ANNUAL WATERSHED REPORT

FOR THE

CITY OF WEST POINT, GEORGIA

JUNE 2023

PROJECT NO. 202380

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Prepared by:

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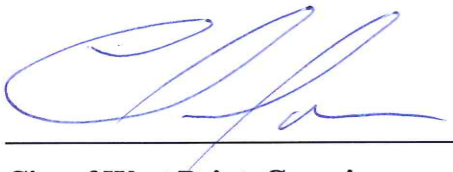
I. Implementation Certification

The Watershed Protection Plan for the City of West Point is being implemented by the City. Chemical and physical testing is being accomplished annually by Vanasse Hangen Brustlin, Inc. (VHB). The City is also implementing best management practices as described in this report.

I certify, under penalty of law, that the approved Watershed Protection Plan for the City of West Point (permittee) is being implemented. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

This certification is made for the period of January 1, 2022 to December 31, 2022.



City of West Point, Georgia
Ed Moon, City Manager

II. Summary of Annual Testing Results

At each of five monitoring sites, water quality monitoring includes *in-situ*, chemical and bacteriological parameters. None of the streams monitored in West Point fall within EPD guidelines for biological monitoring (drainage basins between 10 and 100 square kilometers. The study area and monitoring sites are shown in Exhibit One, and a description of each site is provided in Table II-1.

Table II-1 Sampling Sites

Site ID	*Location*	*Purpose*	*Coordinates*	*Level IV Ecoregion*	*Sampling Type*	*Drainage Basin Area*
1	East bank of Chattahoochee River at CSX RR bridge	River upstream of city	32.880028 -85.178508	45b	Water Quality	3,540 mi^2 (9,170 $km^{2)}$
2	Confluence of unnamed tributaries to River at West Point Park	Drainage basin for north-central city, east of River	32.879144 -85.176514	45b	Water Quality	0.39 mi^2 (1.0 km^2)
3	Unnamed intermittent tributary to Long Cane Creek, north of SR 18	Drainage basin for north city, east of River	32.879306 -85.153819	45b	Water Quality - Wet Weather	1.07 mi^2 (2.77 km^2)
4	Long Cane Creek at power easement road, upstream of SR 18	Long Cane Creek watershed, including Kia Pkwy service area	32.879617 -85.152175	45b	Water Quality	80.6 mi^2 (209 km^2)
5	East bank of Chattahoochee River at power easement, upstream of WPCP discharge	River downstream	32.856467 -85.179242	45b	Water Quality	3,540 mi^2 (9,180 km^2)

HUC-12 SUBWATERSHED
No. 031300020903

HUC-12 SUBWATERSHED
No. 031300020906

HUC-12 SUBWATERSHED
No. 031300020908

PUMP STATION #5

WEST POINT

WEST PUMP STATION

PEAR ST. PUMP STATION

BOY SCOUT RD PUMP STATION

THE VILLAGE AT HARRIS CREEK PUMP STATION

#1

#2

#3

#4

#5

LEGEND

- CITY LIMITS
- RIVERS / CREEKS / LAKES
- SUBWATERSHED
- 303(b)/303(d) STREAM NOT MEETING DESIGNATED USE
- SAMPLING SITE #1
- EXISTING FORCE MAIN
- EXISTING SEWER LINE

1750 0 1750

GRAPHIC SCALE

EXHIBIT ONE

CITY OF WEST POINT, GEORGIA
WATERSHED PROTECTION PLAN

SAMPLING SITE LOCATION MAP

SCALE: AS SHOWN DATE: JANUARY 2018

G. BEN TURNIPSEED ENGINEERS
Environmental - Civil - Hydraulic
ATLANTA - AUGUSTA - ST. SIMONS ISLAND, GEORGIA

P:\West Point\152018 Watershed Protection Plan\Drawings\Report Drawings\7 SAMPLING SITES.dwg

In this report, results for the monitoring period are summarized and compared to results in previous years. Analyses of water quality at each site are compared to applicable standards in Georgia and indicators of impairment according to the classification of the stream. Chronic ammonia standards are adjusted for sample pH and water temperature. Dissolved metals concentrations are compared with chronic dissolved metals standards, which are adjusted for sample total hardness.

