SUMMARY
DECEMBER 2021
FACILITY: Shenandoah Crossing WTF
SOURCE: Louisa County Station / KVALOUIS2

Date	Avg Temp (F)	Low Temp (F)	High Temp (F)	Precip (IN)	Conditions
12/1/2021	40.8	24.3	57.2	0.00	Sunny
12/2/2021	52.2	37.5	65.3	0.00	Cloudy
12/3/2021	46.9	31.6	63.8	0.00	Sunny
12/4/2021	38.2	26.6	57.9	0.00	Sunny
12/5/2021	37.6	23.5	49.4	0.00	Sunny
12/6/2021	53.2	38.3	69.2	0.00	Cloudy
12/7/2021	35.2	24.6	46.2	0.00	Snow
12/8/2021	29.7	24.4	41.1	0.00	Cloudy
12/9/2021	28.4	18.1	40.7	0.00	Sunny
12/10/2021	40.6	27.1	48.8	0.00	Cloudy
12/11/2021	55.6	44.1	65.0	0.28	Rain
12/12/2021	38.1	23.9	49.9	0.01	Rain
12/13/2021	33.5	19.5	55.9	0.00	Cloudy
12/14/2021	35.1	21.3	58.5	0.00	Sunny
12/15/2021	36.9	21.8	55.3	0.00	Cloudy
12/16/2021	52.2	34.8	65.8	0.00	Rain
12/17/2021	58.8	48.8	67.1	0.00	Rain
12/18/2021	51.5	47.4	57.9	0.00	Sunny
12/19/2021	43.0	28.2	57.9	0.03	Rain
12/20/2021	28.7	18.8	41.2	0.00	Sunny
*12/21/2021	31.9	21.9	39.8	0.00	Sunny
12/22/2021	38.7	24.9	54.8	0.00	Sunny
12/23/2021	30.6	18.8	43.8	0.00	Cloudy
12/24/2021	47.1	33.7	60.4	0.00	Cloudy
12/25/2021	59.6	51.4	70.8	0.00	Cloudy
12/26/2021	47.6	39.1	63.0	0.00	Rain
12/27/2021	41.8	36.4	46.4	0.00	Wind
12/28/2021	48.5	40.8	57.6	0.00	Rain
12/29/2021	53.2	47.8	59.7	0.18	Rain
12/30/2021	50.0	47.8	51.9	0.03	Rain
12/31/2021	52.5	51.1	55.2	0.15	Rain

*Sampling Date

APPENDIX B:

ANALYTICAL REPORTS

Copper Biotic Ligand Model
Sample Collection Standard Operating Procedure
Shenandoah Crossing

EPA Method 1669 (July 1996) provides guidance for sampling ambient water for trace metals. The goal of the procedure is to minimize contamination during sampling activities which will achieve the low detection limits required by the Copper Biotic Ligand Model (CuBLM) study. The following procedures were derived from Method 1669.

1. Safety

   The safety of the technician is the most important concern during all sampling activities. Technicians must wear non-talc disposable gloves during sample collection. Eye protection is necessary for handling nitric acid.

2. Technicians

   Method 1669 describes the use of two technicians – one wearing gloves for 'clean' activities and one wearing gloves for 'dirty' activities. Clean activities include handling sampling containers, filtration equipment, and any other activity that could result in direct contact with the effluent. Dirty activities include the handling of plastic bags used for shipping sample containers.

3. Equipment Preparation

   A minimal amount of equipment is required for the procedure. Do not use metal or allow it to come into contact with the effluent at any time. Equipment includes the following:

   - Sample containers received from analytical laboratory.
   - De-ionized water for blanks and washing glassware. You can use distilled, but it must be metal-free. If it contains metal, it will contaminate the sampling equipment and effluent sample.
   - 10% Nitric acid solution for washing glassware
   - Ziplock bags for sample shipment
   - Non-talc disposable gloves
   - Filtration equipment (with certificate)

4. Procedure

   a. Wash glassware to be used in collecting grab samples. After washing, rinse with nitric acid and then rinse well with de-ionized water. Air dry and store in a Ziplock bag if holding the equipment prior to sampling is necessary.
   b. Put on gloves. The responsibility of each technician is the following:
      i. *Dirty hands* - holds Ziplock bags and opens doors, if necessary
      ii. *Clean hands* - conducts any activity that may result in exposure to effluent sample.
   c. *Clean hands* - run de-ionized water through new filtration apparatus. Collect in sample bottle. This blank sample will prove that the samples were not contaminated by the equipment.
   d. *Dirty hands* - hold the Ziplock bag so *Clean hands* can place the sample in Ziplock bag for transport.
   e. *Dirty hands* - close the Ziploc bag.
   f. *Clean hands* - collect effluent using the prepared glass container. Rinse the glass container with effluent at least one time before collecting the sample.
   g. *Clean hands* - Run effluent through the filtration apparatus. Collect in bottle.
   h. *Dirty hands* - hold Ziplock bag so *Clean hands* can place the sample in it for transport.
   i. *Dirty hands* - close the Ziplock bag.
   j. Place Ziplock bags in cooler and pack on ice for shipping.

Please sign the following after completing the training session:

I will collect dissolved copper samples using the procedures stated above:

Keith Walker — Name — 12/22/20 — Date

[signature] — Name — 12/24/20 — Date

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

January 25, 2021

Beth Thompson
BT Solutions
336 Cobbleview Drive
Lexington, SC 29072

RE: Project: Shenandoah Crossings CuBLM
Pace Project No.: 92517159

Dear Beth Thompson:

Enclosed are the analytical results for sample(s) received by the laboratory on January 19, 2021. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:

- Pace National - Mt. Juliet

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

Sincerely,

Amanda Payne
amanda.payne@pacelabs.com
(704)875-9092
Project Manager

Enclosures

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

CERTIFICATIONS

Project: Shenandoah Crossings CuBLM
Pace Project No.: 92517159

Pace Analytical Services National
12065 Lebanon Road, Mt. Juliet, TN 37122
Alabama Certification #: 40660
Alaska Certification 17-026
Arizona Certification #: AZ0612
Arkansas Certification #: 88-0469
California Certification #: 2932
Canada Certification #: 1461.01
Colorado Certification #: TN00003
Connecticut Certification #: PH-0197
DOD Certification: #1461.01
EPA# TN00003
Florida Certification #: E87487
Georgia DW Certification #: 923
Georgia Certification: NELAP
Idaho Certification #: TN00003
Illinois Certification #: 200008
Indiana Certification #: C-TN-01
Iowa Certification #: 364
Kansas Certification #: E-10277
Kentucky UST Certification #: 16
Kentucky Certification #: 90010
Louisiana Certification #: AI30792
Louisiana DW Certification #: LA180010
Maine Certification #: TN0002
Maryland Certification #: 324
Massachusetts Certification #: M-TN003
Michigan Certification #: 9958
Minnesota Certification #: 047-999-395
Mississippi Certification #: TN00003
Missouri Certification #: 340
Montana Certification #: CERT0086
Nebraska Certification #: NE-OS-15-05
Nevada Certification #: TN-03-2002-34
New Hampshire Certification #: 2975
New Jersey Certification #: TN002
New Mexico DW Certification
New York Certification #: 11742
North Carolina Aquatic Toxicity Certification #: 41
North Carolina Drinking Water Certification #: 21704
North Carolina Environmental Certificate #: 375
North Dakota Certification #: R-140
Ohio VAP Certification #: CL0069
Oklahoma Certification #: 9915
Oregon Certification #: TN200002
Pennsylvania Certification #: 68-02979
Rhode Island Certification #: LAO00356
South Carolina Certification #: 84004
South Dakota Certification
Tennessee DW/Chem/Micro Certification #: 2006
Texas Mold Certification #: LAB0152
Texas Certification #: T 104704245-17-14
USDA Soil Permit #: P330-15-00234
Utah Certification #: TN00003
Virginia Certification #: VT2006
Vermont Dept. of Health: ID# VT-2006
Virginia Certification #: 460132
Washington Certification #: C847
West Virginia Certification #: 233
Wisconsin Certification #: 998093910
Wyoming UST Certification #: via A2LA 2926.01
A2LA-ISO 17025 Certification #: 1461.01
A2LA-ISO 17025 Certification #: 1461.02
AIHA-LAP/LLC EMLAP Certification #:100789

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SAMPLE ANALYTE COUNT

Project: Shenandoah Crossings CuBLM
Pace Project No.: 92517159

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
92517159001	**Final Effluent Filtered**	EPA 200.8	TM	1	PAN
92517159002	**Dissolved Cu Blank**	EPA 200.8	TM	1	PAN
92517159003	**Final Effllluent**	EPA 200.7	CCE, KMG	4	PAN
		EPA 200.8	TM	1	PAN
		SM 2320B	SL	1	PAN
		EPA 300.0	ELN	2	PAN
		SM 4500-H+B	KPS	1	PAN
		SM 5310B	MJA	1	PAN
		SM2340-97	CCE	1	PAN

PAN = Pace National - Mt. Juliet

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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ANALYTICAL RESULTS

Project: Shenandoah Crossings CuBLM
Pace Project No.: 92517159

Sample: Final Effluent Filtered **Lab ID: 92517159001** Collected: 01/18/21 10:35 Received: 01/19/21 08:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
Metals (ICPMS) 200.8, Diss.	Analytical Method: EPA 200.8 Preparation Method: 200.8 Pace National - Mt. Juliet							
Copper, Dissolved	**8.93**	ug/L	1.00	1	01/21/21 00:44	01/21/21 12:27	7440-50-8	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: Shenandoah Crossings CuBLM
Pace Project No.: 92517159

Sample: Dissolved Cu Blank **Lab ID: 92517159002** Collected: 01/18/21 10:35 Received: 01/19/21 08:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
Metals (ICPMS) 200.8, Diss.	Analytical Method: EPA 200.8 Preparation Method: 200.8 Pace National - Mt. Juliet							
Copper, Dissolved	ND	ug/L	1.00	1	01/21/21 00:44	01/21/21 12:31	7440-50-8	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: Shenandoah Crossings CuBLM
Pace Project No.: 92517159

Sample: Final Effluent **Lab ID: 92517159003** Collected: 01/18/21 10:20 Received: 01/19/21 08:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
Metals (ICP) 200.7	Analytical Method: EPA 200.7 Preparation Method: 200.7 Pace National - Mt. Juliet							
Calcium	**30600**	ug/L	1000	1	01/21/21 00:46	01/21/21 12:20	7440-70-2	
Calcium, Dissolved	**31000**	ug/L	1000	1	01/20/21 15:01	01/21/21 07:55	7440-70-2	PH
Magnesium	**5850**	ug/L	1000	1	01/21/21 00:46	01/21/21 12:20	7439-95-4	
Magnesium, Dissolved	**6050**	ug/L	1000	1	01/20/21 15:01	01/21/21 07:55	7439-95-4	PH
Potassium, Dissolved	**8520**	ug/L	1000	1	01/20/21 15:01	01/21/21 07:55	7440-09-7	
Sodium, Dissolved	**60800**	ug/L	1000	1	01/20/21 15:01	01/21/21 07:55	7440-23-5	PH
Metals (ICPMS) 200.8	Analytical Method: EPA 200.8 Preparation Method: 200.8 Pace National - Mt. Juliet							
Copper	**11.4**	ug/L	1.00	1	01/20/21 15:08	01/21/21 01:29	7440-50-8	
Wet Chemistry 2320 B-2011	Analytical Method: SM 2320B Preparation Method: 2320 B-2011 Pace National - Mt. Juliet							
Alkalinity, Total as CaCO3	**31000**	ug/L	20000	1	01/19/21 15:25	01/19/21 15:25		
Wet Chemistry 300.0	Analytical Method: EPA 300.0 Preparation Method: 300.0 Pace National - Mt. Juliet							
Chloride	**38100**	ug/L	1000	1	01/20/21 03:15	01/20/21 03:15	16887-00-6	
Sulfate	**73400**	ug/L	5000	1	01/20/21 03:15	01/20/21 03:15	14808-79-8	
Wet Chemistry 4500H+ B-2011	Analytical Method: SM 4500-H+B Preparation Method: 4500H+ B-2011 Pace National - Mt. Juliet							
pH	**7.34**	Std. Units		1	01/20/21 15:42	01/20/21 15:42		H3
Wet Chemistry 5310 B-2011	Analytical Method: SM 5310B Preparation Method: 5310 B-2011 Pace National - Mt. Juliet							
Dissolved Organic Carbon	**5160**	ug/L	1000	1	01/19/21 15:26	01/19/21 15:26		
Calculated Results	Analytical Method: SM2340-97 Preparation Method: SM2340B Pace National - Mt. Juliet							
Hardness, Total(SM 2340B)	**100000**	ug/L	2500	1	01/21/21 12:20	01/21/21 12:20		

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QUALITY CONTROL DATA

Project: Shenandoah Crossings CuBLM
Pace Project No.: 92517159

QC Batch: 1608361
QC Batch Method: 200.7
Analysis Method: EPA 200.7
Analysis Description: Metals (ICP) 200.7
Laboratory: Pace National - Mt. Juliet
Associated Lab Samples: 92517159003

METHOD BLANK: R3614932-1 Matrix: Water
Associated Lab Samples: 92517159003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Calcium	ug/L	ND	1000	01/21/21 11:22	
Magnesium	ug/L	ND	1000	01/21/21 11:22	

LABORATORY CONTROL SAMPLE: R3614932-2

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Calcium	ug/L	10000	9660	96.6	85.0-115	
Magnesium	ug/L	10000	9770	97.7	85.0-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: R3614932-4 R3614932-5

Parameter	Units	L1307599-03 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Calcium	ug/L	14000	10000	10000	24000	24200	99.9	102	70.0-130	0.702	
Magnesium	ug/L	7150	10000	10000	16700	16700	95.3	95.5	70.0-130	0.103	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: R3614932-6 R3614932-7

Parameter	Units	L1307748-01 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Calcium	ug/L	10200	10000	10000	19700	19500	95.3	93.3	70.0-130	1.02	
Magnesium	ug/L	6020	10000	10000	15600	15500	95.5	95.0	70.0-130	0.332	

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QUALITY CONTROL DATA

Project: Shenandoah Crossings CuBLM
Pace Project No.: 92517159

QC Batch: 1608622
QC Batch Method: 200.7
Analysis Method: EPA 200.7
Analysis Description: Metals (ICP) 200.7
Laboratory: Pace National - Mt. Juliet

Associated Lab Samples:

METHOD BLANK: R3614848-1 Matrix: Water
Associated Lab Samples: 92517159003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Calcium, Dissolved	ug/L	ND	1000	01/21/21 07:49	
Magnesium, Dissolved	ug/L	ND	1000	01/21/21 07:49	
Potassium, Dissolved	ug/L	ND	1000	01/21/21 07:49	
Sodium, Dissolved	ug/L	ND	1000	01/21/21 07:49	

LABORATORY CONTROL SAMPLE: R3614848-2

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Calcium, Dissolved	ug/L	10000	10100	101	85.0-115	
Magnesium, Dissolved	ug/L	10000	10300	103	85.0-115	
Potassium, Dissolved	ug/L	10000	10600	106	85.0-115	
Sodium, Dissolved	ug/L	10000	10900	109	85.0-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: R3614848-4 R3614848-5

Parameter	Units	92517159003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Calcium, Dissolved	ug/L	31000	10000	10000	41400	42100	105	111	70.0-130	1.47	
Magnesium, Dissolved	ug/L	6050	10000	10000	16300	16400	102	103	70.0-130	0.757	
Potassium, Dissolved	ug/L	8520	10000	10000	18200	18600	97.1	101	70.0-130	2.07	
Sodium, Dissolved	ug/L	60800	10000	10000	69900	71200	91.1	103	70.0-130	1.75	

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QUALITY CONTROL DATA

Project: Shenandoah Crossings CuBLM
Pace Project No.: 92517159

QC Batch: 1608363
QC Batch Method: 200.8
Analysis Method: EPA 200.8
Analysis Description: Metals (ICPMS) 200.8
Laboratory: Pace National - Mt. Juliet

Associated Lab Samples: 92517159003

METHOD BLANK: R3614636-1 Matrix: Water
Associated Lab Samples: 92517159003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Copper	ug/L	ND	1.00	01/21/21 00:02	

LABORATORY CONTROL SAMPLE: R3614636-2

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Copper	ug/L	50.0	50.3	101	85.0-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: R3614636-4 R3614636-5

Parameter	Units	L1307665-01 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Copper	ug/L	1.12	50.0	50.0	49.5	51.5	96.7	101	70.0-130	3.88	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: R3614636-6 R3614636-7

Parameter	Units	L1307676-05 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Copper	ug/L	ND	50.0	50.0	48.1	49.1	96.2	98.1	70.0-130	2.02	

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QUALITY CONTROL DATA

Project: Shenandoah Crossings CuBLM
Pace Project No.: 92517159

QC Batch: 1609021
QC Batch Method: 200.8
Analysis Method: EPA 200.8
Analysis Description: Metals (ICPMS) 200.8
Laboratory: Pace National - Mt. Juliet

Associated Lab Samples:

METHOD BLANK: R3614868-1 Matrix: Water
Associated Lab Samples: 92517159001, 92517159002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Copper, Dissolved	ug/L	ND	1.00	01/21/21 11:34	

LABORATORY CONTROL SAMPLE: R3614868-2

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Copper, Dissolved	ug/L	50.0	52.1	104	85.0-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: R3614868-4 R3614868-5

Parameter	Units	L1307665-01 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Copper, Dissolved	ug/L	ND	50.0	50.0	48.7	49.2	97.5	98.4	70.0-130	0.916	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: R3614868-6 R3614868-7

Parameter	Units	L1308162-01 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Copper, Dissolved	ug/L	11.2	50.0	50.0	60.1	61.2	97.9	100	70.0-130	1.80	

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QUALITY CONTROL DATA

Project: Shenandoah Crossings CuBLM
Pace Project No.: 92517159

QC Batch: 1607761
QC Batch Method: 2320 B-2011
Analysis Method: SM 2320B
Analysis Description: Wet Chemistry 2320 B-2011
Laboratory: Pace National - Mt. Juliet
Associated Lab Samples: 92517159003

METHOD BLANK: R3614069-1 Matrix: Water
Associated Lab Samples: 92517159003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Alkalinity, Total as CaCO3	ug/L	ND	20000	01/19/21 09:55	

LABORATORY CONTROL SAMPLE: R3614069-3

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Alkalinity, Total as CaCO3	ug/L	100000	98300	98.3	90.0-110	

SAMPLE DUPLICATE: R3614069-2

Parameter	Units	L1307539-01 Result	Dup Result	RPD	Qualifiers
Alkalinity, Total as CaCO3	ug/L	243000	242000	0.647	

SAMPLE DUPLICATE: R3614069-4

Parameter	Units	L1307705-04 Result	Dup Result	RPD	Qualifiers
Alkalinity, Total as CaCO3	ug/L	302000	299000	1.24	

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QUALITY CONTROL DATA

Project: Shenandoah Crossings CuBLM
Pace Project No.: 92517159

QC Batch: 1608032
QC Batch Method: 300.0
Analysis Method: EPA 300.0
Analysis Description: Wet Chemistry 300.0
Laboratory: Pace National - Mt. Juliet

Associated Lab Samples: 92517159003

METHOD BLANK: R3614340-1 Matrix: Water
Associated Lab Samples: 92517159003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	ug/L	ND	1000	01/19/21 13:12	
Sulfate	ug/L	ND	5000	01/19/21 13:12	

LABORATORY CONTROL SAMPLE: R3614340-2

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	ug/L	40000	39900	99.8	90.0-110	
Sulfate	ug/L	40000	40600	101	90.0-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: R3614340-4 R3614340-5

Parameter	Units	L1307674-01 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Chloride	ug/L	1100	50000	50000	49300	49200	96.3	96.2	80.0-120	0.164	
Sulfate	ug/L	11300	50000	50000	59300	59300	96.0	96.0	80.0-120	0.081	

MATRIX SPIKE SAMPLE: R3614340-7

Parameter	Units	92517159003 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Chloride	ug/L	38100	50000	87000	97.7	80.0-120	
Sulfate	ug/L	73400	50000	123000	99.8	80.0-120	E

SAMPLE DUPLICATE: R3614340-3

Parameter	Units	L1307674-01 Result	Dup Result	RPD	Qualifiers
Chloride	ug/L	1100	1110	0.943	
Sulfate	ug/L	11300	11300	0.108	

SAMPLE DUPLICATE: R3614340-6

Parameter	Units	92517159003 Result	Dup Result	RPD	Qualifiers
Chloride	ug/L	38100	37900	0.710	
Sulfate	ug/L	73400	73700	0.439	

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QUALITY CONTROL DATA

Project: Shenandoah Crossings CuBLM
Pace Project No.: 92517159

QC Batch: 1608780
QC Batch Method: 4500H+ B-2011
Analysis Method: SM 4500-H+B
Analysis Description: Wet Chemistry 4500H+ B-2011
Laboratory: Pace National - Mt. Juliet

Associated Lab Samples: 92517159003

LABORATORY CONTROL SAMPLE: R3614508-1

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
pH	Std. Units	10.0	10.1	101	99.0-101	

SAMPLE DUPLICATE: R3614508-2

Parameter	Units	L1306363-04 Result	Dup Result	RPD	Qualifiers
pH	Std. Units	7.29	7.31	0.274	

SAMPLE DUPLICATE: R3614508-3

Parameter	Units	L1307878-02 Result	Dup Result	RPD	Qualifiers
pH	Std. Units	8.56	8.53	0.351	

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QUALITY CONTROL DATA

Project: Shenandoah Crossings CuBLM
Pace Project No.: 92517159

QC Batch: 1607548
QC Batch Method: 5310 B-2011
Analysis Method: SM 5310B
Analysis Description: Wet Chemistry 5310 B-2011
Laboratory: Pace National - Mt. Juliet
Associated Lab Samples: 92517159003

METHOD BLANK: R3614259-1 Matrix: Water
Associated Lab Samples: 92517159003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Dissolved Organic Carbon	ug/L	ND	1000	01/19/21 11:30	

LABORATORY CONTROL SAMPLE: R3614259-2

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Dissolved Organic Carbon	ug/L	75000	74300	99.1	85.0-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: R3614259-4 R3614259-5

Parameter	Units	92517159003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Dissolved Organic Carbon	ug/L	5160	50000	50000	54600	53600	98.9	96.8	80.0-120	1.94	

SAMPLE DUPLICATE: R3614259-3

Parameter	Units	92517159003 Result	Dup Result	RPD	Qualifiers
Dissolved Organic Carbon	ug/L	5160	5440	5.22	

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QUALIFIERS

Project: Shenandoah Crossings CuBLM
Pace Project No.: 92517159

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.

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

TNI - The NELAC Institute.

SAMPLE QUALIFIERS

Sample: 92517159003
[1] Wet Chemistry by Method 2320 B-2011 - Endpoint pH 4.5 Headspace
[1] Wet Chemistry by Method 4500H+ B-2011 - 7.34 at 18.5C
Sample: R3614069-1
[1] Wet Chemistry by Method 2320 B-2011 - Endpoint pH 4.5
Sample: R3614069-2
[1] Wet Chemistry by Method 2320 B-2011 - Endpoint pH 4.5
Sample: R3614069-3
[1] Wet Chemistry by Method 2320 B-2011 - Endpoint pH 4.5
Sample: R3614069-4
[1] Wet Chemistry by Method 2320 B-2011 - Endpoint pH 4.5
Sample: R3614508-1
[1] Wet Chemistry by Method 4500H+ B-2011 - 10.06 at 19C
Sample: R3614508-2
[1] Wet Chemistry by Method 4500H+ B-2011 - 7.31 at 18.9C

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QUALIFIERS

Project: Shenandoah Crossings CuBLM
Pace Project No.: 92517159

SAMPLE QUALIFIERS

Sample: R3614508-3

[1] Wet Chemistry by Method 4500H+ B-2011 - 8.53 at 19.8C

ANALYTE QUALIFIERS

E	Analyte concentration exceeded the calibration range. The reported result is estimated.
H3	Sample was received or analysis requested beyond the recognized method holding time.
PH	The analyte failed the method required serial dilution test and/or subsequent post-spike criteria. These failures indicate matrix interference.

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

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Shenandoah Crossings CuBLM
Pace Project No.: 92517159

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92517159003	**Final Effllluent**	200.7	1608361	EPA 200.7	1608361
92517159003	**Final Effllluent**	200.7	1608622	EPA 200.7	1608622
92517159001	**Final Effluent Filtered**	200.8	1609021	EPA 200.8	1609021
92517159002	**Dissolved Cu Blank**	200.8	1609021	EPA 200.8	1609021
92517159003	**Final Effllluent**	200.8	1608363	EPA 200.8	1608363
92517159003	**Final Effllluent**	2320 B-2011	1607761	SM 2320B	1607761
92517159003	**Final Effllluent**	300.0	1608032	EPA 300.0	1608032
92517159003	**Final Effllluent**	4500H+ B-2011	1608780	SM 4500-H+B	1608780
92517159003	**Final Effllluent**	5310 B-2011	1607548	SM 5310B	1607548
92517159003	**Final Effllluent**	SM2340B	1608361	SM2340-97	1608361

WO# : 92517159

92517159

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CHAIN-OF-CUSTODY / Analytical Request Document

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

Page : 1 Of 1

Section A – Required Client Information:		Section B – Required Project Information:		Section C – Invoice Information:	
Company:	BT Solutions	Report To:	Beth Thompson	Attention:	Beth Thompson
Address:	336 Cobbleview Drive	Copy To:		Company Name:	BT Solutions, LLC
	Lexington, SC 29072			Address:	336 Cobbleview Dr. SC 29072
Email:	beth@btsolutionssc.com	Purchase Order #:		Pace Quote:	79772
Phone:	(803)447-8471 Fax	Project Name:	Shenandoah Crossings CuBLM	Pace Project Manager:	amanda.payne@pacelabs.com,
Requested Due Date:		Project #:		Pace Profile #:	12739-1

Regulatory Agency	State / Location
	VA

MATRIX	CODE
Drinking Water	DW
Water	WT
Waste Water	WW
Product	P
Soil/Solid	SL
Oil	OL
Wipe	WP
Air	AR
Other	OT
Tissue	TS

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	200.8 Total Cu	200.8 dissolved Cu	200.7 Dissolved Ca, Mg, Na	Total Hardness	300.0 SO4, Cl	Alkalinity/pH	DOC	Residual Chlorine (Y/N)	92517159
1	Final Effluent Filtered	WW	G			1/18/21	1035		1			1							✱	X	✱	✱	✱	✱	✱			001
2	Dissolved Cu Blank	WW	G			1/18/21	1035		1			1								X								002
3	Final Effluent	WW	G			1/18/21	1020		6	3		4							X		X	X	X	X	X			003
4																												
5																												
6																												
7																												
8																												
9																												
10																												
11																												
12																												

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
DOC = 48hr hold time Ship direct to Pace National	Kenneth Walker	1-18-21	1145	Fed Ex	1-18-21	1145	
				Patrick Mulvaney	1-19-21	0845	

Fed Ex 8137262949465

SAMPLER NAME AND SIGNATURE			
PRINT Name of SAMPLER:	Kenneth Walker		
SIGNATURE of SAMPLER:		DATE Signed:	1/18/21

TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
4.3, 1.2, 1.1		N	

Sample Receipt Checklist

COC Seal Present/Intact: __Y__N If Applicable
COC Signed/Accurate: __Y__N VOA Zero Headspace: __Y__N
Bottles arrive intact: __Y__N Pres.Correct/Check: __Y__N
Correct bottles used: __Y__N
Sufficient volume sent: __Y__N

ANALYTICAL REPORT

March 24, 2021

Revised Report

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

BT Solutions, LLC

Sample Delivery Group:	L1318227
Samples Received:	02/22/2021
Project Number:	
Description:	Shenandoah Crossings Copper Study

Report To:

Beth Thompson
336 Cobbleview Drive
Lexington, SC 29072

Entire Report Reviewed By:

John Hawkins
Project Manager

TABLE OF CONTENTS

SAMPLE SUMMARY

FIELD BLANK L1318227-01 WW

Collected by: Aaron A | Collected date/time: 02/15/21 11:12 | Received date/time: 02/22/21 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Metals (ICPMS) by Method 200.8	WG1624205	1	02/23/21 15:44	02/24/21 00:39	LD	Mt. Juliet, TN

FILTERED FINAL EFFLUENT L1318227-02 WW

Collected by: Aaron A | Collected date/time: 02/15/21 11:12 | Received date/time: 02/22/21 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Metals (ICPMS) by Method 200.8	WG1624205	1	02/23/21 15:44	02/24/21 00:43	LD	Mt. Juliet, TN

FINAL EFFLUENT L1318227-03 WW

Collected by: Aaron A | Collected date/time: 02/15/21 11:12 | Received date/time: 02/22/21 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Calculated Results	WG1624589	1	02/25/21 02:50	02/25/21 02:50	TM	Mt. Juliet, TN
Wet Chemistry by Method 2320 B-2011	WG1624860	1	02/24/21 15:34	02/24/21 15:34	ARD	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG1626845	1	02/27/21 17:39	02/27/21 17:39	ELN	Mt. Juliet, TN
Wet Chemistry by Method 4500H+ B-2011	WG1624363	1	02/23/21 20:35	02/23/21 20:35	WOS	Mt. Juliet, TN
Wet Chemistry by Method 5310 B-2011	WG1626299	1	02/26/21 12:14	02/26/21 12:14	VRP	Mt. Juliet, TN
Metals (ICP) by Method 200.7	WG1624591	1	02/25/21 05:49	02/25/21 18:13	JDG	Mt. Juliet, TN
Metals (ICPMS) by Method 200.8	WG1624589	1	02/24/21 14:26	02/25/21 02:50	TM	Mt. Juliet, TN

CASE NARRATIVE

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

John Hawkins
Project Manager

Report Revision History

Level II Report - Version 1: 03/02/21 16:20
Level II Report - Version 2: 03/22/21 10:37

Project Narrative

DOC analyzed outside 48 hour hold due weather delay in shipping.
X qualifier is applied = Holding Time Exceeded Due to National Emergency

Sample Delivery Group (SDG) Narrative

Sample analysis performed past holding time due to a local natural disaster.

Lab Sample ID	Project Sample ID	Method
L1318227-03	FINAL EFFLUENT	5310 B-2011

Metals (ICPMS) by Method 200.8

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Copper,Dissolved	ND		0.00100	1	02/24/2021 00:39	WG1624205

Metals (ICPMS) by Method 200.8

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Copper,Dissolved	0.00712		0.00100	1	02/24/2021 00:43	WG1624205

Calculated Results

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Hardness (calculated) as CaCO3	100		2.50	1	02/25/2021 02:50	WG1624589

Wet Chemistry by Method 2320 B-2011

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Alkalinity,Carbonate	ND		20.0	1	02/24/2021 15:34	WG1624860

Sample Narrative:

L1318227-03 WG1624860: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 300.0

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Chloride	47.4		1.00	1	02/27/2021 17:39	WG1626845
Sulfate	18.0		5.00	1	02/27/2021 17:39	WG1626845

Wet Chemistry by Method 4500H+ B-2011

Analyte	Result su	Qualifier	Dilution	Analysis date / time	Batch
pH	5.27	T8	1	02/23/2021 20:35	WG1624363

Sample Narrative:

L1318227-03 WG1624363: 5.27 at 18.4C

Wet Chemistry by Method 5310 B-2011

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
DOC	4.98	T8	1.00	1	02/26/2021 12:14	WG1626299

Sample Narrative:

L1318227-03 WG1626299: X2 Sample analysis performed past holding time due to a local natural disaster.

Metals (ICP) by Method 200.7

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Calcium,Dissolved	30.3		1.00	1	02/25/2021 18:13	WG1624591
Magnesium,Dissolved	5.18		1.00	1	02/25/2021 18:13	WG1624591
Potassium,Dissolved	6.68		1.00	1	02/25/2021 18:13	WG1624591
Sodium,Dissolved	37.2		1.00	1	02/25/2021 18:13	WG1624591

Metals (ICPMS) by Method 200.8

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Calcium	31.2		1.00	1	02/25/2021 02:50	WG1624589
Copper	0.00703		0.00100	1	02/25/2021 02:50	WG1624589
Magnesium	5.46		1.00	1	02/25/2021 02:50	WG1624589

Method Blank (MB)

(MB) R3624998-1 02/24/21 15:23

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Alkalinity,Carbonate	U		8.45	20.0

Sample Narrative:

BLANK: Endpoint pH 4.5

L1318546-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1318546-01 02/24/21 16:31 • (DUP) R3624998-2 02/24/21 16:42

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity,Carbonate	ND	ND	1	0.000		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

L1318583-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1318583-01 02/24/21 17:44 • (DUP) R3624998-4 02/24/21 17:53

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity,Carbonate	ND	ND	1	0.000		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

Method Blank (MB)

(MB) R3625827-1 02/27/21 11:29

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Chloride	U		0.379	1.00
Sulfate	U		0.594	5.00

L1318227-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1318227-03 02/27/21 17:39 • (DUP) R3625827-3 02/27/21 17:56

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chloride	47.4	47.1	1	0.714		20
Sulfate	18.0	19.1	1	6.29		20

L1318683-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1318683-02 02/28/21 01:42 • (DUP) R3625827-7 02/28/21 02:00

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chloride	ND	ND	1	0.000		20

L1318683-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1318683-02 02/28/21 02:36 • (DUP) R3625827-9 02/28/21 02:54

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Sulfate	108	108	5	0.302		20

Laboratory Control Sample (LCS)

(LCS) R3625827-2 02/27/21 11:47

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Chloride	40.0	40.8	102	90.0-110	
Sulfate	40.0	41.6	104	90.0-110	

L1318227-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1318227-03 02/27/21 17:39 • (MS) R3625827-4 02/27/21 18:14 • (MSD) R3625827-5 02/27/21 18:32

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Chloride	50.0	47.4	95.3	95.4	95.8	95.9	1	80.0-120			0.0649	20
Sulfate	50.0	18.0	68.8	69.1	102	102	1	80.0-120			0.366	20

L1318683-02 Original Sample (OS) • Matrix Spike (MS)

(OS) L1318683-02 02/28/21 01:42 • (MS) R3625827-8 02/28/21 02:18

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Chloride	50.0	ND	49.5	97.8	1	80.0-120	
Sulfate	50.0	108	152	88.2	1	80.0-120	E

L1317573-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1317573-01 02/23/21 20:35 • (DUP) R3624430-2 02/23/21 20:35

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	su	su		%		%
pH	8.13	8.12	1	0.123		1

Sample Narrative:

OS: 8.13 at 19.8C

DUP: 8.12 at 19.2C

L1318469-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1318469-03 02/23/21 20:35 • (DUP) R3624430-3 02/23/21 20:35

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	su	su		%		%
pH	7.46	7.46	1	0.000		1

Sample Narrative:

OS: 7.46 at 19C

DUP: 7.46 at 19C

Laboratory Control Sample (LCS)

(LCS) R3624430-1 02/23/21 20:35

Analyte	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
	su	su	%	%	
pH	10.0	10.1	101	99.0-101	

Sample Narrative:

LCS: 10.05 at 20C

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) R3625692-1 02/26/21 11:06

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
DOC	0.274	J	0.106	1.00

L1318227-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1318227-03 02/26/21 12:14 • (DUP) R3625692-4 02/26/21 12:26

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
DOC	4.98	4.93	1	1.07		20

Sample Narrative:

OS: X2 Sample analysis performed past holding time due to a local natural disaster.

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3625692-2 02/26/21 11:34 • (LCSD) R3625692-3 02/26/21 11:51

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
DOC	75.0	73.7	73.9	98.3	98.5	85.0-115			0.203	20

L1318227-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1318227-03 02/26/21 12:14 • (MS) R3625692-5 02/26/21 12:44 • (MSD) R3625692-6 02/26/21 13:02

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
DOC	50.0	4.98	49.1	49.7	88.2	89.3	1	80.0-120			1.20	20

Sample Narrative:

OS: X2 Sample analysis performed past holding time due to a local natural disaster.