In 2022, Vanasse Hangen Brustlin, Inc. (VHB) performed water quality sampling and analyses required by the Watershed Protection Plan and current guidance of the Georgia Environmental Protection Division (EPD). VHB's water quality monitoring report and sampling data are included in the appendix to this report. The VHB report includes complete, categorized results for each sampling event, analysis, and parameter. The EPD's Excel Watershed Assessment and Protection Plan Data Submittal Form and laboratory reports are included on electronic media submitted with this report. Water quality sampling events and analyses performed in this period are shown in Table II-2.

Table II-2 Water Quality Testing Events

Date	*Wet/Dry*	*In-situ*	*Chemical*	*Metals*	*Bacteriological*
6/27/2022	Dry	✓			✓
7/5/2022	Wet	✓			✓
7/13/2022	Wet	✓			✓
7/20/2022	Wey	✓			✓
8/22/2022	Dry	✓	✓		✓
9/6/2022	Wet	✓			✓
9/13/2022	Dry	✓	✓		✓
9/20/2022	Dry	✓			✓
11/30/2022	Wet	✓	✓	✓	

A. Site 1 – East Bank of Chattahoochee River at CSX Railroad Bridge

Site 1 has a drainage area of approximately 3,540 square miles (9,170 square kilometers). The reach of the Chattahoochee River in which this site is located is classified as a drinking water stream and designated on the EPD 305(b)/303(d) list of streams as not supporting classification for fishing due to antimony in fish tissue. Site 1 was selected to represent water quality in the Chattahoochee River upstream of the City. Data from this site will document in-situ conditions and water quality in tailwaters in close proximity to West Point Dam, 2.4 miles upstream. This site is located on the river bank at West Point River Park in a wooded area, except for the railroad bridge. On the east bank immediately upstream, adjacent property owned by the City is heavily wooded. A summary of sampling results for Site 1 is shown in Table II-3, and trends for selected water quality parameters are shown in Table II-4.

Table II-3 Water Quality Testing Results for Site 1

Parameter	*Units*	*Standard*	*Maximum*	*Minimum*	*Median*	*Average*
In Situ						
Air Temperature	°C		31.1	17.8	27.2	26.9
Water Temperature	°C	32.2	28.4	14.5	26.4	25.6
Dissolved Oxygen	mg/L	5.0/4.0	9.05	3.94	4.30	4.93
Dissolved Oxygen % Saturation			90.6	49.8	56.2	60.2
pH	standard units	6.0 - 8.5	7.72	6.25	6.67	6.85
Salinity	ppt		0.06	0.05	0.05	0.05
Specific Conductance	µS/cm		112	99	107	106
Turbidity	NTU	10	7.9	2.0	3.3	4.3
Chemical						
Alkalinity	mg/L as $CaCO_3$		34.6	29.7	32.9	32.4
BOD_5	mg/L	5	<2.0	<2.0	<2.0	<2.0
COD	mg/L		12.20	<5.64	10.60	9.48
Ammonia adjusted standard	mg/L	Varies	1.590	1.240		
Ammonia as N	mg/L	1.240	0.160	<0.133	<0.133	0.142
Total Kjeldahl Nitrogen	mg/L	4	0.67	0.14	0.60	0.47
Nitrate-Nitrite as N	mg/L		0.815	0.456	0.517	0.596
Ortho-phosphate as P	mg/L	0.1	<0.0080	<0.0080	<0.0080	<0.0080
Total Phosphorous	mg/L	0.1	<0.046	<0.046	<0.046	<0.046
Total Suspended Solids	mg/L	25	5.6	<0.8	<1.3	2.6
Total Hardness	mg/L as $CaCO_3$		27.60	25.20	25.60	26.13
Metals						
Cadmium (Dissolved)	µg/L	0.272	<0.0693			
Copper (Dissolved)	µg/L	2.981	<0.9690			
Lead (Dissolved)	µg/L	0.605	<0.6620			
Zinc (Dissolved)	µg/L	39.689	<4.3500			
Bacteriological						
E. coli Geometric Mean 1	MPN	126	21			
E. coli Geometric Mean 2	MPN	126	22			
Fecal Coliform Geometric Mean 1	CFU		22			
Fecal Coliform Geometric Mean 2	CFU		28			