QUALITY CONTROL SUMMARY

L1318227-03

Method Blank (MB)

(MB) R3625338-1 02/25/21 17:39

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Calcium,Dissolved	U		0.0473	1.00
Magnesium,Dissolved	U		0.115	1.00
Potassium,Dissolved	U		0.313	1.00
Sodium,Dissolved	U		0.444	1.00

Laboratory Control Sample (LCS)

(LCS) R3625338-2 02/25/21 17:42

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Calcium,Dissolved	10.0	9.75	97.5	85.0-115	
Magnesium,Dissolved	10.0	9.77	97.7	85.0-115	
Potassium,Dissolved	10.0	9.15	91.5	85.0-115	
Sodium,Dissolved	10.0	9.82	98.2	85.0-115	

L1318536-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1318536-01 02/25/21 17:45 • (MS) R3625338-4 02/25/21 17:50 • (MSD) R3625338-5 02/25/21 17:53

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Calcium,Dissolved	10.0	22.0	31.9	31.5	99.1	95.0	1	70.0-130			1.28	20
Magnesium,Dissolved	10.0	15.8	25.4	25.0	95.1	91.4	1	70.0-130			1.45	20
Potassium,Dissolved	10.0	2.20	11.1	11.0	89.4	88.1	1	70.0-130			1.19	20
Sodium,Dissolved	10.0	433	444	438	107	48.4	1	70.0-130		V	1.33	20

L1318546-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1318546-01 02/25/21 17:56 • (MS) R3625338-6 02/25/21 17:59 • (MSD) R3625338-7 02/25/21 18:01

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Calcium,Dissolved	10.0	59.3	69.7	68.5	104	91.8	1	70.0-130			1.79	20
Magnesium,Dissolved	10.0	22.1	31.9	31.4	98.6	93.2	1	70.0-130			1.69	20
Potassium,Dissolved	10.0	2.53	11.5	11.4	90.0	89.0	1	70.0-130			0.838	20
Sodium,Dissolved	10.0	46.6	55.9	55.2	93.3	86.5	1	70.0-130			1.23	20

Method Blank (MB)

(MB) R3624459-1 02/23/21 23:04

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Copper,Dissolved	U		0.000670	0.00100

Laboratory Control Sample (LCS)

(LCS) R3624459-2 02/23/21 23:08

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Copper,Dissolved	0.0500	0.0503	101	85.0-115	

L1316569-07 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1316569-07 02/23/21 23:11 • (MS) R3624459-4 02/23/21 23:18 • (MSD) R3624459-5 02/23/21 23:21

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Copper,Dissolved	0.0500	0.00161	0.0505	0.0482	97.8	93.2	1	70.0-130			4.60	20

L1317061-16 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1317061-16 02/23/21 23:24 • (MS) R3624459-6 02/23/21 23:27 • (MSD) R3624459-7 02/23/21 23:31

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Copper,Dissolved	0.0500	0.00317	0.0517	0.0511	97.0	95.8	1	70.0-130			1.10	20

QUALITY CONTROL SUMMARY

L1318227-03

Method Blank (MB)

(MB) R3624874-1 02/25/21 01:21

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Calcium	U		0.112	1.00
Copper	U		0.000670	0.00100
Magnesium	U		0.0690	1.00

Laboratory Control Sample (LCS)

(LCS) R3624874-2 02/25/21 01:24

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Calcium	5.00	5.08	102	85.0-115	
Copper	0.0500	0.0500	100	85.0-115	
Magnesium	5.00	5.11	102	85.0-115	

L1317923-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1317923-01 02/25/21 01:27 • (MS) R3624874-4 02/25/21 01:34 • (MSD) R3624874-5 02/25/21 01:38

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Calcium	5.00	24.6	29.1	29.9	90.9	108	1	70.0-130			2.84	20
Copper	0.0500	ND	0.0493	0.0499	97.3	98.3	1	70.0-130			1.06	20
Magnesium	5.00	12.1	17.0	17.1	99.1	100	1	70.0-130			0.363	20

L1318368-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1318368-01 02/25/21 01:41 • (MS) R3624874-6 02/25/21 01:45 • (MSD) R3624874-7 02/25/21 01:48

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Calcium	5.00	115	119	117	71.3	32.8	1	70.0-130		V	1.63	20
Copper	0.0500	0.0222	0.0703	0.0711	96.1	97.7	1	70.0-130			1.14	20
Magnesium	5.00	7.81	12.6	12.4	96.4	91.3	1	70.0-130			2.05	20

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
J	The identification of the analyte is acceptable; the reported value is an estimate.
T8	Sample(s) received past/too close to holding time expiration.
V	The sample concentration is too high to evaluate accurate spike recoveries.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
BT Solutions, LLC
336 Cobbleview Drive
Lexington, SC 29072

Billing Information:
Beth Thompson
336 Cobbleview Drive
Lexington, SC 29072

Report to: **Beth Thompson**

Email To: **beth@btsolutionssc.com**

Project Description: **Shenandoah Crossings Copper Study**

City/State Collected: Gordonsville, VA

Please Circle: PT MT CT (ET)

Phone: **803-447-8471**

Client Project #

Lab Project # **BTSOLLSC-SCCUBLM**

Collected by (print): Aaron Akuki

Site/Facility ID #

P.O. #

Collected by (signature):

Quote #

Immediately Packed on Ice N ___ Y ✓

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day
Date Results Needed

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	ALKCA,CL,PH,SO4 250mlHDPE-NoPres	Copper Diss 200.8 250mlHDPE-HNO3	Copper Hardness 250mlHDPE-HNO3	DOC, Diss CA, MG, NA 250mlHDPE-NoPres	Remarks	Sample # (lab only)
FIELD BLANK	G	WW		2-15-21	1112	1		X				-01
FILTERED FINAL EFFLUENT	G	WW		2-15-21	1112	1		X				-02
FILTERED FINAL EFFLUENT	G	WW		2-15-21	1112	3	X		X	X		-03

Chain of Custody Page ___ of ___

Pace Analytical® National Center for Testing & Innovation

12065 Lebanon Road Mt Juliet, TN 37122
Phone: 615-758-5858 Alt: 800-767-5859
Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard-terms.pdf

SDG # L[illegible]8227
C237

Acctnum: **BTSOLLSC**
Template: **T181868**
Prelogin: **P827198**
PM: **341 - John Hawkins**
PB: Os 02/9/21
Shipped Via: **FedEX Ground**

* Matrix:
SS - Soil **AIR** - Air **F** - Filter
GW - Groundwater **B** - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks: Total gallons .061660 Total gallons

pH 7.33 Temp 9.8 °C
Flow 29.57gpm Other _____

Samples returned via: __ UPS __ FedEx X Courier _____

Tracking # 9517 5759 7099

Sample Receipt Checklist
COC Seal Present/Intact: NP Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N
RAD Screen <0.5 mR/hr: Y N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No HCL / MeoH TBR
	2.15.21	1200	FedEx	
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: °C Bottles Received:
				2.8-2.3.0 5
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: Time:
				2/22/21 9:00

If preservation required by Login: Date/Time

Hold: Condition: NCF / OK

L1318227 BTSOLLSC NCF

Shortholds

Time estimate: oh **Time spent:** oh **Grouping date:** 22 February 2

Members

Cole Medley (responsible) JVH John V Hawkins

- [x] Parameter(s) past holding time
- [ ] Temperature not in range
- [ ] Improper container type
- [ ] pH not in range
- [ ] Insufficient sample volume
- [ ] Sample is biphasic
- [ ] Vials received with headspace
- [ ] Broken container
- [ ] Sufficient sample remains
- [ ] If broken container: Insufficient packing material around container
- [ ] If broken container: Insufficient packing material inside cooler
- [ ] If broken container: Improper handling by carrier:_____
- [ ] If broken container: Sample was frozen
- [ ] If broken container: Container lid not intact
- [x] Client informed by Call
- [x] Client informed by Email
- [ ] Client informed by Voicemail
- [x] Date/Time:___2-22-21 11:35_____
- [x] PM initials:_____JVH_____
- [x] Client Contact:_____Beth_____

Comments

Cole Medley *22 February 2021 11:17 AM*

Received DOC OOH for ID FILTERED FINAL EFFLUENT

John V Hawkins *22 February 2021 11:38 AM*

Client gives permission to run DOC out of hold and qualify

Cole Medley *22 February 2021 12:13 PM*

Done.

ANALYTICAL REPORT

April 06, 2021

Revised Report

BT Solutions, LLC

Sample Delivery Group:	L1320476
Samples Received:	02/26/2021
Project Number:	
Description:	Shenandoah Crossings Copper Study

Report To: Beth Thompson
336 Cobbleview Drive
Lexington, SC 29072

Entire Report Reviewed By:

John Hawkins
Project Manager

Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

TABLE OF CONTENTS

SAMPLE SUMMARY

FIELD BLANK L1320476-01 WW

Collected by: Aaron A | Collected date/time: 02/25/21 10:40 | Received date/time: 02/26/21 09:55

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Metals (ICPMS) by Method 200.8	WG1626000	1	02/26/21 11:59	02/27/21 02:41	JPD	Mt. Juliet, TN

FILTERED FINAL EFFLUENT L1320476-02 WW

Collected by: Aaron A | Collected date/time: 02/25/21 10:40 | Received date/time: 02/26/21 09:55

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Metals (ICPMS) by Method 200.8	WG1626000	1	02/26/21 11:59	02/27/21 02:44	JPD	Mt. Juliet, TN

FINAL EFFLUENT L1320476-03 WW

Collected by: Aaron A | Collected date/time: 02/25/21 10:40 | Received date/time: 02/26/21 09:55

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Calculated Results	WG1627048	1	03/01/21 10:39	03/01/21 10:39	EL	Mt. Juliet, TN
Wet Chemistry by Method 2320 B-2011	WG1627481	1	03/01/21 14:56	03/01/21 14:56	ARD	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG1629331	5	03/04/21 11:39	03/04/21 11:39	LBR	Mt. Juliet, TN
Wet Chemistry by Method 4500H+ B-2011	WG1627244	1	02/28/21 21:28	02/28/21 21:28	KPS	Mt. Juliet, TN
Wet Chemistry by Method 5310 B-2011	WG1628225	1	03/03/21 12:04	03/03/21 12:04	MJA	Mt. Juliet, TN
Wet Chemistry by Method 5310 B-2011	WG1643274	1	04/02/21 18:20	04/02/21 18:20	VRP	Mt. Juliet, TN
Metals (ICP) by Method 200.7	WG1626116	1	02/27/21 08:05	02/27/21 18:19	JDG	Mt. Juliet, TN
Metals (ICP) by Method 200.7	WG1627048	1	02/28/21 09:38	03/01/21 10:39	EL	Mt. Juliet, TN
Metals (ICPMS) by Method 200.8	WG1626692	1	02/27/21 08:21	02/27/21 17:21	JPD	Mt. Juliet, TN

CASE NARRATIVE

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

John Hawkins
Project Manager

Report Revision History

Level II Report - Version 1: 03/05/21 13:47
Level II Report - Version 2: 03/22/21 10:37

Project Narrative

DOC 4.61 mg/l analyzed iniitlly from unpreserved and lab filtered and preserved container and DOC 4.81 mg/l reanalyzed from field filtered and preserved container for comparison.

Metals (ICPMS) by Method 200.8

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Copper,Dissolved	ND		0.00100	1	02/27/2021 02:41	WG1626000

Metals (ICPMS) by Method 200.8

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Copper,Dissolved	0.00585		0.00100	1	02/27/2021 02:44	WG1626000

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Flow Measure	41.55	
pH (On Site)	7.32	su
Temperature (on-site)	9.2	Deg C

Calculated Results

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Hardness (calculated) as CaCO3	89.6		2.50	1	03/01/2021 10:39	WG1627048

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Alkalinity,Carbonate	ND		20.0	1	03/01/2021 14:56	WG1627481

Sample Narrative:

L1320476-03 WG1627481: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Chloride	46.0		5.00	5	03/04/2021 11:39	WG1629331
Sulfate	40.9		25.0	5	03/04/2021 11:39	WG1629331

Wet Chemistry by Method 4500H+ B-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	su			date / time	
pH	7.72	T8	1	02/28/2021 21:28	WG1627244

Sample Narrative:

L1320476-03 WG1627244: 7.72 at 20.3C

Wet Chemistry by Method 5310 B-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
DOC	4.61	T8	1.00	1	03/03/2021 12:04	WG1628225
DOC	4.81	T8	1.00	1	04/02/2021 18:20	WG1643274

Metals (ICP) by Method 200.7

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Calcium	27.7		1.00	1	03/01/2021 10:39	WG1627048
Calcium,Dissolved	26.8		1.00	1	02/27/2021 18:19	WG1626116
Magnesium	4.96		1.00	1	03/01/2021 10:39	WG1627048
Magnesium,Dissolved	5.04		1.00	1	02/27/2021 18:19	WG1626116
Potassium,Dissolved	8.69		1.00	1	02/27/2021 18:19	WG1626116
Sodium,Dissolved	60.4		1.00	1	02/27/2021 18:19	WG1626116

Metals (ICPMS) by Method 200.8

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Copper	0.00535		0.00100	1	02/27/2021 17:21	WG1626692

Method Blank (MB)

(MB) R3626346-1 03/01/21 14:46

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Alkalinity,Carbonate	U		8.45	20.0

Sample Narrative:

BLANK: Endpoint pH 4.5

L1320534-05 Original Sample (OS) • Duplicate (DUP)

(OS) L1320534-05 03/01/21 15:05 • (DUP) R3626346-3 03/01/21 15:14

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity,Carbonate	ND	ND	1	0.000		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

L1320613-04 Original Sample (OS) • Duplicate (DUP)

(OS) L1320613-04 03/01/21 16:56 • (DUP) R3626346-6 03/01/21 17:04

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity,Carbonate	ND	ND	1	0.000		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

Method Blank (MB)

(MB) R3627668-1 03/04/21 05:05

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Chloride	U		0.379	1.00
Sulfate	U		0.594	5.00

L1322226-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1322226-01 03/04/21 19:57 • (DUP) R3627668-7 03/04/21 20:15

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chloride	12.1	12.1	1	0.142		20
Sulfate	14.0	13.9	1	0.475		20

L1322745-07 Original Sample (OS) • Duplicate (DUP)

(OS) L1322745-07 03/04/21 23:50 • (DUP) R3627668-8 03/05/21 00:08

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chloride	19.5	19.1	5	1.75		20
Sulfate	104	102	5	1.86		20

Laboratory Control Sample (LCS)

(LCS) R3627668-2 03/04/21 05:23

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Chloride	40.0	40.8	102	90.0-110	
Sulfate	40.0	42.3	106	90.0-110	

L1322671-12 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1322671-12 03/04/21 16:40 • (MS) R3627668-4 03/04/21 16:58 • (MSD) R3627668-5 03/04/21 17:16

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Chloride	50.0	194	237	237	84.3	85.6	1	80.0-120	E	E	0.283	20
Sulfate	50.0	400	424	424	48.4	48.3	1	80.0-120	E V	E V	0.0158	20

L1322362-01 Original Sample (OS) • Matrix Spike (MS)

(OS) L1322362-01 03/04/21 19:21 • (MS) R3627668-6 03/04/21 19:39

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Chloride	50.0	ND	52.6	104	1	80.0-120	
Sulfate	50.0	22.7	75.1	105	1	80.0-120	

L1320207-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1320207-01 02/28/21 21:28 • (DUP) R3625921-2 02/28/21 21:28

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	su	su		%		%
pH	7.67	7.63	1	0.523		1

Sample Narrative:

OS: 7.67 at 21.9C

DUP: 7.63 at 21.8C

L1321258-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1321258-01 02/28/21 21:28 • (DUP) R3625921-3 02/28/21 21:28

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	su	su		%		%
pH	3.89	3.89	1	0.000		1

Sample Narrative:

OS: 3.89 at 18C

DUP: 3.89 at 18.3C

Laboratory Control Sample (LCS)

(LCS) R3625921-1 02/28/21 21:28

Analyte	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
	su	su	%	%	
pH	10.0	10.1	101	99.0-101	

Sample Narrative:

LCS: 10.06 at 20.4C

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) R3627235-1 03/03/21 10:54

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
DOC	0.368	J	0.106	1.00

L1320476-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1320476-03 03/03/21 12:04 • (DUP) R3627235-3 03/03/21 12:17

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
DOC	4.61	4.44	1	3.87		20

Laboratory Control Sample (LCS)

(LCS) R3627235-2 03/03/21 11:23

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
DOC	75.0	74.7	99.6	85.0-115	

L1320476-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1320476-03 03/03/21 12:04 • (MS) R3627235-4 03/03/21 12:36 • (MSD) R3627235-5 03/03/21 12:54

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
DOC	50.0	4.61	54.5	53.3	99.7	97.5	1	80.0-120			2.11	20

Method Blank (MB)

(MB) R3637780-1 04/02/21 11:37

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
DOC	0.378	J	0.106	1.00

L1332298-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1332298-01 04/02/21 14:06 • (DUP) R3637780-5 04/02/21 14:22

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
DOC	5.68	5.49	1	3.36		20

Laboratory Control Sample (LCS)

(LCS) R3637780-2 04/02/21 12:16

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
DOC	75.0	74.9	99.8	85.0-115	

L1331937-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1331937-01 04/02/21 13:06 • (MS) R3637780-3 04/02/21 13:28 • (MSD) R3637780-4 04/02/21 13:51

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
DOC	50.0	1.08	49.2	50.2	96.3	98.2	1	80.0-120			1.87	20

Method Blank (MB)

(MB) R3625820-1 02/27/21 17:26

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Calcium,Dissolved	U		0.0473	1.00
Magnesium,Dissolved	U		0.115	1.00
Potassium,Dissolved	U		0.313	1.00
Sodium,Dissolved	U		0.444	1.00

Laboratory Control Sample (LCS)

(LCS) R3625820-2 02/27/21 17:28

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Calcium,Dissolved	10.0	9.47	94.7	85.0-115	
Magnesium,Dissolved	10.0	9.55	95.5	85.0-115	
Potassium,Dissolved	10.0	9.40	94.0	85.0-115	
Sodium,Dissolved	10.0	9.49	94.9	85.0-115	

L1320242-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1320242-03 02/27/21 17:31 • (MS) R3625820-4 02/27/21 17:37 • (MSD) R3625820-5 02/27/21 17:39

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Calcium,Dissolved	10.0	240	251	250	115	109	1	70.0-130			0.250	20
Magnesium,Dissolved	10.0	70.5	80.5	80.1	99.8	95.4	1	70.0-130			0.546	20
Potassium,Dissolved	10.0	4.08	13.8	13.9	97.4	97.9	1	70.0-130			0.316	20
Sodium,Dissolved	10.0	8.77	18.7	18.6	98.8	98.2	1	70.0-130			0.348	20

L1320533-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1320533-01 02/27/21 17:42 • (MS) R3625820-6 02/27/21 17:44 • (MSD) R3625820-7 02/27/21 17:47

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Calcium,Dissolved	10.0	4.00	13.5	13.4	94.8	93.6	1	70.0-130			0.867	20
Magnesium,Dissolved	10.0	ND	10.4	10.3	94.4	93.3	1	70.0-130			1.01	20
Potassium,Dissolved	10.0	1.79	12.4	12.5	106	108	1	70.0-130			1.16	20
Sodium,Dissolved	10.0	604	627	625	232	212	1	70.0-130	V	V	0.309	20

Method Blank (MB)

(MB) R3626311-1 03/01/21 10:02

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Calcium	U		0.0473	1.00
Magnesium	U		0.115	1.00

Laboratory Control Sample (LCS)

(LCS) R3626311-2 03/01/21 10:04

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Calcium	10.0	10.4	104	85.0-115	
Magnesium	10.0	10.1	101	85.0-115	

L1320489-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1320489-01 03/01/21 10:07 • (MS) R3626311-4 03/01/21 10:13 • (MSD) R3626311-5 03/01/21 10:15

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Calcium	10.0	140	148	154	87.5	149	1	70.0-130		V	4.06	20
Magnesium	10.0	18.0	27.8	28.8	98.3	108	1	70.0-130			3.48	20

Method Blank (MB)

(MB) R3625675-1 02/27/21 00:59

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Copper,Dissolved	U		0.000670	0.00100

Laboratory Control Sample (LCS)

(LCS) R3625675-2 02/27/21 01:03

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Copper,Dissolved	0.0500	0.0489	97.9	85.0-115	

L1317073-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1317073-04 02/27/21 01:10 • (MS) R3625675-4 02/27/21 01:17 • (MSD) R3625675-5 02/27/21 01:20

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Copper,Dissolved	0.0500	0.0210	0.0673	0.0686	92.5	95.1	1	70.0-130			1.97	20

L1320242-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1320242-04 02/27/21 01:24 • (MS) R3625675-6 02/27/21 01:27 • (MSD) R3625675-7 02/27/21 01:31

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Copper,Dissolved	0.0500	ND	0.0481	0.0486	96.1	97.2	1	70.0-130			1.10	20

Method Blank (MB)

(MB) R3625762-1 02/27/21 16:19

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Copper	U		0.000670	0.00100

Laboratory Control Sample (LCS)

(LCS) R3625762-2 02/27/21 16:23

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Copper	0.0500	0.0465	93.0	85.0-115	

L1320046-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1320046-01 02/27/21 16:26 • (MS) R3625762-4 02/27/21 16:33 • (MSD) R3625762-5 02/27/21 16:36

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Copper	0.0500	0.0132	0.0579	0.0576	89.5	88.8	1	70.0-130			0.570	20

L1320314-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1320314-01 02/27/21 16:40 • (MS) R3625762-6 02/27/21 16:43 • (MSD) R3625762-7 02/27/21 16:46

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Copper	0.0500	ND	0.0486	0.0469	97.2	93.7	1	70.0-130			3.66	20

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
J	The identification of the analyte is acceptable; the reported value is an estimate.
T8	Sample(s) received past/too close to holding time expiration.
V	The sample concentration is too high to evaluate accurate spike recoveries.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LA000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
BT Solutions, LLC

336 Cobbleview Drive
Lexington, SC 29072

Billing Information:
Beth Thompson
336 Cobbleview Drive
Lexington, SC 29072

Pres Chk

Report to:
Beth Thompson

Email To: **beth@btsolutionssc.com**

Project Description:
Shenandoah Crossings Copper Study

City/State Collected: Gordonsville, VA

Please Circle: PT MT CT (ET)

Phone: **803-447-8471**

Client Project #

Lab Project #
BTSOLLSC-SCCUBLM

Collected by (print):
Aaron Akacki

Site/Facility ID #

P.O. #

Collected by (signature):
[signature]

Immediately Packed on Ice N ___ Y ✓

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	ALKCA,CL,PH,SO4 250mlHDPE-NoPres	Copper Diss 200.8 250mlHDPE-HNO3	Copper Hardness 250mlHDPE-HNO3	DOC, Diss CA, MG, NA 250mlHDPE-NoPres	Remarks	Sample # (lab only)
FIELD BLANK	G	WW		2.25.21	10:40	1		X				-01
FILTERED FINAL EFFLUENT	G	WW		2.25.21	10:40	1		X				-02
FILTERED FINAL EFFLUENT	G	WW		2.25.21	10:40	3	X		X	X		-03

* Matrix:
SS - Soil **AIR** - Air **F** - Filter
GW - Groundwater **B** - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:
Total gallons was 058955

pH 7.32 Temp 9.2°C
Flow 41.55 Other _____

Samples returned via:
__ UPS __ FedEx __ Courier _____

Tracking # 9517 5262 0349

Relinquished by : (Signature) [signature] Date: 2.25.21 Time: 1100
Received by: (Signature)

Relinquished by : (Signature) Date: Time:
Received by: (Signature)

Relinquished by : (Signature) Date: Time:
Received for lab by: (Signature) [signature] Date: 2-26-21 Time: 9:55

Trip Blank Received: Yes / No
HCL / MeoH
TBR

Temp: 23.5-5=18 °C Bottles Received: 5

If preservation required by Login: Date/Time

Hold: Condition: NCF / (OK)

Sample Receipt Checklist
COC Seal Present/Intact: NP Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N
RAD Screen <0.5 mR/hr: Y N

Chain of Custody Page ___ of ___

Pace Analytical®
National Center for Testing & Innovation

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Phone: 615-758-5858 Alt: 800-767-5859
Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard-terms.pdf

SDG # L1320476
E094

Acctnum: BTSOLLSC
Template: T182326
Prelogin: P828667
PM: 341 - John Hawkins
PB: TB 2-22-21
Shipped Via: FedEx Ground

ANALYTICAL REPORT

April 05, 2021

BT Solutions, LLC

Sample Delivery Group:	L1327076
Samples Received:	03/16/2021
Project Number:	
Description:	Shenandoah Crossings Copper Study

Report To:

Beth Thompson
336 Cobbleview Drive
Lexington, SC 29072

Entire Report Reviewed By:

John Hawkins
Project Manager

TABLE OF CONTENTS

SAMPLE SUMMARY

FIELD BLANK L1327076-01 WW

Collected by: Aaron A | Collected date/time: 03/15/21 09:00 | Received date/time: 03/16/21 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Metals (ICPMS) by Method 200.8	WG1635089	1	03/17/21 10:51	03/17/21 18:15	JPD	Mt. Juliet, TN

FILTERED FINAL EFFLUENT L1327076-02 WW

Collected by: Aaron A | Collected date/time: 03/15/21 09:00 | Received date/time: 03/16/21 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Metals (ICPMS) by Method 200.8	WG1635089	1	03/17/21 10:51	03/17/21 19:01	JPD	Mt. Juliet, TN

FINAL EFFLUENT L1327076-03 WW

Collected by: Aaron A | Collected date/time: 03/15/21 09:00 | Received date/time: 03/16/21 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Calculated Results	WG1636437	1	03/21/21 21:33	03/21/21 21:33	EL	Mt. Juliet, TN
Wet Chemistry by Method 2320 B-2011	WG1636448	1	03/18/21 09:47	03/18/21 09:47	SL	Mt. Juliet, TN
Wet Chemistry by Method 300.0	WG1637611	5	03/21/21 15:04	03/21/21 15:04	ELN	Mt. Juliet, TN
Wet Chemistry by Method 4500H+ B-2011	WG1635651	1	03/17/21 09:00	03/17/21 09:00	AMH	Mt. Juliet, TN
Wet Chemistry by Method 5310 B-2011	WG1643274	1	04/02/21 18:36	04/02/21 18:36	VRP	Mt. Juliet, TN
Metals (ICP) by Method 200.7	WG1636437	1	03/20/21 15:30	03/21/21 21:33	EL	Mt. Juliet, TN
Metals (ICPMS) by Method 200.8	WG1637236	1	03/19/21 09:59	03/19/21 18:15	JPD	Mt. Juliet, TN

CASE NARRATIVE

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

John Hawkins
Project Manager

Metals (ICPMS) by Method 200.8

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Copper,Dissolved	ND		0.00100	1	03/17/2021 18:15	WG1635089

Metals (ICPMS) by Method 200.8

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Copper,Dissolved	0.0197		0.00100	1	03/17/2021 19:01	WG1635089

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
Flow Measure	30.26	
pH (On Site)	7.06	su
Temperature (on-site)	12.4	Deg. C

Calculated Results

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Hardness,Dissolved (calculated) as CaCO3	83.0		2.50	1	03/21/2021 21:33	WG1636437

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Alkalinity,Carbonate	ND		20.0	1	03/18/2021 09:47	WG1636448

Sample Narrative:

L1327076-03 WG1636448: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 300.0

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Chloride	27.3		5.00	5	03/21/2021 15:04	WG1637611
Sulfate	47.1		25.0	5	03/21/2021 15:04	WG1637611

Wet Chemistry by Method 4500H+ B-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	su			date / time	
pH	7.70	T8	1	03/17/2021 09:00	WG1635651

Sample Narrative:

L1327076-03 WG1635651: 7.7 at 20C

Wet Chemistry by Method 5310 B-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
DOC	5.93		1.00	1	04/02/2021 18:36	WG1643274

Metals (ICP) by Method 200.7

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Calcium,Dissolved	24.9		1.00	1	03/21/2021 21:33	WG1636437
Magnesium,Dissolved	5.05		1.00	1	03/21/2021 21:33	WG1636437
Potassium,Dissolved	8.48		1.00	1	03/21/2021 21:33	WG1636437
Sodium,Dissolved	58.9		1.00	1	03/21/2021 21:33	WG1636437

Metals (ICPMS) by Method 200.8

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Copper	0.0186		0.00100	1	03/19/2021 18:15	WG1637236

Method Blank (MB)

(MB) R3632422-1 03/18/21 06:16

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Alkalinity,Carbonate	U		8.45	20.0

Sample Narrative:

BLANK: Endpoint pH 4.5

L1326699-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1326699-02 03/18/21 06:36 • (DUP) R3632422-2 03/18/21 06:47

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity,Carbonate	ND	ND	1	0.000		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

L1327112-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1327112-01 03/18/21 08:24 • (DUP) R3632422-4 03/18/21 08:32

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity,Carbonate	ND	ND	1	0.000		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

Method Blank (MB)

(MB) R3633285-1 03/21/21 09:13

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Chloride	U		0.379	1.00
Sulfate	U		0.594	5.00

L1327059-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1327059-01 03/21/21 11:23 • (DUP) R3633285-3 03/21/21 11:41

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chloride	ND	ND	5	0.000		20
Sulfate	145	144	5	0.992		20

L1327162-06 Original Sample (OS) • Duplicate (DUP)

(OS) L1327162-06 03/21/21 18:45 • (DUP) R3633285-6 03/21/21 19:03

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Chloride	ND	ND	1	0.000		20

L1327162-06 Original Sample (OS) • Duplicate (DUP)

(OS) L1327162-06 03/22/21 10:42 • (DUP) R3633285-8 03/22/21 11:00

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Sulfate	278	284	5	1.83		20

Laboratory Control Sample (LCS)

(LCS) R3633285-2 03/21/21 09:31

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Chloride	40.0	39.4	98.5	90.0-110	
Sulfate	40.0	39.5	98.7	90.0-110	

L1327059-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1327059-02 03/21/21 12:00 • (MS) R3633285-4 03/21/21 12:18 • (MSD) R3633285-5 03/21/21 12:36

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Chloride	50.0	ND	49.7	50.6	98.2	100	1	80.0-120			1.96	20
Sulfate	50.0	54.5	101	102	93.6	95.5	1	80.0-120	E	E	0.964	20

L1327162-07 Original Sample (OS) • Matrix Spike (MS)

(OS) L1327162-07 03/21/21 19:22 • (MS) R3633285-7 03/21/21 19:40

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Chloride	50.0	ND	50.8	100	1	80.0-120	
Sulfate	50.0	283	313	58.9	1	80.0-120	E V

L1326567-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1326567-01 03/17/21 09:00 • (DUP) R3631559-2 03/17/21 09:00

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	su	su		%		%
pH	6.87	6.87	1	0.000		1

Sample Narrative:

OS: 6.87 at 21.1C

DUP: 6.87 at 20.3C

L1327342-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1327342-03 03/17/21 09:00 • (DUP) R3631559-3 03/17/21 09:00

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	su	su		%		%
pH	6.90	6.91	1	0.145		1

Sample Narrative:

OS: 6.9 at 20.7C

DUP: 6.91 at 20.5C

Laboratory Control Sample (LCS)

(LCS) R3631559-1 03/17/21 09:00

Analyte	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
	su	su	%	%	
pH	10.0	10.1	101	99.0-101	

Sample Narrative:

LCS: 10.05 at 22C

Method Blank (MB)

(MB) R3637780-1 04/02/21 11:37

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
DOC	0.378	J	0.106	1.00

L1332298-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1332298-01 04/02/21 14:06 • (DUP) R3637780-5 04/02/21 14:22

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
DOC	5.68	5.49	1	3.36		20

Laboratory Control Sample (LCS)

(LCS) R3637780-2 04/02/21 12:16

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
DOC	75.0	74.9	99.8	85.0-115	

L1331937-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1331937-01 04/02/21 13:06 • (MS) R3637780-3 04/02/21 13:28 • (MSD) R3637780-4 04/02/21 13:51

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
DOC	50.0	1.08	49.2	50.2	96.3	98.2	1	80.0-120			1.87	20

Method Blank (MB)

(MB) R3633259-1 03/21/21 21:17

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Calcium,Dissolved	U		0.0473	1.00
Magnesium,Dissolved	U		0.115	1.00
Potassium,Dissolved	U		0.313	1.00
Sodium,Dissolved	U		0.444	1.00

Laboratory Control Sample (LCS)

(LCS) R3633259-2 03/21/21 21:20

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Calcium,Dissolved	10.0	8.96	89.6	85.0-115	
Magnesium,Dissolved	10.0	9.18	91.8	85.0-115	
Potassium,Dissolved	10.0	9.17	91.7	85.0-115	
Sodium,Dissolved	10.0	9.37	93.7	85.0-115	

L1327848-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1327848-01 03/21/21 21:22 • (MS) R3633259-4 03/21/21 21:28 • (MSD) R3633259-5 03/21/21 21:30

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Calcium,Dissolved	10.0	30.1	39.9	40.8	98.1	107	1	70.0-130			2.17	20
Magnesium,Dissolved	10.0	7.28	16.6	16.6	92.8	93.7	1	70.0-130			0.547	20
Potassium,Dissolved	10.0	2.95	12.3	12.4	93.9	94.8	1	70.0-130			0.772	20
Sodium,Dissolved	10.0	23.2	32.7	33.1	94.6	98.8	1	70.0-130			1.26	20

Method Blank (MB)

(MB) R3631916-1 03/17/21 17:55

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Copper,Dissolved	U		0.000670	0.00100

Laboratory Control Sample (LCS)

(LCS) R3631916-2 03/17/21 17:58

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Copper,Dissolved	0.0500	0.0499	99.7	85.0-115	

L1326190-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1326190-01 03/17/21 18:01 • (MS) R3631916-4 03/17/21 18:08 • (MSD) R3631916-5 03/17/21 18:11

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Copper,Dissolved	0.0500	ND	0.0508	0.0498	99.7	97.8	1	70.0-130			1.89	20

L1327076-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1327076-01 03/17/21 18:15 • (MS) R3631916-6 03/17/21 18:18 • (MSD) R3631916-7 03/17/21 18:21

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Copper,Dissolved	0.0500	ND	0.0505	0.0505	101	101	1	70.0-130			0.0326	20

Method Blank (MB)

(MB) R3632820-1 03/19/21 17:17

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Copper	U		0.000670	0.00100

Laboratory Control Sample (LCS)

(LCS) R3632820-2 03/19/21 17:20

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Copper	0.0500	0.0481	96.2	85.0-115	

L1327059-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1327059-01 03/19/21 17:23 • (MS) R3632820-4 03/19/21 17:30 • (MSD) R3632820-5 03/19/21 17:33

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Copper	0.0500	ND	0.0501	0.0499	100	99.7	1	70.0-130			0.489	20

L1327185-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1327185-01 03/19/21 17:36 • (MS) R3632820-6 03/19/21 17:39 • (MSD) R3632820-7 03/19/21 17:43

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Copper	0.0500	0.0136	0.0596	0.0600	92.1	92.7	1	70.0-130			0.536	20

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
J	The identification of the analyte is acceptable; the reported value is an estimate.
T8	Sample(s) received past/too close to holding time expiration.
V	The sample concentration is too high to evaluate accurate spike recoveries.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LA000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
BT Solutions, LLC

336 Cobbleview Drive
Lexington, SC 29072

Billing Information:
Beth Thompson
336 Cobbleview Drive
Lexington, SC 29072

Report to:
Beth Thompson

Email To: **beth@btsolutionssc.com**

Project Description:
Shenandoah Crossings Copper Study

City/State Collected: Goodlysville, VA

Please Circle: PT MT CT ET

Phone: **803-447-8471**

Client Project #

Lab Project #
BTSOLLSC-SCCUBLM

Collected by (print):
Aaron Hacker

Site/Facility ID #

P.O. #

Collected by (signature):

Quote #

Immediately Packed on Ice N ___ Y ✓

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Date Results Needed

Analysis / Container / Preservative

Pres Chk

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	ALKCA,CL,PH,SO4 250mlHDPE-NoPres	Copper Diss 200.8 250mlHDPE-HNO3	Copper Hardness 250mlHDPE-HNO3	DOC, Diss CA, MG, NA 250mlHDPE-NoPres	Remarks	Sample # (lab only)
FIELD BLANK	G	WW		3-15-21	0900	1		X				-01
FILTERED FINAL EFFLUENT	G	WW		3-15-21	0900	1		X				-02
FILTERED FINAL EFFLUENT	G	WW		3-15-21	0900	3	X		X	X		-03

Chain of Custody Page ___ of ___

Pace Analytical®
National Center for Testing & Innovation

12065 Lebanon Road Mt Juliet, TN 37122
Phone: 615-758-5858 Alt: 800-767-5859
Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard-terms.pdf

SDG # L1327076
1178

Acctnum: **BTSOLLSC**
Template: **T181868**
Prelogin: **P827199**
PM: **341 - John Hawkins**
PB: 3/5/21 MH
Shipped Via: **FedEX Ground**

* Matrix:
SS - Soil **AIR** - Air **F** - Filter
GW - Groundwater **B** - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:
Total gallons .048471

pH 7.06 Temp 12.4°C
Flow 30.26 Other _____

Samples returned via:
__ UPS __ FedEx __ Courier _____

Tracking # 9517 5765 4256

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
	3-15-21	0929	
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)
			Kristy Smiley

Trip Blank Received: Yes / No
0
HCL / MeoH
TBR

Temp 1.0 °C Bottles Received: 5
9-3=6

Date: 03/16/21 Time: 09:00

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

Sample Receipt Checklist

COC Seal Present/Intact:	NP	Y N
COC Signed/Accurate:		Y N
Bottles arrive intact:		Y N
Correct bottles used:		Y N
Sufficient volume sent:		Y N
If Applicable		
VOA Zero Headspace:		Y N
Preservation Correct/Checked:		Y N
RAD Screen <0.5 mR/hr:		Y N

CHAIN OF CUSTODY

Company Name: BT Solutions, LLC
Company Contact: Beth Thompson Telephone: (803) 447-8471
Results To: Beth Thompson email: beth@btsolutionssc.com
Address: 336 Cobbleview Drive
Lexington, SC 29072
Project ID: **BLM Chemistry - Shenandoah Crossing**

			Composite				Grab			ANALYSES REQUESTED														
Bottle ID										A	B	C	D	E	A									
Preserv.										1	2	1	1	2	2									
JRA ID # 21-	Sample Type*	Sample Location	Start Date	Start Time	End Date	End Time	Date	Time	Total # of cont.	DOC (filter in lab)	Diss Ca **(MDL)**, Mg **(MDL)**, Na **(MDL)**, K**(MDL)**, Cu**	Chloride**(MDL)**, Sulfate	Alkalinity	Hardness, Total Cu	Diss Cu **(MDL)****									
06434	WW	Final Effluent	XXXXX	XXXXX	XXXXX	XXXXX	4.20.21	0850	5	X	X	X	X	X										
06435		Blank	XXXXX	XXXXX	XXXXX	XXXXX	4.20.21	0850	1		pH<2 HNO_3			pH<2 HNO_3	X pH<2 HNO_3									

*WW= Wastewater, GW = Groundwater, DW - Drinking Water, HW - Hazardous Waste, **OTHER: NaOH Soln**

Sampled By: Aaron Akerki Date/Time: 4.20.21 0850
Relinquished By: Date/Time:
Received By: Date/Time:
Relinquished By: Fed Ex Date/Time: 4/21/21 @ 1115
Received By: BFA Date/Time: 4/21/21 @ 1115

Preservatives:

1 = <4°C	5 = $Na_2S_2O_3$	9 = NH_4Cl
2 = HNO_3	6 = $Na_2S_2O_3$ + HCl	10=Ascorbic Acid + HCl
3 = H_2SO_4	7 = NaOH + ZnOAc	11=HCl
4 = NaOH	8 = H_2SO_4 + FAS	12=Zinc Acetate + NaOH

___for Compliance
__Not for Compliance

Samples must be stored and transported on ice to be received <6oC.