Table II-4 – Water Quality Trends for Site 1

Average Results	*2020*	*2021*	*2022*
Dissolved Oxygen (mg/l)	7.8	6.0	4.9
Specific Conductance (µS/cm)	87	84	106
Turbidity (NTU)	12.4	8.5	4.3
TKN (mg/l as N)	BRL	0.69	0.47
NH_3 (mg/l as N)	BRL	0.156	0.142
P total (mg/l as P)	BRL	BRL	BRL
Cadmium, Dissolved (µg/L)	BRL	BRL	BRL
Copper, Dissolved (µg/L)	BRL	BRL	BRL
Lead, Dissolved (µg/L)	BRL	BRL	BRL
Zinc, Dissolved (µg/L)	BRL	BRL	BRL

Bacteriological Geometric Means	*2020*	*2021*	*2022*
E. coli Geo Mean (MPN/ 100 ml)	124	19	21
E. coli Geo Mean (MPN/ 100 ml)	214	58	22
Fecal Geo Mean (count/ 100 ml)	203	53	22
Fecal Geo Mean (count/ 100 ml)	223	1.5	28

BRL - below reporting limit

In 2022, most pollutant indicators were within Georgia water quality standards. Accounting for expected variations between wet and dry events, turbidity, BOD_5 and total suspended solids results were consistent with unimpaired waters. Alkalinity, specific conductance, salinity, and hardness were characteristic of streams in this ecoregion. Nutrient levels were low and within standards. Estimated flows for the August 22 and September 13 dry events were 789 cfs and 760 cfs, respectively.

Median and average dissolved oxygen concentrations were 4.30 and 4.93 mg/L, respectively. All but one warm season measurements were less than the 5 mg/L daily average standard, with one reading (3.94) less than the 4 mg/L minimum.

Escherichia coli (*E. coli*) 30-day geometric means of 21 and 22 MPN / 100 mL, indicating the influence of warm-blooded animals, were very low and well below the warm season standard of 126 MPN / 100 mL.

Concentrations of dissolved cadmium, copper, lead, and zinc were below detection limits.

This site does not meet EPD guidelines for biological monitoring.

B. Site 2 – Confluence of Unnamed Tributaries at West Point Park

Site 2, with a drainage area of approximately 0.39 square miles (1.0 square kilometers), is located at the confluence of two unnamed tributaries, approximately 700 feet upstream of the combined tributary's mouth on the Chattahoochee River. The reach of the Chattahoochee River to which the tributaries flow is classified as a drinking water stream and designated on the EPD 305(b)/303(d) list of streams as not supporting classification for fishing due to antimony in fish tissue. Monitoring this site is an effort to access perennial flow from a central, developed area of the City, while attempting to avoid backwater from the river during high flows. The two tributaries may lack flow during dry conditions. Located in a city park, this site collects drainage from adjacent athletic fields and other recreation facilities. A summary of sampling results for Site 2 is shown in Table II-5. Trends for selected water quality parameters are shown in Table II-6.

Table II-5 Water Quality Testing Results for Site 2

Parameter	*Units*	*Standard*	*Maximum*	*Minimum*	*Median*	*Average*
In Situ						
Air Temperature	°C		31.1	17.8	27.2	26.8
Water Temperature	°C	32.2	24.7	15.5	23.7	22.5
Dissolved Oxygen	mg/L	5.0/4.0	7.41	3.48	4.70	4.90
Dissolved Oxygen % Saturation			75.6	42.5	52.8	57.3
pH	standard units	6.0 - 8.5	7.42	5.75	6.46	6.60
Salinity	ppt		0.08	0.03	0.08	0.07
Specific Conductance	µS/cm		179	57	170	159
Turbidity	NTU	10	36.7	2.3	4.3	7.5
Chemical						
Alkalinity	mg/L as $CaCO_3$		69.8	30.5	63.9	54.7
BOD_5	mg/L	5	2.3	<2.0	<2.0	2.1
COD	mg/L		32.90	<5.64	<5.64	14.73
Ammonia adjusted standard	mg/L	Varies	2.010	1.670		
Ammonia as N	mg/L	1.670	<0.133	<0.133	<0.133	<0.133
Total Kjeldahl Nitrogen	mg/L	4	1.07	0.62	0.88	0.86
Nitrate-Nitrite as N	mg/L		0.758	0.194	0.666	0.539
Ortho-phosphate as P	mg/L	0.1	0.0410	<0.0080	<0.0080	0.0190
Total Phosphorous	mg/L	0.1	0.124	<0.046	<0.046	0.072
Total Suspended Solids	mg/L	25	35.6	<0.8	<0.8	12.4
Total Hardness	mg/L as $CaCO_3$		69.50	25.60	66.70	53.93
Metals						
Cadmium (Dissolved)	µg/L	0.257	<0.0693			
Copper (Dissolved)	µg/L	2.795	3.4800	*		
Lead (Dissolved)	µg/L	0.556	0.6980	*		
Zinc (Dissolved)	µg/L	37.239	8.8700	*		
Bacteriological						
E. coli Geometric Mean 1	MPN	126	607			
E. coli Geometric Mean 2	MPN	126	576			
Fecal Coliform Geometric Mean 1	CFU		1588			
Fecal Coliform Geometric Mean 2	CFU		1545			