Ship Bottles to: Shenandoah Crossing (Attn: Kenny Walker)
223 Lunker Lane
Gordonsville, VA 22942

****Dissolved Metals required to be filtered and preserved within 15 minutes of collection.**
(Sample) Filtration Date_____Time_____Analyst_____
(Blank) Filtration Date_____Time_____Analyst_____

Arrival Temp: 3.8 °C

JAMES R. REED and ASSOCIATES (757) 873-4703; FAX (757) 873-1498
770 Pilot House Drive, Newport News, VA 23606

Sample PH. 7.27 D.O. 8.02 Temp 15.0°C

REPORT OF ANALYSIS

CLIENT: BT Solutions, LLC
ATTN: Beth Thompson
ADDRESS: 336 Cobblestone Drive
Lexington, SC 29072
PHONE: 803-447-8471
EMAIL: beth@btsolutionssc.com

Special Notes:
BLM CHEMISTRY - SHENANDOAH CROSSING

REPORT NO: 21-0643416:06
GRAB COLLECTION:
Date: 4/20/2021 Time: 0850
COMPOSITE COLLECTION:
Start Date: Time:
End Date: Time:
SAMPLE RECEIPT:
Date: 4/21/2021 Time: 1115

SAMPLE ID: Final Effluent
SAMPLE NO: 21-06434

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time
Dissolved Organic Carbon	*5310B	0.5	3.6	mg/L	AAH	4/22/2021	1851
Dissolved Calcium	200.7	0.050	27.9	mg/L	JMH	4/29/2021	1216
Dissolved Magnesium	200.7	0.050	5.50	mg/L	JMH	4/29/2021	1216
Dissolved Sodium	200.7	0.050	53.1	mg/L	JMH	4/29/2021	1216
Dissolved Potassium	200.7	0.050	11.2	mg/L	JMH	4/29/2021	1216
Dissolved Copper	200.7	0.001	0.009	mg/L	JMH	4/29/2021	1216
Chloride	300.0	0.5	42.6	mg/L	AAH	4/22/2021	1624
Sulfate	300.0	1.0	39.1	mg/L	AAH	4/22/2021	1624
Alkalinity	*2320B	1	26	mg/L	JMH	4/23/2021	1622
Hardness	*2340B	0.331	90.9	mg/L	JMH	4/26/2021	1549
Total Copper	200.7	0.001	0.010	mg/L	JMH	4/26/2021	1549

REPORT OF ANALYSIS

SAMPLE ID: Final Effluent
SAMPLE NO: 21-06434

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time

NOTES:

JRA Quantification Level is the concentration of the lowest calibration standard above zero with a reliable signal.

The results on this report relate only to the sample(s) provided for analysis.

Results conform to TNI standards, where applicable, unless otherwise indicated.

*SM 2011

Dissolved metals filtered in the field.

RESPECTFULLY SUBMITTED

Elaine Claiborne
Laboratory Director
Date: 29-Apr-21

James R. Reed & Associates
770 Pilot House Drive, Newport News, VA 23606
(757) 873-4703 ● Fax: (757) 873-1498

VELAP# 460013
EPA# VA00015

REPORT OF ANALYSIS

CLIENT: BT Solutions, LLC
ATTN: Beth Thompson
ADDRESS: 336 Cobblestone Drive
Lexington, SC 29072
PHONE: 803-447-8471
EMAIL: beth@btsolutionssc.com

Special Notes:
BLM CHEMISTRY - SHENANDOAH CROSSING

REPORT NO: 21-0643516:06
GRAB COLLECTION:
Date: 4/20/2021 Time: 0850
COMPOSITE COLLECTION:
Start Date: Time:
End Date: Time:
SAMPLE RECEIPT:
Date: 4/21/2021 Time: 1115

SAMPLE ID: BLANK
SAMPLE NO: 21-06435

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time
Dissolved Copper	200.7	0.001	< 0.001	mg/L	JMH	4/26/2021	1303

NOTES:

JRA Quantification Level is the concentration of the lowest calibration standard above zero with a reliable signal.

The results on this report relate only to the sample(s) provided for analysis.

Results conform to TNI standards, where applicable, unless otherwise indicated.

Dissolved metals filtered in the field.

RESPECTFULLY SUBMITTED

Elaine Claiborne
Laboratory Director
Date: 29-Apr-21

James R. Reed & Associates
770 Pilot House Drive, Newport News, VA 23606
(757) 873-4703 ● Fax: (757) 873-1498

VELAP# 460013
EPA# VA00015

CHAIN OF CUSTODY

Company Name: BT Solutions, LLC
Company Contact: Beth Thompson Telephone: (803) 447-8471
Results To: Beth Thompson email: beth@btsolutionssc.com
Address: 336 Cobbleview Drive
Lexington, SC 29072
Project ID: **BLM Chemistry - Shenandoah Crossing**

ANALYSES REQUESTED

JRA ID # 21	Sample Type*	Sample Location	Composite Start Date	Composite Start Time	Composite End Date	Composite End Time	Grab Date	Grab Time	Total # of cont.	Bottle ID	A	B	C	D	E	A								
										Preserv.	1	2	1	1	2	2								
											DOC (filter in lab)	Diss Ca (MDL), Mg (MDL), Na (MDL), K(MDL), Cu**	Chloride(MDL), Sulfate	Alkalinity	Hardness, Total Cu	Diss Cu (MDL)**								
08348	WW	Final Effluent	XXXXX	XXXXX	XXXXX	XXXXX	5/22/21	0835	5		X	X	X	X	X									
08349		Blank	XXXXX	XXXXX	XXXXX	XXXXX	5/22/21	0841	1			pH<2 HNO_3			pH<2 HNO_3	X								
																pH<2 HNO_3								

*WW= Wastewater, GW = Groundwater, DW - Drinking Water, HW - Hazardous Waste, **OTHER: NaOH Soln**

Sampled By: Aaron Akucki Date/Time: 5/22/21 0930
Relinquished By: Aaron Akucki Date/Time: 5/22/21
Received By: Date/Time:
Relinquished By: Fed Ex Bag Date/Time: 5-24-21 1357
Received By: Date/Time: 5-24-21 1357

Preservatives:

1 = <4°C	5 = $Na_2S_2O_3$	9 = NH_4Cl
2 = HNO_3	6 = $Na_2S_2O_3$ + HCl	10=Ascorbic Acid + HCl
3 = H_2SO_4	7 = NaOH + ZnOAc	11=HCl
4 = NaOH	8 = H_2SO_4 + FAS	12=Zinc Acetate + NaOH

___for Compliance
__Not for Compliance

Samples must be stored and transported on ice to be received <6oC.

Payment: Credit Card on file

Ship Bottles to: Shenandoah Crossing (Attn: Kenny Walker)
223 Lunker Lane
Gordonsville, VA 22942

**Dissolved Metals required to be filtered and preserved within 15 minutes of collection.

(Sample) Filtration Date 5/22/21 **Time** 0935 **Analyst** _____
(Blank) Filtration Date 5/22/21 **Time** 0841 **Analyst** _____

Analyze per Client

Arrival Temp: 24.8 °C

JAMES R. REED and ASSOCIATES (757) 873-4703; FAX (757) 873-1498
770 Pilot House Drive, Newport News, VA 23606

REPORT OF ANALYSIS

CLIENT: BT Solutions, LLC
ATTN: Beth Thompson
ADDRESS: 336 Cobblestone Drive
Lexington, SC 29072
PHONE: 803-447-8471
EMAIL: beth@btsolutionssc.com

Special Notes:
BLM CHEMISTRY - SHENANDOAH CROSSING

REPORT NO: 21-0834813:44
GRAB COLLECTION:
Date: 5/22/2021 Time: 0935
COMPOSITE COLLECTION:
Start Date: Time:
End Date: Time:
SAMPLE RECEIPT:
Date: 5/24/2021 Time: 1357

SAMPLE ID: FINAL EFFLUENT
SAMPLE NO: 21-08348

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time
Dissolved Organic Carbon	*5310B	0.5	3.5	mg/L	AAH	5/25/2021	0242
Dissolved Calcium	200.7	0.050	25.3	mg/L	JMH	6/1/2021	1507
Dissolved Magnesium	200.7	0.050	5.66	mg/L	JMH	6/1/2021	1507
Dissolved Sodium	200.7	0.050	56.2	mg/L	JMH	6/1/2021	1507
Dissolved Potassium	200.7	0.050	13.9	mg/L	JMH	6/1/2021	1507
Dissolved Copper	200.7	0.001	0.009	mg/L	JMH	6/1/2021	1507
Chloride	300.0	0.5	35.8	mg/L	AAH	6/7/2021	1409
Sulfate	300.0	1.0	26.3	mg/L	AAH	6/7/2021	1409
Alkalinity	*2320B	1	42	mg/L	JMH	5/27/2021	1651
Hardness	*2340B	0.331	85.6	mg/L	JMH	6/1/2021	1510
Total Copper	200.7	0.001	0.009	mg/L	JMH	6/1/2021	1510

REPORT OF ANALYSIS

SAMPLE ID: FINAL EFFLUENT
SAMPLE NO: 21-08348

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time

NOTES:

JRA Quantification Level is the concentration of the lowest calibration standard above zero with a reliable signal.

The results on this report relate only to the sample(s) provided for analysis.

Results conform to TNI standards, where applicable, unless otherwise indicated.

*SM 2011

Dissolved metals filtered in the field.

RESPECTFULLY SUBMITTED

Elaine Claiborne
Laboratory Director
Date: 08-Jun-21

James R. Reed & Associates
770 Pilot House Drive, Newport News, VA 23606
(757) 873-4703 ● Fax: (757) 873-1498

VELAP# 460013
EPA# VA00015

REPORT OF ANALYSIS

CLIENT: BT Solutions, LLC
ATTN: Beth Thompson
ADDRESS: 336 Cobblestone Drive
Lexington, SC 29072
PHONE: 803-447-8471
EMAIL: beth@btsolutionssc.com

Special Notes:
BLM CHEMISTRY - SHENANDOAH CROSSING

REPORT NO: 21-0834913:45
GRAB COLLECTION:
Date: 5/22/2021 Time: 0941
COMPOSITE COLLECTION:
Start Date: Time:
End Date: Time:
SAMPLE RECEIPT:
Date: 5/24/2021 Time: 1357

SAMPLE ID: BLANK
SAMPLE NO: 21-08349

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time
Dissolved Copper	200.7	0.001	< 0.001	mg/L	JMH	5/26/2021	1511

NOTES:

JRA Quantification Level is the concentration of the lowest calibration standard above zero with a reliable signal.

The results on this report relate only to the sample(s) provided for analysis.

Results conform to TNI standards, where applicable, unless otherwise indicated.

Dissolved metals filtered in the field.

RESPECTFULLY SUBMITTED

Elaine Claiborne
Laboratory Director
Date: 08-Jun-21

James R. Reed & Associates
770 Pilot House Drive, Newport News, VA 23606
(757) 873-4703 ● Fax: (757) 873-1498

VELAP# 460013
EPA# VA00015

CHAIN OF CUSTODY

Company Name: BT Solutions, LLC
Company Contact: Beth Thompson Telephone: (803) 447-8471
Results To: Beth Thompson email: beth@btsolutionssc.com
Address: 336 Cobbleview Drive
Lexington, SC 29072
Project ID: **BLM Chemistry - Shenandoah Crossing**

ANALYSES REQUESTED

Bottle ID	A	B	C	D	E	A									
Preserv.	1	2	1	1	2	2									
	DOC (filter in lab)	Diss Ca (MDL), Mg (MDL), Na (MDL), K(MDL), Cu**	Chloride(MDL), Sulfate	Alkalinity	Hardness, Total Cu	Diss Cu (MDL)**									

JRA ID # 21-	Sample Type*	Sample Location	Composite Start Date	Composite Start Time	Composite End Date	Composite End Time	Grab Date	Grab Time	Total # of cont.													
10269	WW	Final Effluent	XXXXX	XXXXX	XXXXX	XXXXX	6.22.21	0830	5	X	X	X	X	X								
10270		Blank	XXXXX	XXXXX	XXXXX	XXXXX	6.22.21	0830	1		pH<2 HNO_3			pH<2 HNO_3	X pH<2 HNO_3							

*WW= Wastewater, GW = Groundwater, DW - Drinking Water, HW - Hazardous Waste, **OTHER: NaOH Soln**

Sampled By: Aaron Akucki Date/Time: 6.22.21 0830
Relinquished By: Aaron Akucki Date/Time: 6.22.21 0915
Received By: Date/Time:
Relinquished By: Date/Time: 6/24/21 @ 1545
Received By: Date/Time: 6/24/21 @ 1545

Preservatives:

1 = <4°C	5 = $Na_2S_2O_3$	9 = NH_4Cl
2 = HNO_3	6 = $Na_2S_2O_3$ + HCl	10=Ascorbic Acid + HCl
3 = H_2SO_4	7 = NaOH + ZnOAc	11=HCl
4 = NaOH	8 = H_2SO_4 + FAS	12=Zinc Acetate + NaOH

___for Compliance
__Not for Compliance

Samples must be stored and transported on ice to be received <6oC.

Payment: Credit Card on file

Ship Bottles to: Shenandoah Crossing (Attn: Kenny Walker)
223 Lunker Lane
Gordonsville, VA 22942

Samples Received out of temperature.

****Dissolved Metals required to be filtered and preserved within 15 minutes of collection.**

(Sample) Filtration Date_____Time_____Analyst_____
(Blank) Filtration Date_____Time_____Analyst_____

Arrival Temp: 22.0 °C

JAMES R. REED and ASSOCIATES (757) 873-4703; FAX (757) 873-1498
770 Pilot House Drive, Newport News, VA 23606

REPORT OF ANALYSIS

CLIENT: BT Solutions, LLC
ATTN: Beth Thompson
ADDRESS: 336 Cobblestone Drive
Lexington, SC 29072
PHONE: 803-447-8471
EMAIL: beth@btsolutionssc.com

Special Notes:
BLM CHEMISTRY - SHENANDOAH CROSSING

REPORT NO: 21-1026915:22
GRAB COLLECTION:
Date: 6/22/2021 Time: 0830
COMPOSITE COLLECTION:
Start Date: Time:
End Date: Time:
SAMPLE RECEIPT:
Date: 6/24/2021 Time: 1545

SAMPLE ID: FINAL EFFLUENT
SAMPLE NO: 21-10269

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time
Dissolved Organic Carbon	*5310B	0.5	3.6	mg/L	AAH	6/30/2021	0054
Dissolved Calcium	200.7	0.050	35.2	mg/L	AME	7/7/2021	1122
Dissolved Magnesium	200.7	0.050	6.82	mg/L	AME	7/7/2021	1122
Dissolved Sodium	200.7	0.050	52.8	mg/L	AME	7/7/2021	1122
Dissolved Potassium	200.7	0.050	16.0	mg/L	AME	7/7/2021	1122
Dissolved Copper	200.7	0.001	0.006	mg/L	AME	7/7/2021	1122
Chloride	300.0	0.5	59.2	mg/L	AAH	6/29/2021	1531
Sulfate	300.0	1.0	45.0	mg/L	AAH	6/29/2021	1531
Alkalinity	*2320B	1	22	mg/L	JMH	6/29/2021	1250
Hardness	*2340B	0.331	115	mg/L	AME	7/7/2021	1135
Total Copper	200.7	0.001	0.006	mg/L	AME	7/7/2021	1135

REPORT OF ANALYSIS

SAMPLE ID: FINAL EFFLUENT
SAMPLE NO: 21-10269

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time

NOTES:

JRA Quantification Level is the concentration of the lowest calibration standard above zero with a reliable signal.

The results on this report relate only to the sample(s) provided for analysis.

Results conform to TNI standards, where applicable, unless otherwise indicated.

*SM 2011

Dissolved metals filtered in the field.

RESPECTFULLY SUBMITTED

Elaine Claiborne
Laboratory Director
Date: 08-Jul-21

James R. Reed & Associates
770 Pilot House Drive, Newport News, VA 23606
(757) 873-4703 ● Fax: (757) 873-1498

VELAP# 460013
EPA# VA00015

REPORT OF ANALYSIS

CLIENT: BT Solutions, LLC
ATTN: Beth Thompson
ADDRESS: 336 Cobblestone Drive
Lexington, SC 29072
PHONE: 803-447-8471
EMAIL: beth@btsolutionssc.com

Special Notes:
BLM CHEMISTRY - SHENANDOAH CROSSING

REPORT NO: 21-1027015:22
GRAB COLLECTION:
Date: 6/22/2021 Time: 0830
COMPOSITE COLLECTION:
Start Date: Time:
End Date: Time:
SAMPLE RECEIPT:
Date: 6/24/2021 Time: 1545

SAMPLE ID: BLANK
SAMPLE NO: 21-10270

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time
Dissolved Copper	200.7	0.001	< 0.001	mg/L	AME	7/1/2021	1048

NOTES:

JRA Quantification Level is the concentration of the lowest calibration standard above zero with a reliable signal.

The results on this report relate only to the sample(s) provided for analysis.

Results conform to TNI standards, where applicable, unless otherwise indicated.

Dissolved metals filtered in the field.

RESPECTFULLY SUBMITTED

Elaine Claiborne
Laboratory Director
Date: 08-Jul-21

James R. Reed & Associates
770 Pilot House Drive, Newport News, VA 23606
(757) 873-4703 ● Fax: (757) 873-1498

VELAP# 460013
EPA# VA00015

CHAIN OF CUSTODY

Company Name	BT Solutions, LLC
Company Contact	Beth Thompson — Telephone (803) 447-8471
Results To	Beth Thompson — email beth@btsolutionssc.com
Address	336 Cobbleview Drive
	Lexington, SC 29072
Project ID	**BLM Chemistry - Shenandoah Crossing**

ANALYSES REQUESTED

Bottle ID	A	B	C	D	E	A
Preserv	1	2	1	1	2	2
	DOC (filter in lab)	Diss Ca (MDL), Mg (MDL), Na (MDL), K(MDL), Cu**	Chloride(MDL), Sulfate	Alkalinity	Hardness, Total Cu	Diss Cu (MDL)**
		pH<2 HNO_3			pH<2 HNO_3	pH<2 HNO_3

JRA ID # 21-	Sample Type*	Sample Location	Composite Start Date	Composite Start Time	Composite End Date	Composite End Time	Grab Date	Grab Time	Total # of cont.
11763	WW	Final Effluent	XXXXX	XXXXX	XXXXX	XXXXX	7.20.21	11:00	5
11764		Blank	XXXXX	XXXXX	XXXXX	XXXXX	7.20.21	11:05	1

*WW= Wastewater, GW = Groundwater, DW - Drinking Water, HW - Hazardous Waste, OTHER: NaOH Soln

Sampled By	Aaron Akacki	Date/Time 7.20.21	11:00
Relinquished By	Aaron Akacki	Date/Time 7.20.21	11:15
Received By		Date/Time	
Relinquished By	FedEx	Date/Time 7/21/21	@1000
Received By	BHan	Date/Time 7/21/21	@1000

Preservatives

1 = <4°C	5 = $Na_2S_2O_3$	9 = NH_4Cl
2 = HNO_3	6 = $Na_2S_2O_3$ + HCl	10=Ascorbic Acid + HCl
3 = H_2SO_4	7 = NaOH + ZnOAc	11=HCl
4 = NaOH	8 = H_2SO_4 + FAS	12=Zinc Acetate + NaOH

___for Compliance
__Not for Compliance

Samples must be stored and transported on ice to be received <6oC.

Payment: Credit Card on file

Ship Bottles to: Shenandoah Crossing (Attn: Kenny Walker)
223 Lunker Lane
Gordonsville, VA 22942

****Dissolved Metals required to be filtered and preserved within 15 minutes of collection.**

(Sample) Filtration Date 7/20/21 **Time** 11:00 **Analyst** A

(Blank) Filtration Date 7/20/21 **Time** 11:05 **Analyst** A

Arrival Temp 2.9 °C

JAMES R. REED and ASSOCIATES (757) 873-4703; FAX (757) 873-1498
770 Pilot House Drive, Newport News, VA 23606

* corrected COC - TAG 7/22/21

PH - 7.06 DO - 6.43 Temp - 24.9°C

CHAIN OF CUSTODY

Company Name: BT Solutions, LLC
Company Contact: Beth Thompson Telephone: (803) 447-8471
Results To: Beth Thompson email: beth@btsolutionssc.com
Address: 336 Cobbleview Drive
Lexington, SC 29072
Project ID: **BLM Chemistry - Shenandoah Crossing**

ANALYSES REQUESTED

JRA ID # 21-	Sample Type*	Sample Location	Composite Start Date	Composite Start Time	Composite End Date	Composite End Time	Grab Date	Grab Time	Total # of cont.	A: DOC (filter in lab)	B: Diss Ca (MDL), Mg (MDL), Na (MDL), K(MDL), Cu**	C: Chloride(MDL), Sulfate	D: Alkalinity	E: Hardness, Total Cu	A: Diss Cu (MDL)**
										Preserv. 1	2	1	1	2	2
11763	WW	Final Effluent	XXXXX	XXXXX	XXXXX	XXXXX	7.20.21	11:00	5	X	X	X	X	X	
11764		Blank	XXXXX	XXXXX	XXXXX	XXXXX	7.20.21	11:05	1		pH<2 HNO_3			pH<2 HNO_3	X pH<2 HNO_3

*WW= Wastewater, GW = Groundwater, DW - Drinking Water, HW - Hazardous Waste, **OTHER: NaOH Soln**

Sampled By: Aaron Akacki Date/Time: 7.20.21 | 11:00
Relinquished By: Aaron Akacki Date/Time: 7.20.21 | 11:15
Received By: Date/Time:
Relinquished By: FedEx Date/Time: 7/21/21 @1000
Received By: BTEX Date/Time: 7/21/21 @1000

Preservatives:

1 = <4°C	5 = $Na_2S_2O_3$	9 = NH_4Cl
2 = HNO_3	6 = $Na_2S_2O_3$ + HCl	10=Ascorbic Acid + HCl
3 = H_2SO_4	7 = NaOH + ZnOAc	11=HCl
4 = NaOH	8 = H_2SO_4 + FAS	12=Zinc Acetate + NaOH

___for Compliance
__Not for Compliance

Samples must be stored and transported on ice to be received <6oC.

Payment: Credit Card on file

Ship Bottles to: Shenandoah Crossing (Attn: Kenny Walker)
223 Lunker Lane
Gordonsville, VA 22942

****Dissolved Metals required to be filtered and preserved within 15 minutes of collection.**

(Sample) Filtration Date_____Time_____Analyst_____
(Blank) Filtration Date_____Time_____Analyst_____

Arrival Temp: 2.9 °C

*emailed Beth regarding missing filtration Date/Time - TAG 7/22/21

JAMES R. REED and ASSOCIATES (757) 873-4703; FAX (757) 873-1498
770 Pilot House Drive, Newport News, VA 23606

PH - 7.06 DO - 6.43 Temp - 24.9°C

REPORT OF ANALYSIS

CLIENT: BT Solutions, LLC
ATTN: Beth Thompson
ADDRESS: 336 Cobblestone Drive
Lexington, SC 29072
PHONE: 803-447-8471
EMAIL: beth@btsolutionssc.com

Special Notes:
BLM CHEMISTRY - SHENANDOAH CROSSING

REPORT NO: 21-1176314:32
GRAB COLLECTION:
Date: 7/20/2021 Time: 1100
COMPOSITE COLLECTION:
Start Date: Time:
End Date: Time:
SAMPLE RECEIPT:
Date: 7/21/2021 Time: 1000

SAMPLE ID: FINAL EFFLUENT
SAMPLE NO: 21-11763

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time
Dissolved Organic Carbon	*5310B	0.5	4.2	mg/L	AAH	7/27/2021	0021
Dissolved Calcium	200.7	0.050	37.9	mg/L	AME	7/29/2021	1622
Dissolved Magnesium	200.7	0.050	6.76	mg/L	AME	7/29/2021	1622
Dissolved Sodium	200.7	0.050	80.8	mg/L	AME	7/29/2021	1622
Dissolved Potassium	200.7	0.050	17.4	mg/L	AME	7/29/2021	1622
Dissolved Copper	200.7	0.001	0.009	mg/L	AME	7/29/2021	1622
Chloride	300.0	0.5	69.3	mg/L	AAH	7/26/2021	1545
Sulfate	300.0	1.0	36.6	mg/L	AAH	7/26/2021	1545
Alkalinity	*2320B	1	37	mg/L	JMH	7/28/2021	1450
Hardness	*2340B	0.331	119	mg/L	AME	7/29/2021	1625
Total Copper	200.7	0.001	0.009	mg/L	AME	7/29/2021	1625

REPORT OF ANALYSIS

SAMPLE ID: FINAL EFFLUENT
SAMPLE NO: 21-11763

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time

NOTES:

JRA Quantification Level is the concentration of the lowest calibration standard above zero with a reliable signal.

The results on this report relate only to the sample(s) provided for analysis.

Results conform to TNI standards, where applicable, unless otherwise indicated.

*SM 2011

Dissolved metals filtered in the field.

RESPECTFULLY SUBMITTED

Elaine Claiborne
Laboratory Director
Date: 30-Jul-21

James R. Reed & Associates
770 Pilot House Drive, Newport News, VA 23606
(757) 873-4703 ● Fax: (757) 873-1498

VELAP# 460013
EPA# VA00015

REPORT OF ANALYSIS

CLIENT: BT Solutions, LLC
ATTN: Beth Thompson
ADDRESS: 336 Cobblestone Drive
Lexington, SC 29072
PHONE: 803-447-8471
EMAIL: beth@btsolutionssc.com

Special Notes:
BLM CHEMISTRY - SHENANDOAH CROSSING

REPORT NO: 21-1176414:32
GRAB COLLECTION:
Date: 7/20/2021 Time: 1105
COMPOSITE COLLECTION:
Start Date: Time:
End Date: Time:
SAMPLE RECEIPT:
Date: 7/21/2021 Time: 1000

SAMPLE ID: BLANK
SAMPLE NO: 21-11764

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time
Dissolved Copper	200.7	0.001	< 0.001	mg/L	AME	7/29/2021	1233

NOTES:

JRA Quantification Level is the concentration of the lowest calibration standard above zero with a reliable signal.

The results on this report relate only to the sample(s) provided for analysis.

Results conform to TNI standards, where applicable, unless otherwise indicated.

*SM 2011

Dissolved metals filtered in the field.

RESPECTFULLY SUBMITTED

Elaine Claiborne
Laboratory Director
Date: 30-Jul-21

James R. Reed & Associates
770 Pilot House Drive, Newport News, VA 23606
(757) 873-4703 ● Fax: (757) 873-1498

VELAP# 460013
EPA# VA00015

CHAIN OF CUSTODY

Company Name: BT Solutions, LLC
Company Contact: Beth Thompson Telephone: (803) 447-8471
Results To: Beth Thompson email: beth@btsolutionssc.com
Address: 336 Cobbleview Drive
Lexington, SC 29072
Project ID: **BLM Chemistry - Shenandoah Crossing**

ANALYSES REQUESTED

JRA ID # 21-	Sample Type*	Sample Location	Composite Start Date	Composite Start Time	Composite End Date	Composite End Time	Grab Date	Grab Time	Total # of cont.	Bottle ID	A	B	C	D	E	A									
										Preserv.	1	2	1	1	2	2									
											DOC (filter in lab)	Diss Ca (MDL), Mg (MDL), Na (MDL), K(MDL), Cu**	Chloride(MDL), Sulfate	Alkalinity	Hardness, Total Cu	Diss Cu (MDL)**									
13759	WW	Final Effluent	XXXXX	XXXXX	XXXXX	XXXXX	8.17.21	0829	5		X	X	X	X	X										
13760		Blank	XXXXX	XXXXX	XXXXX	XXXXX	8.17.21	0827	1							X									
								✓				$pH<2 HNO_3$			$pH<2 HNO_3$	$pH<2 HNO_3$									
									per sample containers - Tag 8/18/21																

*WW= Wastewater, GW = Groundwater, DW - Drinking Water, HW - Hazardous Waste, **OTHER: NaOH Soln**

Sampled By: Aaron Akacki Date/Time: 8.17.21 0820
Relinquished By: Aaron Akacki Date/Time: 8.17.21 0832
Received By: FedEx Date/Time:
Relinquished By: Date/Time:
Received By: Date/Time: 8-18-21 @ 1010 HDC 8-18-21

Preservatives:

1 = <4°C	5 = $Na_2S_2O_3$	9 = NH_4Cl
2 = HNO_3	6 = $Na_2S_2O_3$ + HCl	10=Ascorbic Acid + HCl
3 = H_2SO_4	7 = NaOH + ZnOAc	11=HCl
4 = NaOH	8 = H_2SO_4 + FAS	12=Zinc Acetate + NaOH

___for Compliance
__Not for Compliance

Samples must be stored and transported on ice to be received <6oC.

Payment: Credit Card on file

Ship Bottles to: Shenandoah Crossing (Attn: Kenny Walker)
223 Lunker Lane
Gordonsville, VA 22942

****Dissolved Metals required to be filtered and preserved within 15 minutes of collection.**

(Sample) Filtration Date 8.17.21 **Time** 0820 **Analyst**
(Blank) Filtration Date 8.17.21 **Time** 0827 **Analyst**

Arrival Temp: 5.7 °C

JAMES R. REED and ASSOCIATES (757) 873-4703; FAX (757) 873-1498
770 Pilot House Drive, Newport News, VA 23606

PH - 7.36 D.O. - 7.64 Temp - 25.4

REPORT OF ANALYSIS

CLIENT: BT Solutions, LLC
ATTN: Beth Thompson
ADDRESS: 336 Cobblestone Drive
Lexington, SC 29072
PHONE: 803-447-8471
EMAIL: beth@btsolutionssc.com

Special Notes:
BLM CHEMISTRY - SHENANDOAH CROSSING

REPORT NO: 21-1375912:17
GRAB COLLECTION:
Date: 8/17/2021 Time: 0829
COMPOSITE COLLECTION:
Start Date: Time:
End Date: Time:
SAMPLE RECEIPT:
Date: 8/18/2021 Time: 1010

SAMPLE ID: FINAL EFFLUENT
SAMPLE NO: 21-13759

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time
Dissolved Organic Carbon	*5310B	0.5	4.2	mg/L	AAH	8/19/2021	1908
Dissolved Calcium	200.7	0.050	46.2	mg/L	AME	8/19/2021	1509
Dissolved Magnesium	200.7	0.050	8.13	mg/L	AME	8/19/2021	1509
Dissolved Sodium	200.7	0.050	59.4	mg/L	AME	8/19/2021	1509
Dissolved Potassium	200.7	0.050	17.5	mg/L	AME	8/19/2021	1509
Dissolved Copper	200.7	0.001	0.014	mg/L	AME	8/19/2021	1509
Chloride	300.0	0.5	59.1	mg/L	JMH	8/24/2021	1425
Sulfate	300.0	1.0	52.8	mg/L	JMH	8/24/2021	1425
Alkalinity	*2320B	2	6	mg/L	JMH	8/25/2021	1445
Hardness	*2340B	0.331	149	mg/L	AME	8/19/2021	1506
Total Copper	200.7	0.001	0.015	mg/L	AME	8/19/2021	1506

REPORT OF ANALYSIS

SAMPLE ID: FINAL EFFLUENT
SAMPLE NO: 21-13759

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time

NOTES:

JRA Quantification Level is the concentration of the lowest calibration standard above zero with a reliable signal.

The results on this report relate only to the sample(s) provided for analysis.

Results conform to TNI standards, where applicable, unless otherwise indicated.

*SM 2011

Dissolved metals filtered in the field.

RESPECTFULLY SUBMITTED

Elaine Claiborne
Laboratory Director
Date: 01-Sep-21

James R. Reed & Associates
770 Pilot House Drive, Newport News, VA 23606
(757) 873-4703 ● Fax: (757) 873-1498

VELAP# 460013
EPA# VA00015

REPORT OF ANALYSIS

CLIENT: BT Solutions, LLC
ATTN: Beth Thompson
ADDRESS: 336 Cobblestone Drive
Lexington, SC 29072
PHONE: 803-447-8471
EMAIL: beth@btsolutionssc.com

Special Notes:
BLM CHEMISTRY - SHENANDOAH CROSSING

REPORT NO: 21-1376012:17
GRAB COLLECTION:
Date: 8/17/2021 Time: 0827
COMPOSITE COLLECTION:
Start Date: Time:
End Date: Time:
SAMPLE RECEIPT:
Date: 8/18/2021 Time: 1010

SAMPLE ID: BLANK
SAMPLE NO: 21-13760

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time
Dissolved Copper	200.7	0.001	< 0.001	mg/L	AME	8/19/2021	1413

NOTES:

JRA Quantification Level is the concentration of the lowest calibration standard above zero with a reliable signal.

The results on this report relate only to the sample(s) provided for analysis.

Results conform to TNI standards, where applicable, unless otherwise indicated.

Dissolved metals filtered in the field.

RESPECTFULLY SUBMITTED

Elaine Claiborne
Laboratory Director
Date: 01-Sep-21

CHAIN OF CUSTODY

Company Name: BT Solutions, LLC
Company Contact: Beth Thompson Telephone: (803) 447-8471
Results To: Beth Thompson email: beth@btsolutionssc.com
Address: 336 Cobbleview Drive
Lexington, SC 29072
Project ID: **BLM Chemistry - Shenandoah Crossing**

ANALYSES REQUESTED

JRA ID # 21	Sample Type*	Sample Location	Composite Start Date	Composite Start Time	Composite End Date	Composite End Time	Grab Date	Grab Time	Total # of cont.	A: DOC (filter in lab)	B: Diss Ca (MDL), Mg (MDL), Na (MDL), K(MDL), Cu**	C: Chloride(MDL), Sulfate	D: Alkalinity	E: Hardness, Total Cu	A: Diss Cu (MDL)**
Bottle ID										A	B	C	D	E	A
Preserv.										1	2	1	1	2	2
15735	WW	Final Effluent	XXXXX	XXXXX	XXXXX	XXXXX	9.21.21	0915	5	X	X	X	X	X	
15736		Blank	XXXXX	XXXXX	XXXXX	XXXXX	9.21.21	0910	1		pH<2 HNO_3				X
														pH<2 HNO_3	pH<2 HNO_3

*WW= Wastewater, GW = Groundwater, DW - Drinking Water, HW - Hazardous Waste, **OTHER: NaOH Soln**

Sampled By: Aaron Atraeki Date/Time: 9.21.21
Relinquished By: Date/Time:
Received By: Date/Time:
Relinquished By: Fed Ex Date/Time: 9-22-21 @ 1111
Received By: Date/Time: 9-22-21 @ 1111

Preservatives:

1 = <4°C	5 = $Na_2S_2O_3$	9 = NH_4Cl
2 = HNO_3	6 = $Na_2S_2O_3$ + HCl	10=Ascorbic Acid + HCl
3 = H_2SO_4	7 = NaOH + ZnOAc	11=HCl
4 = NaOH	8 = H_2SO_4 + FAS	12=Zinc Acetate + NaOH

___for Compliance
__Not for Compliance

Samples must be stored and transported on ice to be received <6oC.

Payment: Credit Card on file

Ship Bottles to: Shenandoah Crossing (Attn: Kenny Walker)
223 Lunker Lane
Gordonsville, VA 22942

****Dissolved Metals required to be filtered and preserved within 15 minutes of collection.**
(Sample) Filtration Date 9.21.21 **Time**_____ **Analyst** Aaron
(Blank) Filtration Date 9.21.21 **Time**_____ **Analyst** Aaron

Arrival Temp: 2.8 °C

JAMES R. REED and ASSOCIATES (757) 873-4703; FAX (757) 873-1498
770 Pilot House Drive, Newport News, VA 23606

PH - 7.62
DO - 7.27
Temp - 22.5°C

REPORT OF ANALYSIS

CLIENT: BT Solutions, LLC
ATTN: Beth Thompson
ADDRESS: 336 Cobblestone Drive
Lexington, SC 29072
PHONE: 803-447-8471
EMAIL: beth@btsolutionssc.com

Special Notes:
BLM CHEMISTRY - SHENANDOAH CROSSING

REPORT NO: 21-1573511:05
GRAB COLLECTION:
Date: 9/21/2021 Time: 0915
COMPOSITE COLLECTION:
Start Date: Time:
End Date: Time:
SAMPLE RECEIPT:
Date: 9/22/2021 Time: 1111

SAMPLE ID: FINAL EFFLUENT
SAMPLE NO: 21-15735

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time
Dissolved Organic Carbon	*5310B	0.5	4.0	mg/L	AAH	9/27/2021	1556
Dissolved Calcium	200.7	0.050	32.6	mg/L	JMH	9/30/2021	1320
Dissolved Magnesium	200.7	0.050	6.37	mg/L	JMH	9/30/2021	1320
Dissolved Sodium	200.7	0.050	80.2	mg/L	JMH	9/30/2021	1320
Dissolved Potassium	200.7	0.050	16.9	mg/L	JMH	9/30/2021	1320
Dissolved Copper	200.7	0.001	0.011	mg/L	JMH	9/30/2021	1320
Chloride	300.0	0.5	54.3	mg/L	AAH	9/28/2021	1424
Sulfate	300.0	1.0	31.1	mg/L	AAH	9/28/2021	1424
Alkalinity	*2320B	2	43	mg/L	JMH	10/1/2021	1450
Hardness	*2340B	0.331	108	mg/L	JMH	9/30/2021	1323
Total Copper	200.7	0.001	0.012	mg/L	JMH	9/30/2021	1323

REPORT OF ANALYSIS

SAMPLE ID: FINAL EFFLUENT
SAMPLE NO: 21-15735

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time

NOTES:

JRA Quantification Level is the concentration of the lowest calibration standard above zero with a reliable signal.

The results on this report relate only to the sample(s) provided for analysis.

Results conform to TNI standards, where applicable, unless otherwise indicated.

*SM 2011

Dissolved metals filtered in the field.

RESPECTFULLY SUBMITTED

Elaine Claiborne

Elaine Claiborne
Laboratory Director
Date: 04-Oct-21

James R. Reed & Associates
770 Pilot House Drive, Newport News, VA 23606
(757) 873-4703 ● Fax: (757) 873-1498

VELAP# 460013
EPA# VA00015

REPORT OF ANALYSIS

CLIENT: BT Solutions, LLC
ATTN: Beth Thompson
ADDRESS: 336 Cobblestone Drive
Lexington, SC 29072
PHONE: 803-447-8471
EMAIL: beth@btsolutionssc.com

Special Notes:
BLM CHEMISTRY - SHENANDOAH CROSSING

REPORT NO: 21-1573611:05
GRAB COLLECTION:
Date: 9/21/2021 Time: 0910
COMPOSITE COLLECTION:
Start Date: Time:
End Date: Time:
SAMPLE RECEIPT:
Date: 9/22/2021 Time: 1111

SAMPLE ID: BLANK
SAMPLE NO: 21-15736

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time
Dissolved Copper	200.7	0.001	< 0.001	mg/L	JMH	10/1/2021	1236

NOTES:

JRA Quantification Level is the concentration of the lowest calibration standard above zero with a reliable signal.

The results on this report relate only to the sample(s) provided for analysis.

Results conform to TNI standards, where applicable, unless otherwise indicated.

Dissolved metals filtered in the field.