**Detectable, but below reporting limit*

Table II-6 – Water Quality Trends for Site 2

Average Results	***2020***	***2021***	***2022***
Dissolved Oxygen (mg/l)	8.3	6.0	4.9
Specific Conductance (µS/cm)	156	119	159
Turbidity (NTU)	13.2	29.5	7.5
TKN (mg/l as N)	BRL	0.71	0.86
NH_3 (mg/l as N)	BRL	BRL	BRL
P total (mg/l as P)	0.111	0.082	0.072
Cadmium, Dissolved (µg/L)	BRL	BRL	BRL
Copper, Dissolved (µg/L)	BRL	BRL	BRL
Lead, Dissolved (µg/L)	BRL	BRL	BRL
Zinc, Dissolved (µg/L)	BRL	BRL	BRL

Bacteriological Geometric Means	***2020***	***2021***	***2022***
E. coli Geo Mean (MPN/ 100 ml)	1103	289	576
E. coli Geo Mean (MPN/ 100 ml)	1277	899	607
Fecal Geo Mean (count/ 100 ml)	873	1095	1545
Fecal Geo Mean (count/ 100 ml)	2428	2967	1588

BRL - below reporting limit

In 2022, most pollutant indicators were within Georgia water quality standards. Accounting for expected variations between wet and dry events, turbidity, BOD_5 and total suspended solids results were consistent with unimpaired waters. Alkalinity, specific conductance, salinity, and hardness were characteristic of streams in this ecoregion. Nutrient levels were generally low and within standards. One September pH reading of 5.75 was slightly below the minimum standard of 6.0. Estimated flows for the August 22 and September 13 dry events were 0.3 cfs and 0.3 cfs, respectively.

Median and average dissolved oxygen concentrations were 4.70 and 4.90 mg/L, respectively. Most warm season measurements were less than the 5 mg/L daily average standard, with one reading (3.48) less than the 4 mg/L minimum.

Site 2 consistently had the highest *E. coli* counts among sites in this study, indicating the influence of warm-blooded animals. 30-day geometric means of 607 and 578 MPN / 100 mL exceeded the warm season standard of 126 MPN / 100 mL.

The concentration of dissolved cadmium was below the detection limit. Concentrations of dissolved copper, lead, and zinc were detectable, but below reporting limits and therefore not statistically reliable.

This site does not meet EPD guidelines for biological monitoring.

C. Site 3 – Unnamed Intermittent Tributary to Long Cane Creek North of SR 18

Site 3, with a drainage area of approximately 1.07 square miles (2.77 square kilometers), is on an unnamed, intermittent tributary, immediately upstream of its mouth on Long Cane Creek. The segment of Long Cane Creek to which this tributary flows is designated in the EPD 305(b)/303(d) list of streams as not supporting its classification for fishing due to impacted fish communities and fecal coliforms. This site was selected on an intermittent stream to access sample data when flow is sufficient from a north region of the City. Site 2 and Site 3 have limitations, but provide the only water quality data primarily resulting from conditions within the City service area. Better sites are not available. This site is located in a cleared power easement within a large, heavily-wooded tract zoned for agricultural use. A summary of sampling results for Site 3 is shown in Table II-7. Trends for selected water quality parameters are shown in Table II-8.