RESPECTFULLY SUBMITTED

Elaine Claiborne
Laboratory Director
Date: 04-Oct-21

James R. Reed & Associates
770 Pilot House Drive, Newport News, VA 23606
(757) 873-4703 ● Fax: (757) 873-1498

VELAP# 460013
EPA# VA00015

CHAIN OF CUSTODY

Company Name: BT Solutions, LLC
Company Contact: Beth Thompson Telephone: (803) 447-8471
Results To: Beth Thompson email: beth@btsolutionssc.com
Address: 336 Cobbleview Drive
Lexington, SC 29072
Project ID: **BLM Chemistry - Shenandoah Crossing**

ANALYSES REQUESTED

JRA ID # 21-	Sample Type*	Sample Location	Composite Start Date	Composite Start Time	Composite End Date	Composite End Time	Grab Date	Grab Time	Total # of cont.	DOC (filter in lab)	Diss Ca (MDL), Mg (MDL), Na (MDL), K(MDL), Cu**	Chloride(MDL), Sulfate	Alkalinity	Hardness, Total Cu	Diss Cu (MDL)**
Bottle ID										A	B	C	D	E	A
Preserv.										1	2	1	1	2	2
17599	WW	Final Effluent	XXXXX	XXXXX	XXXXX	XXXXX	10.20.21	0835	5	X	X	X	X	X	
17600		Blank	XXXXX	XXXXX	XXXXX	XXXXX	10.20.21	0840	1		pH<2HNO3				X
													pH<2HNO3	pH<2HNO3	

*WW= Wastewater, GW = Groundwater, DW - Drinking Water, HW - Hazardous Waste, **OTHER: NaOH Soln**

Sampled By: Aaron AKacki Date/Time: 10.20.21 0835
Relinquished By: Aaron AKacki Date/Time: 10.20.21 0845
Received By: Date/Time:
Relinquished By: 10-21-21 FedEx Date/Time: 10-21-21 @ 1000
Received By: BAA Date/Time: 10-21-21 @ 1000

Preservatives:

1 = <4°C	5 = $Na_2S_2O_3$	9 = NH_4Cl
2 = HNO_3	6 = $Na_2S_2O_3$ + HCl	10=Ascorbic Acid + HCl
3 = H_2SO_4	7 = NaOH + ZnOAc	11=HCl
4 = NaOH	8 = H_2SO_4 + FAS	12=Zinc Acetate + NaOH

___for Compliance
__Not for Compliance

Samples must be stored and transported on ice to be received <6oC.

Payment: Credit Card on file

Ship Bottles to: Shenandoah Crossing (Attn: Kenny Walker)
223 Lunker Lane
Gordonsville, VA 22942

****Dissolved Metals required to be filtered and preserved within 15 minutes of collection.**

(Sample) Filtration Date 10.20.21 **Time** 0835 **Analyst** Aaron AKacki
(Blank) Filtration Date 10.20.21 **Time** 0840 **Analyst** Aaron AKacki

Arrival Temp: 2.9 °C

JAMES R. REED and ASSOCIATES (757) 873-4703; FAX (757) 873-1498
770 Pilot House Drive, Newport News, VA 23606

PH - 7.25
CL - 0.01
D.O. - 7.18
Temp - 17.1°C

REPORT OF ANALYSIS

CLIENT: BT Solutions, LLC
ATTN: Beth Thompson
ADDRESS: 336 Cobblestone Drive
Lexington, SC 29072
PHONE: 803-447-8471
EMAIL: beth@btsolutionssc.com

Special Notes:
BLM CHEMISTRY - SHENANDOAH CROSSING

REPORT NO: 21-1759913:07
GRAB COLLECTION:
Date: 10/20/2021 Time: 0835
COMPOSITE COLLECTION:
Start Date: Time:
End Date: Time:
SAMPLE RECEIPT:
Date: 10/21/2021 Time: 1000

SAMPLE ID: FINAL EFFLUENT
SAMPLE NO: 21-17599

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time
Dissolved Organic Carbon	*5310B	0.5	4.4	mg/L	AAH	10/25/2021	1249
Dissolved Calcium	200.7	0.050	27.7	mg/L	JMH	10/29/2021	1252
Dissolved Magnesium	200.7	0.050	6.05	mg/L	JMH	10/29/2021	1252
Dissolved Sodium	200.7	0.050	84.2	mg/L	JMH	10/29/2021	1252
Dissolved Potassium	200.7	0.050	18.3	mg/L	JMH	10/29/2021	1252
Dissolved Copper	200.7	0.001	0.011	mg/L	JMH	10/29/2021	1252
Chloride	300.0	0.5	45.6	mg/L	AAH	10/28/2021	1316
Sulfate	300.0	1.0	41.7	mg/L	AAH	10/28/2021	1316
Alkalinity	*2320B	2	46	mg/L	ACS	10/26/2021	0955
Hardness	*2340B	0.331	94.6	mg/L	JMH	10/29/2021	1211
Total Copper	200.7	0.001	0.011	mg/L	JMH	10/29/2021	1211

REPORT OF ANALYSIS

SAMPLE ID: FINAL EFFLUENT
SAMPLE NO: 21-17599

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time

NOTES:

JRA Quantification Level is the concentration of the lowest calibration standard above zero with a reliable signal.

The results on this report relate only to the sample(s) provided for analysis and conform to TNI standards unless otherwise indicated.

Chain of Custody attached.

*SM 2011

Dissolved metals filtered in the field.

RESPECTFULLY SUBMITTED

Elaine Claiborne
Laboratory Director
Date: 03-Nov-21

James R. Reed & Associates
770 Pilot House Drive, Newport News, VA 23606
(757) 873-4703 ● Fax: (757) 873-1498

VELAP# 460013
EPA# VA00015

REPORT OF ANALYSIS

CLIENT: BT Solutions, LLC
ATTN: Beth Thompson
ADDRESS: 336 Cobblestone Drive
Lexington, SC 29072
PHONE: 803-447-8471
EMAIL: beth@btsolutionssc.com

Special Notes:
BLM CHEMISTRY - SHENANDOAH CROSSING

REPORT NO: 21-1760013:07
GRAB COLLECTION:
Date: 10/20/2021 Time: 0840
COMPOSITE COLLECTION:
Start Date: Time:
End Date: Time:
SAMPLE RECEIPT:
Date: 10/21/2021 Time: 1000

SAMPLE ID: BLANK
SAMPLE NO: 21-17600

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time
Dissolved Copper	200.7	0.001	< 0.001	mg/L	JMH	10/26/2021	1348

NOTES:

JRA Quantification Level is the concentration of the lowest calibration standard above zero with a reliable signal.

The results on this report relate only to the sample(s) provided for analysis and conform to TNI standards unless otherwise indicated.

Chain of Custody attached.

Dissolved metals filtered in the field.

RESPECTFULLY SUBMITTED

Elaine Claiborne
Laboratory Director
Date: 03-Nov-21

James R. Reed & Associates
770 Pilot House Drive, Newport News, VA 23606
(757) 873-4703 • Fax: (757) 873-1498

VELAP# 460013
EPA# VA00015

CHAIN OF CUSTODY

Company Name: BT Solutions, LLC
Company Contact: Beth Thompson Telephone: (803) 447-8471
Results To: Beth Thompson email: beth@btsolutionssc.com
Address: 336 Cobbleview Drive
Lexington, SC 29072
Project ID: **BLM Chemistry - Shenandoah Crossing**

ANALYSES REQUESTED

JRA ID # 21-	Sample Type*	Sample Location	Composite Start Date	Composite Start Time	Composite End Date	Composite End Time	Grab Date	Grab Time	Total # of cont.	DOC (filter in lab)	Diss Ca (MDL), Mg (MDL), Na (MDL), K(MDL), Cu**	Chloride(MDL), Sulfate	Alkalinity	Hardness, Total Cu	Diss Cu (MDL)**
Bottle ID										A	B	C	D	E	A
Preserv.										1	2	1	1	2	2
19356	WW	Final Effluent	XXXXX	XXXXX	XXXXX	XXXXX	11.16.21	0900	5	X	X	X	X	X	
19357		Blank	XXXXX	XXXXX	XXXXX	XXXXX	11.16.21	0912	1		pH<2 HNO3			pH<2 HNO3	X
											pH<2 HNO3			pH<2 HNO3	
											pH<2 HNO3			pH<2 HNO3	
											pH<2 HNO3			pH<2 HNO3	
											pH<2 HNO3			pH<2 HNO3	

*WW= Wastewater, GW = Groundwater, DW - Drinking Water, HW - Hazardous Waste, **OTHER: NaOH Soln**

Sampled By: Aaron Alcaki
Relinquished By: Aaron Alcaki Date/Time: 11.16.21 0900
Received By: Date/Time: 11.16.21 0912
Relinquished By: Date/Time:
Received By: Date/Time: 11-17-21 @ 1000

Preservatives:
1 = <4°C 5 = $Na_2S_2O_3$ 9 = NH_4Cl
2 = HNO_3 6 = $Na_2S_2O_3$ + HCl 10=Ascorbic Acid + HCl
3 = H_2SO_4 7 = NaOH + ZnOAc 11=HCl
4 = NaOH 8 = H_2SO_4 + FAS 12=Zinc Acetate + NaOH

___for Compliance
__Not for Compliance

Samples must be stored and transported on ice to be received <6oC.

Payment: Credit Card on file

Ship Bottles to: Shenandoah Crossing (Attn: Kenny Walker)
223 Lunker Lane
Gordonsville, VA 22942

****Dissolved Metals required to be filtered and preserved within 15 minutes of collection.**

(Sample) Filtration Date 11.16.21 **Time** 0900 **Analyst** Aaron
(Blank) Filtration Date 11.16.21 **Time** 0912 **Analyst** Aaron

Arrival Temp: 2.5 °C

JAMES R. REED and ASSOCIATES (757) 873-4703; FAX (757) 873-1498
770 Pilot House Drive, Newport News, VA 23606

P.H.- 7.34
D.O.- 8.10
Temp - 11.9
CL - 0.01

OBB

REPORT OF ANALYSIS

CLIENT: BT Solutions, LLC
ATTN: Beth Thompson
ADDRESS: 336 Cobblestone Drive
Lexington, SC 29072
PHONE: 803-447-8471
EMAIL: beth@btsolutionssc.com

Special Notes:
BLM CHEMISTRY - SHENANDOAH CROSSING

REPORT NO: 21-1935611:15
GRAB COLLECTION:
Date: 11/16/2021 Time: 0900
COMPOSITE COLLECTION:
Start Date: Time:
End Date: Time:
SAMPLE RECEIPT:
Date: 11/17/2021 Time: 1000

SAMPLE ID: FINAL EFFLUENT
SAMPLE NO: 21-19356

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time
Dissolved Organic Carbon	*5310B	0.5	5.9	mg/L	AAH	11/29/2021	1128
Dissolved Calcium	200.7	0.050	28.4	mg/L	JMH	11/30/2021	1258
Dissolved Magnesium	200.7	0.050	5.68	mg/L	JMH	11/30/2021	1258
Dissolved Sodium	200.7	0.050	86.5	mg/L	JMH	11/30/2021	1258
Dissolved Potassium	200.7	0.050	16.6	mg/L	JMH	11/30/2021	1258
Dissolved Copper	200.7	0.001	0.014	mg/L	JMH	11/30/2021	1258
Chloride	300.0	0.5	55.5	mg/L	AAH	11/22/2021	1338
Sulfate	300.0	1.0	56.0	mg/L	AAH	11/22/2021	1338
Alkalinity	*2320B	2	108	mg/L	ACS	11/24/2021	1255
Hardness	*2340B	0.331	95.4	mg/L	JMH	11/30/2021	1301
Total Copper	200.7	0.001	0.015	mg/L	JMH	11/30/2021	1301

REPORT OF ANALYSIS

SAMPLE ID: FINAL EFFLUENT
SAMPLE NO: 21-19356

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time

NOTES:

JRA Quantification Level is the concentration of the lowest calibration standard above zero with a reliable signal.

The results on this report relate only to the sample(s) provided for analysis and conform to TNI standards unless otherwise indicated.

Chain of Custody attached.

*SM 2011

Dissolved metals filtered in the field.

RESPECTFULLY SUBMITTED

Elaine Claiborne
Laboratory Director
Date: 01-Dec-21

James R. Reed & Associates
770 Pilot House Drive, Newport News, VA 23606
(757) 873-4703 ● Fax: (757) 873-1498

VELAP# 460013
EPA# VA00015

REPORT OF ANALYSIS

CLIENT: BT Solutions, LLC
ATTN: Beth Thompson
ADDRESS: 336 Cobblestone Drive
Lexington, SC 29072
PHONE: 803-447-8471
EMAIL: beth@btsolutionssc.com

Special Notes:
BLM CHEMISTRY - SHENANDOAH CROSSING

REPORT NO: 21-1935711:15
GRAB COLLECTION:
Date: 11/16/2021 Time: 0912
COMPOSITE COLLECTION:
Start Date: Time:
End Date: Time:
SAMPLE RECEIPT:
Date: 11/17/2021 Time: 1000

SAMPLE ID: BLANK
SAMPLE NO: 21-19357

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time
Dissolved Copper	200.7	0.001	< 0.001	mg/L	JMH	11/29/2021	1331

NOTES:

JRA Quantification Level is the concentration of the lowest calibration standard above zero with a reliable signal.

The results on this report relate only to the sample(s) provided for analysis and conform to TNI standards unless otherwise indicated.

Chain of Custody attached.

*SM 2011

Dissolved metals filtered in the field.

RESPECTFULLY SUBMITTED

Elaine Claiborne
Laboratory Director
Date: 01-Dec-21

James R. Reed & Associates
770 Pilot House Drive, Newport News, VA 23606
(757) 873-4703 ● Fax: (757) 873-1498

VELAP# 460013
EPA# VA00015

CHAIN OF CUSTODY

Company Name: BT Solutions, LLC
Company Contact: Beth Thompson Telephone: (803) 447-8471
Results To: Beth Thompson email: beth@btsolutionssc.com
Address: 336 Cobbleview Drive
Lexington, SC 29072
Project ID: **BLM Chemistry - Shenandoah Crossing**

ANALYSES REQUESTED

Bottle ID	A	B	C	D	E	A								
Preserv.	1	2	1	1	2	2								
	DOC (filter in lab)	Diss Ca (MDL), Mg (MDL), Na (MDL), K(MDL), Cu**	Chloride(MDL), Sulfate	Alkalinity	Hardness, Total Cu	Diss Cu (MDL)**								

JRA ID # 21-	Sample Type*	Sample Location	Composite Start Date	Composite Start Time	Composite End Date	Composite End Time	Grab Date	Grab Time	Total # of cont.											
21400	WW	Final Effluent	XXXXX	XXXXX	XXXXX	XXXXX	12/21/21	0845	5	X	X	X	X	X						
21401		Blank	XXXXX	XXXXX	XXXXX	XXXXX	12/21/21	0845	1		pH<2 HNO3			pH<2 HNO3	X pH<2 HNO3					

*WW= Wastewater, GW = Groundwater, DW - Drinking Water, HW - Hazardous Waste, **OTHER: NaOH Soln**

Sampled By: Aaron Akucki
Relinquished By: Aaron Akucki Date/Time: 12/21/21 0845
Received By: Date/Time: 12/21/21 1000
Relinquished By: Date/Time:
Received By: Date/Time: 12/22/21 @ 1415
Date/Time: 12/22/21 @ 1415

Preservatives:

1 = <4°C	5 = $Na_2S_2O_3$	9 = NH_4Cl
2 = HNO_3	6 = $Na_2S_2O_3$ + HCl	10=Ascorbic Acid + HCl
3 = H_2SO_4	7 = NaOH + ZnOAc	11=HCl
4 = NaOH	8 = H_2SO_4 + FAS	12=Zinc Acetate + NaOH

___for Compliance
__Not for Compliance

Samples must be stored and transported on ice to be received <6oC.

Payment: Credit Card on file

Ship Bottles to: Shenandoah Crossing (Attn: Kenny Walker)
223 Lunker Lane
Gordonsville, VA 22942

****Dissolved Metals required to be filtered and preserved within 15 minutes of collection.**

(Sample) Filtration Date 12/21/21 **Time** 0955 **Analyst** Aaron
(Blank) Filtration Date 12/21/21 **Time** 0945 **Analyst** Aaron

Arrival Temp: 2.1 °C

JAMES R. REED and ASSOCIATES (757) 873-4703; FAX (757) 873-1498
770 Pilot House Drive, Newport News, VA 23606

PH- 7.33 D.O - 8.55 Temp - 10.6°C

REPORT OF ANALYSIS

CLIENT: BT Solutions, LLC
ATTN: Beth Thompson
ADDRESS: 336 Cobblestone Drive
Lexington, SC 29072
PHONE: 803-447-8471
EMAIL: beth@btsolutionssc.com

Special Notes:
BLM CHEMISTRY - SHENANDOAH CROSSING

REPORT NO: 21-2140012:44
GRAB COLLECTION:
Date: 12/21/2021 Time: 0945
COMPOSITE COLLECTION:
Start Date: Time:
End Date: Time:
SAMPLE RECEIPT:
Date: 12/22/2021 Time: 1415

SAMPLE ID: Final Effluent
SAMPLE NO: 21-21400

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time
Dissolved Organic Carbon	*5310B	0.5	7.2	mg/L	AAH	12/28/2021	1755
Dissolved Calcium	200.7	0.050	31.5	mg/L	JMH	1/5/2022	1342
Dissolved Magnesium	200.7	0.050	6.11	mg/L	JMH	1/5/2022	1342
Dissolved Sodium	200.7	0.050	73.0	mg/L	JMH	1/5/2022	1342
Dissolved Potassium	200.7	0.050	15.1	mg/L	JMH	1/5/2022	1342
Dissolved Copper	200.7	0.001	0.010	mg/L	JMH	1/5/2022	1342
Chloride	300.0	0.5	52.3	mg/L	AAH	12/23/2021	1533
Sulfate	300.0	1.0	32.6	mg/L	AAH	12/23/2021	1533
Alkalinity	*2320B	2	86	mg/L	ACS	12/23/2021	1547
Hardness	*2340B	0.331	107	mg/L	JMH	1/5/2022	1345
Total Copper	200.7	0.001	0.011	mg/L	JMH	1/5/2022	1345

REPORT OF ANALYSIS

SAMPLE ID: Final Effluent
SAMPLE NO: 21-21400

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time

NOTES:

JRA Quantification Level is the concentration of the lowest calibration standard above zero with a reliable signal.

The results on this report relate only to the sample(s) provided for analysis and conform to TNI standards unless otherwise indicated.

Chain of Custody attached.

*SM 2011

Dissolved metals filtered in the field.

RESPECTFULLY SUBMITTED

Elaine Claiborne
Laboratory Director
Date: 06-Jan-22

James R. Reed & Associates
770 Pilot House Drive, Newport News, VA 23606
(757) 873-4703 ● Fax: (757) 873-1498

VELAP# 460013
EPA# VA00015

REPORT OF ANALYSIS

CLIENT: BT Solutions, LLC
ATTN: Beth Thompson
ADDRESS: 336 Cobblestone Drive
Lexington, SC 29072
PHONE: 803-447-8471
EMAIL: beth@btsolutionssc.com

Special Notes:
BLM CHEMISTRY - SHENANDOAH CROSSING

REPORT NO: 21-2140112:44
GRAB COLLECTION:
Date: 12/21/2021 Time: 0945
COMPOSITE COLLECTION:
Start Date: Time:
End Date: Time:
SAMPLE RECEIPT:
Date: 12/22/2021 Time: 1415

SAMPLE ID: BLANK
SAMPLE NO: 21-21401

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time
Dissolved Copper	200.7	0.001	< 0.001	mg/L	JMH	1/4/2022	1222

NOTES:

JRA Quantification Level is the concentration of the lowest calibration standard above zero with a reliable signal.

The results on this report relate only to the sample(s) provided for analysis and conform to TNI standards unless otherwise indicated.

Chain of Custody attached.

Dissolved metals filtered in the field.