Table II-7 Water Quality Testing Results for Site 3

Parameter	*Units*	*Standard*	*Maximum*	*Minimum*	*Median*	*Average*
In Situ						
Air Temperature	°C		32.2	20.0	28.3	27.1
Water Temperature	°C	32.2	24.6	15.1	23.5	21.8
Dissolved Oxygen	mg/L	5.0/4.0	6.72	2.44	4.73	4.74
Dissolved Oxygen % Saturation			68.4	29.9	57.25	54.9
pH	standard units	6.0 - 8.5	7.37	5.84	6.40	6.43
Salinity	ppt		0.05	0.01	0.04	0.04
Specific Conductance	µS/cm		108	19	83	76
Turbidity	NTU	10	22.6	6.8	19.4	16.7
Chemical						
Alkalinity	mg/L as $CaCO_3$		41.6	8.65	41.4	30.6
BOD_5	mg/L	5	<2.0	<2.0	<2.0	<2.0
COD	mg/L		21.80	9.90	14.50	15.40
Ammonia adjusted standard	mg/L	Varies	2.960	1.700		
Ammonia as N	mg/L	1.700	<0.133	<0.133	<0.133	<0.133
Total Kjeldahl Nitrogen	mg/L	4	0.99	0.58	0.66	0.74
Nitrate-Nitrite as N	mg/L		0.053	0.015	0.030	0.032
Ortho-phosphate as P	mg/L	0.1	0.0320	0.0210	0.0240	0.0257
Total Phosphorous	mg/L	0.1	0.059	<0.046	<0.046	0.050
Total Suspended Solids	mg/L	25	18.8	6.4	7.6	10.9
Total Hardness	mg/L as $CaCO_3$		33.10	6.72	31.00	23.61
Metals						
Cadmium (Dissolved)	µg/L	0.094	<0.0693			
Copper (Dissolved)	µg/L	0.891	1.5200	*		
Lead (Dissolved)	µg/L	0.121	<0.6620			
Zinc (Dissolved)	µg/L	11.990	4.9800	*		
Bacteriological						
E. coli Geometric Mean 1	MPN	126	158			
E. coli Geometric Mean 2	MPN	126	150			
Fecal Coliform Geometric Mean 1	CFU		205			
Fecal Coliform Geometric Mean 2	CFU		194			

**Detectable, but below reporting limit*

Table II-8 – Water Quality Trends for Site 3

Average Results	***2020***	***2021***	***2022***
Dissolved Oxygen (mg/l)	8.3	5.9	4.7
Specific Conductance (µS/cm)	87	75	76
Turbidity (NTU)	16.0	25.5	16.7
TKN (mg/l as N)	BRL	0.57	0.74
NH_3 (mg/l as N)	BRL	BRL	BRL
P total (mg/l as P)	0.110	0.043	0.050
Cadmium, Dissolved (µg/L)	BRL	BRL	BRL
Copper, Dissolved (µg/L)	BRL	BRL	BRL
Lead, Dissolved (µg/L)	BRL	BRL	BRL
Zinc, Dissolved (µg/L)	BRL	BRL	BRL

Bacteriological Geometric Means	***2020***	***2021***	***2022***
E. coli Geo Mean (MPN/ 100 ml)	131	246	150
E. coli Geo Mean (MPN/ 100 ml)	171	297	158
Fecal Geo Mean (count/ 100 ml)	117	628	194
Fecal Geo Mean (count/ 100 ml)	212	797	205

BRL - below reporting limit

In 2022, most pollutant indicators were within Georgia water quality standards. Accounting for expected variations between wet and dry events, turbidity, BOD_5 and total suspended solids results were consistent with unimpaired waters. Alkalinity, specific conductance, salinity, and hardness were characteristic of streams in this ecoregion. Nutrient levels were low and within standards. One September pH reading of 5.84 was slightly below the minimum standard of 6.0. Only trickle flow was observed for the August 22 and September 13 dry events.

Median and average dissolved oxygen concentrations were 4.73 and 4.74 mg/L, respectively. All but one warm season measurements were less than the 5 mg/L daily average standard, with one reading (2.44) less than the 4 mg/L minimum.

E. coli 30-day geometric means of 158 and 150 MPN / 100 mL slightly exceeded the warm season standard of 126 MPN / 100 mL, indicating the influence of warm-blooded animals.

Concentrations of dissolved cadmium and lead were below detection limits. Concentrations of dissolved copper and zinc were detectable, but below reporting limits and therefore not statistically reliable.

This site does not meet EPD guidelines for biological monitoring.