RESPECTFULLY SUBMITTED

Elaine Claiborne
Laboratory Director
Date: 06-Jan-22

James R. Reed & Associates
770 Pilot House Drive, Newport News, VA 23606
(757) 873-4703 ● Fax: (757) 873-1498

VELAP# 460013
EPA# VA00015

APPENDIX C:

BIOTIC LIGAND MODEL REPORTS

Ver 3.41.2.12g, build 2015-10-12										
C:\Program Files (x86)\Biotic Ligand Model - Research Mode\Model\CuOH5%le_10-11-07.DAT										
C:\Users\18034\OneDrive - BT Solutions LLC\BLM Files\Shenandoah Crossing BLM.blm										
/S C:\USERS\18034\ONEDRIVE - BT SOLUTIONS LLC\BLM FILES\SHENANDOAH CROSSING BLM.SCR, /W /QQ /VER3.41 /O3 /K1 /ZD1095 /L										
			Acute FMB (geo mean)	**Chronic (geo mean)**						
			ug/L	**ug/L**						
			17.28	10.84						
			Based on an exceedance frequency of 1/1095 days (once in 3.0 years).							
Site Label	**Sample Label**	**Final Acute Value**	**CMC**	**CCC**	**Cu**	**Acute Toxic Units**	**Chronic Toxic**	**Censored Flag**		
		(FAV), ug/L	**(CMC=FAV/2), ug/L**	**(CCC=FAV/ACR), ug/L**	**ug/L**	**(Acute TU=Cu/CMC)**	**(Chronic TU=**	**(0 = quantified, 1 = BDL)**		
"SCSTP Effluent "	"SC011821 "	49.89	24.94	15.49	8.93	0.36	0.58	0.00		
"SCSTP Effluent "	"SC021521 "	34.92	17.46	10.84	7.12	0.41	0.66	0.00		
"SCSTP Effluent "	"SC022521 "	35.46	17.73	11.01	5.85	0.33	0.53	0.00		
"SCSTP Effluent "	"SC031521 "	35.33	17.66	10.97	19.70	1.12	1.80	0.00		
"SCSTP Effluent "	"SC042021 "	26.05	13.03	8.09	9.00	0.69	1.11	0.00		
"SCSTP Effluent "	"SC052221 "	33.09	16.54	10.28	9.00	0.54	0.88	0.00		
"SCSTP Effluent "	"SC062221 "	32.88	16.44	10.21	6.00	0.36	0.59	0.00		
"SCSTP Effluent "	"SC072021 "	26.21	13.11	8.14	9.00	0.69	1.11	0.00		
"SCSTP Effluent "	"SC081721 "	37.42	18.71	11.62	14.00	0.75	1.20	0.00		
"SCSTP Effluent "	"SC092121 "	51.08	25.54	15.86	11.00	0.43	0.69	0.00		
"SCSTP Effluent "	"SC102021 "	35.41	17.71	11.00	11.00	0.62	1.00	0.00		
"SCSTP Effluent "	"SC111621 "	49.98	24.99	15.52	14.00	0.56	0.90	0.00		
"SCSTP Effluent "	"SC122121 "	58.60	29.30	18.20	10.00	0.34	0.55	0.00		

Ver 3.41.2.12g, build 2015-10-12																		
C:\Program Files (x86)\Biotic Ligand Model - Research Mode\Model\CuOH5%le_10-11-07.DAT																		
C:\Users\18034\OneDrive - BT Solutions LLC\BLM Files\Shenandoah Crossing BLM.blm																		
/S C:\USERS\18034\ONEDRIVE - BT SOLUTIONS LLC\BLM FILES\SHENANDOAH CROSSING BLM.SCR, /W /QQ /VER3.41 /O3 /K1 /ZD1095 /L																		
Site Label	**Sample Label**	**Mode**	**pH**	**Dis. Cu**	**Free Cu**	**TOrg Cu**	**BL-Cu**	**BL-CuOH**	**DOC**	**HA%**	**T.Ca**	**T.Mg**	**T.Na**	**T.K**	**T.SO4**	**T.Cl**	**T.CO3**	**T.S**
				mol/L	**mol/L**	**mol/L**	**nmol/gw**	**nmol/gw**	**mg/L**		**mol/L**	**mol/L**	**mol/L**	**mol/L**	**mol/L**	**mol/L**	**mol/L**	**mol/L**
"SCSTP Effluent "	"SC011821 "	LC50	7.5	7.85E-07	3.86E-10	7.81E-07	0.031856	0.002089	5.16	10	0.000773	0.000249	0.002645	0.000218	0.000764	0.001075	0.000662	3.12E-15
"SCSTP Effluent "	"SC021521 "	LC50	7.3	5.5E-07	3.26E-10	5.48E-07	0.032594	0.001355	4.98	10	0.000756	0.000213	0.001618	0.000171	0.000187	0.001337	0.000222	3.12E-15
"SCSTP Effluent "	"SC022521 "	LC50	7.3	5.58E-07	3.7E-10	5.57E-07	0.032599	0.001349	4.61	10	0.000669	0.000207	0.002627	0.000222	0.000426	0.001297	0.000222	3.12E-15
"SCSTP Effluent "	"SC031521 "	LC50	7.1	5.56E-07	3.65E-10	5.55E-07	0.03311	0.000869	5.93	10	0.000621	0.000208	0.002562	0.000217	0.00049	0.00077	0.000235	3.12E-15
"SCSTP Effluent "	"SC042021 "	LC50	7.27	4.1E-07	3.57E-10	4.07E-07	0.032692	0.001257	3.6	10	0.000696	0.000226	0.00231	0.000286	0.000407	0.001202	0.000582	3.12E-15
"SCSTP Effluent "	"SC052221 "	LC50	7.46	5.21E-07	3.48E-10	5.15E-07	0.03203	0.001908	3.5	10	0.000631	0.000233	0.002445	0.000356	0.000274	0.00101	0.000903	3.12E-15
"SCSTP Effluent "	"SC062221 "	LC50	7.42	5.17E-07	3.9E-10	5.14E-07	0.032206	0.001744	3.6	10	0.000878	0.000281	0.002297	0.000409	0.000468	0.00167	0.000477	3.12E-15
"SCSTP Effluent "	"SC072021 "	LC50	7.06	4.13E-07	4.94E-10	4.06E-07	0.033139	0.000782	4.2	10	0.000946	0.000278	0.003515	0.000445	0.000381	0.001955	0.000884	3.12E-15
"SCSTP Effluent "	"SC081721 "	LC50	7.36	5.89E-07	4.66E-10	5.87E-07	0.032397	0.001528	4.2	10	0.001153	0.000334	0.002584	0.000448	0.00055	0.001667	0.000132	3.12E-15
"SCSTP Effluent "	"SC092121 "	LC50	7.6	8.04E-07	4.4E-10	7.95E-07	0.031373	0.002573	4	10	0.000813	0.000262	0.003489	0.000432	0.000324	0.001532	0.000906	3.12E-15
"SCSTP Effluent "	"SC102021 "	LC50	7.25	5.57E-07	4.48E-10	5.51E-07	0.032745	0.001202	4.4	10	0.000691	0.000249	0.003662	0.000468	0.000434	0.001286	0.001035	3.12E-15
"SCSTP Effluent "	"SC111621 "	LC50	7.3	7.87E-07	4.57E-10	7.73E-07	0.03258	0.001346	5.9	10	0.000709	0.000234	0.003763	0.000425	0.000583	0.001565	0.002399	3.12E-15
"SCSTP Effluent "	"SC122121 "	LC50	7.3	9.22E-07	4.4E-10	9.12E-07	0.032591	0.001356	7.2	10	0.000786	0.000251	0.003175	0.000386	0.000339	0.001475	0.00191	3.12E-15

Ver 3.41.2.12g, build 2015-10-12										
C:\Program Files (x86)\Biotic Ligand Model - Research Mode\Model\CuOH5%le_10-11-07.DAT										
C:\Users\18034\OneDrive - BT Solutions LLC\BLM Files\Shenandoah Crossing BLM.blm										
/S C:\USERS\18034\ONEDRIVE - BT SOLUTIONS LLC\BLM FILES\SHENANDOAH CROSSING BLM.SCR, /W /QQ /VER3.41 /O3 /K1 /ZD1095 /L										
Site Label	**Sample Label**	**H**	**Cu**	**DOC**	**Ca**	**Mg**	**Na**	**K**	**SO4**	**Cl**
"SCSTP Effluent "	**"SC011821 "**	3.42247E-08	3.86E-10	0.01032	0.00071	0.00023	0.002639	0.000217	0.000706	0.001076
"SCSTP Effluent "	**"SC021521 "**	5.359E-08	3.26E-10	0.00996	0.000728	0.000206	0.001614	0.00017	0.000172	0.00134
"SCSTP Effluent "	**"SC022521 "**	5.38963E-08	3.7E-10	0.00922	0.000631	0.000197	0.002622	0.000222	0.000395	0.001299
"SCSTP Effluent "	**"SC031521 "**	8.52653E-08	3.65E-10	0.01186	0.000578	0.000194	0.002555	0.000216	0.000455	0.000772
"SCSTP Effluent "	**"SC042021 "**	5.78042E-08	3.57E-10	0.0072	0.000658	0.000214	0.002306	0.000286	0.000374	0.001203
"SCSTP Effluent "	**"SC052221 "**	3.72765E-08	3.48E-10	0.007	0.000602	0.000222	0.002441	0.000355	0.000252	0.001011
"SCSTP Effluent "	**"SC062221 "**	4.11897E-08	3.9E-10	0.0072	0.000827	0.000263	0.002294	0.000409	0.000418	0.001671
"SCSTP Effluent "	**"SC072021 "**	9.49464E-08	4.94E-10	0.0084	0.000896	0.000262	0.00351	0.000444	0.000339	0.001956
"SCSTP Effluent "	**"SC081721 "**	4.75376E-08	4.66E-10	0.0084	0.001085	0.000312	0.00258	0.000447	0.000477	0.001669
"SCSTP Effluent "	**"SC092121 "**	2.72778E-08	4.4E-10	0.008	0.000772	0.000248	0.003484	0.000432	0.000292	0.001533
"SCSTP Effluent "	**"SC102021 "**	6.10035E-08	4.48E-10	0.0088	0.000649	0.000234	0.003657	0.000467	0.000399	0.001288
"SCSTP Effluent "	**"SC111621 "**	5.46832E-08	4.57E-10	0.0118	0.00065	0.000215	0.003754	0.000424	0.000541	0.001567
"SCSTP Effluent "	**"SC122121 "**	5.43957E-08	4.4E-10	0.0144	0.000736	0.000236	0.003167	0.000385	0.000312	0.001478

CO3	S	BL	BL-Cu	BL-CuOH	BL-Ca	BL-Mg	BL-H	BL-Na	HCO3	H2CO3	HS	H2S	MgHCO3	MgCO3
7.63E-07	1.19E-21	9.38E-11	5.67E-13	3.72E-14	1.65E-10	5.37E-11	7.16E-13	2.2E-10	0.000607	5.04E-05	2.42E-15	7.06E-16	1.13E-06	6.93E-08
1.59E-07	6.43E-22	1.1E-10	5.8E-13	2.41E-14	2.05E-10	5.79E-11	1.33E-12	1.59E-10	0.000196	2.52E-05	2.13E-15	9.97E-16	3.42E-07	1.46E-08
1.59E-07	6.54E-22	9.76E-11	5.8E-13	2.4E-14	1.57E-10	4.89E-11	1.18E-12	2.29E-10	0.000196	2.53E-05	2.13E-15	9.92E-16	3.19E-07	1.33E-08
1.07E-07	3.46E-22	1.02E-10	5.89E-13	1.55E-14	1.48E-10	4.96E-11	1.94E-12	2.32E-10	0.000196	3.85E-05	1.79E-15	1.33E-15	3.23E-07	9.49E-09
4.43E-07	5.98E-22	9.99E-11	5.82E-13	2.24E-14	1.7E-10	5.53E-11	1.3E-12	2.07E-10	0.000512	6.55E-05	2.08E-15	1.04E-15	9.34E-07	4.42E-08
1.13E-06	1.05E-21	9.99E-11	5.7E-13	3.4E-14	1.56E-10	5.76E-11	8.4E-13	2.19E-10	0.000829	6.78E-05	2.36E-15	7.61E-16	1.58E-06	1.19E-07
6.4E-07	9.53E-22	9.13E-11	5.73E-13	3.1E-14	1.93E-10	6.13E-11	8.45E-13	1.87E-10	0.000436	3.54E-05	2.31E-15	8.11E-16	9.91E-07	8.52E-08
5.03E-07	3.17E-22	7.58E-11	5.9E-13	1.39E-14	1.7E-10	4.97E-11	1.61E-12	2.37E-10	0.000742	0.000134	1.73E-15	1.39E-15	1.66E-06	6.59E-08
1.62E-07	8.11E-22	7.85E-11	5.77E-13	2.72E-14	2.13E-10	6.12E-11	8.34E-13	1.8E-10	0.000119	1.07E-05	2.23E-15	8.93E-16	3.19E-07	2.57E-08
1.88E-06	1.59E-21	7.98E-11	5.58E-13	4.58E-14	1.55E-10	4.99E-11	4.88E-13	2.48E-10	0.00085	4.57E-05	2.53E-15	5.86E-16	1.8E-06	2.31E-07
8.02E-07	5.75E-22	8.22E-11	5.83E-13	2.14E-14	1.34E-10	4.82E-11	1.12E-12	2.68E-10	0.00091	0.000118	2.06E-15	1.07E-15	1.78E-06	8.57E-08
1.9E-06	6.81E-22	8.31E-11	5.8E-13	2.4E-14	1.31E-10	4.32E-11	1.01E-12	2.75E-10	0.002124	0.000261	2.14E-15	9.82E-16	3.65E-06	1.65E-07
1.45E-06	6.71E-22	8.69E-11	5.8E-13	2.41E-14	1.54E-10	4.93E-11	1.05E-12	2.43E-10	0.001687	0.000212	2.14E-15	9.86E-16	3.22E-06	1.4E-07

MgSO4	CaHCO3	CaCO3	CaSO4	CuOH	Cu(OH)2	CuSO4	CuCO3	Cu(CO3)2	CuCl	CuHCO3	Charge	Ionic S.	Temp (K)	Water (L)
1.29E-05	3.1E-06	3.39E-07	4.63E-05	7.06E-11	9.8E-13	2.75E-11	9.15E-10	1.03E-12	6.53E-13	2.32E-09	-0.00562	0.013785	280.4	1
3.28E-06	1.11E-06	8.33E-08	1.29E-05	4.77E-11	5.19E-13	6.37E-12	1.76E-10	4.12E-14	7.36E-13	6.97E-10	-0.00519	0.011844	282.8	1
6.8E-06	9.37E-07	6.85E-08	2.46E-05	5.06E-11	5.21E-13	1.58E-11	1.91E-10	4.5E-14	7.88E-13	7.64E-10	-0.00404	0.012192	282.2	1
8.6E-06	9.13E-07	4.61E-08	2.72E-05	4.14E-11	3.52E-13	1.9E-11	1.29E-10	2.05E-14	4.8E-13	8.17E-10	-0.00659	0.013087	285.4	1
8.21E-06	2.81E-06	2.25E-07	2.56E-05	7.37E-11	1.14E-12	1.55E-11	5.11E-10	3.35E-13	7.43E-13	2.19E-09	-0.00236	0.011213	288	1
5.92E-06	4.23E-06	5.36E-07	1.6E-05	1.19E-10	3.06E-12	1.04E-11	1.28E-09	2.13E-12	6.17E-13	3.53E-09	-0.00186	0.011008	288.8	1
1.33E-05	3.33E-06	4.61E-07	3.71E-05	2.09E-10	8.53E-12	2E-11	7.7E-10	7.29E-13	1.19E-12	2.35E-09	-0.0022	0.012083	295.9	1
1.09E-05	6.2E-06	3.91E-07	3.18E-05	1.33E-10	2.74E-12	2.01E-11	7.34E-10	5.45E-13	1.76E-12	5.16E-09	-0.00259	0.013438	297.9	1
1.86E-05	1.22E-06	1.55E-07	5.47E-05	2.6E-10	1.11E-11	2.7E-11	2.25E-10	5.4E-14	1.42E-12	7.93E-10	-0.00225	0.013425	298.4	1
8.55E-06	5.98E-06	1.23E-06	2.37E-05	3.45E-10	2.06E-11	1.54E-11	2.52E-09	7.01E-12	1.22E-12	5.09E-09	-0.00191	0.012877	295.5	1
9.59E-06	4.96E-06	3.97E-07	2.6E-05	1.03E-10	1.79E-12	2.02E-11	1.1E-09	1.3E-12	9.9E-13	4.96E-09	-0.00295	0.01308	290.1	1
9.96E-06	1.04E-05	8.1E-07	3.22E-05	7.57E-11	9.63E-13	2.51E-11	2.55E-09	7.18E-12	1.15E-12	1.04E-08	-0.00769	0.015623	284.9	1
6.29E-06	9.33E-06	7.03E-07	2.15E-05	6.62E-11	7.59E-13	1.42E-11	1.94E-09	4.16E-12	1.05E-12	7.83E-09	-0.0097	0.016122	283.6	1

BL (kg we	# Iter.	T.H	T.Cu	T.DOC	T.Ca	T.Mg	T.Na	T.K	T.SO4	T.Cl	T.CO3	T.S	T.BL
1	11	3.16E-08	7.85E-07	0.01032	0.000773	0.000249	0.002645	0.000218	0.000764	0.001075	0.000662	3.12E-15	1.78E-05
1	11	5.01E-08	5.5E-07	0.00996	0.000756	0.000213	0.001618	0.000171	0.000187	0.001337	0.000222	3.12E-15	1.78E-05
1	11	5.01E-08	5.58E-07	0.00922	0.000669	0.000207	0.002627	0.000222	0.000426	0.001297	0.000222	3.12E-15	1.78E-05
1	10	7.94E-08	5.56E-07	0.01186	0.000621	0.000208	0.002562	0.000217	0.00049	0.00077	0.000235	3.12E-15	1.78E-05
1	11	5.37E-08	4.1E-07	0.0072	0.000696	0.000226	0.00231	0.000286	0.000407	0.001202	0.000582	3.12E-15	1.78E-05
1	11	3.47E-08	5.21E-07	0.007	0.000631	0.000233	0.002445	0.000356	0.000274	0.00101	0.000903	3.12E-15	1.78E-05
1	11	3.8E-08	5.17E-07	0.0072	0.000878	0.000281	0.002297	0.000409	0.000468	0.00167	0.000477	3.12E-15	1.78E-05
1	10	8.71E-08	4.13E-07	0.0084	0.000946	0.000278	0.003515	0.000445	0.000381	0.001955	0.000884	3.12E-15	1.78E-05
1	11	4.37E-08	5.89E-07	0.0084	0.001153	0.000334	0.002584	0.000448	0.00055	0.001667	0.000132	3.12E-15	1.78E-05
1	11	2.51E-08	8.04E-07	0.008	0.000813	0.000262	0.003489	0.000432	0.000324	0.001532	0.000906	3.12E-15	1.78E-05
1	10	5.62E-08	5.57E-07	0.0088	0.000691	0.000249	0.003662	0.000468	0.000434	0.001286	0.001035	3.12E-15	1.78E-05
1	10	5.01E-08	7.87E-07	0.0118	0.000709	0.000234	0.003763	0.000425	0.000583	0.001565	0.002399	3.12E-15	1.78E-05
1	10	5.01E-08	9.22E-07	0.0144	0.000786	0.000251	0.003175	0.000386	0.000339	0.001475	0.00191	3.12E-15	1.78E-05