D. Site 4 – Long Cane Creek at Power Easement, Upstream of SR 18

Site 4 has a drainage area of approximately 80.6 square miles (209 square kilometers). The segment of Long Cane Creek in which this site is located is designated on the EPD 305(b)/303(d) list as not supporting its classification for fishing due to impacted fish communities and fecal coliforms. Site No. 4 reflects conditions and development in the area of Kia Parkway industrial development. It also represents cumulative water quality in a very large drainage basin with headwaters in the City of LaGrange and beyond. This site is located in a cleared power easement within a large, heavily-wooded tract zoned for agricultural use. A summary of sampling results for Site 4 is shown in Table II-9. Trends for selected water quality parameters are shown in Table II-10.

Table II-9 Water Quality Testing Results for Site 4

Parameter	*Units*	*Standard*	*Maximum*	*Minimum*	*Median*	*Average*
In Situ						
Air Temperature	°C		32.2	20.0	28.3	27.1
Water Temperature	°C	32.2	26.8	14.6	24.3	23.2
Dissolved Oxygen	mg/L	5.0/4.0	8.65	6.39	6.79	7.04
Dissolved Oxygen % Saturation			88.1	78.2	83	83.1
pH	standard units	6.0 - 8.5	7.49	6.41	6.74	6.84
Salinity	ppt		0.05	0.02	0.04	0.04
Specific Conductance	µS/cm		113	35	87	86
Turbidity	NTU	10	52.8	7.7	13.8	21.0
Chemical						
Alkalinity	mg/L as $CaCO_3$		44.4	16.6	38.6	33.2
BOD_5	mg/L	5	2.5	<2.0	<2.0	2.2
COD	mg/L		46.30	<5.64	16.80	22.91
Ammonia adjusted standard	mg/L	Varies	2.880	1.550		
Ammonia as N	mg/L	1.550	<0.133	<0.133	<0.133	<0.133
Total Kjeldahl Nitrogen	mg/L	4	0.92	0.50	0.56	0.66
Nitrate-Nitrite as N	mg/L		0.195	0.015	0.151	0.120
Ortho-phosphate as P	mg/L	0.1	0.0430	0.0340	0.0380	0.0383
Total Phosphorous	mg/L	0.1	0.185	<0.046	<0.046	0.092
Total Suspended Solids	mg/L	25	135.0	<0.8	9.9	48.6
Total Hardness	mg/L as $CaCO_3$		38.90	13.70	32.60	28.40
Metals						
Cadmium (Dissolved)	µg/L	0.161	0.0729	*		
Copper (Dissolved)	µg/L	1.638	1.4000	*		
Lead (Dissolved)	µg/L	0.274	<0.6620			
Zinc (Dissolved)	µg/L	21.925	<4.3500			
Bacteriological						
E. coli Geometric Mean 1	MPN	126	222			
E. coli Geometric Mean 2	MPN	126	290			
Fecal Coliform Geometric Mean 1	CFU		440			
Fecal Coliform Geometric Mean 2	CFU		394			

**Detectable, but below reporting limit*

Table II-10 – Water Quality Trends for Site 4

Average Results	*2020*	*2021*	*2022*
Dissolved Oxygen (mg/l)	8.6	8.1	7.0
Specific Conductance (µS/cm)	109	79	86
Turbidity (NTU)	17.3	26.9	21.0
TKN (mg/l as N)	BRL	0.45	0.66
NH_3 (mg/l as N)	BRL	BRL	BRL
P total (mg/l as P)	0.159	0.043	0.092
Cadmium, Dissolved (µg/L)	BRL	BRL	BRL
Copper, Dissolved (µg/L)	BRL	BRL	BRL
Lead, Dissolved (µg/L)	BRL	BRL	BRL
Zinc, Dissolved (µg/L)	BRL	BRL	BRL

Bacteriological Geometric Means	*2020*	*2021*	*2022*
E. coli Geo Mean (MPN/ 100 ml)	104	307	222
E. coli Geo Mean (MPN/ 100 ml)	108	405	290
Fecal Geo Mean (count/ 100 ml)	80	654	394
Fecal Geo Mean (count/ 100 ml)	103	796	440

BRL - below reporting limit

In 2022, most pollutant indicators were within Georgia water quality standards. Accounting for expected variations between wet and dry events, dissolved oxygen, turbidity, BOD_5 and total suspended solids results were consistent with unimpaired waters. Alkalinity, specific conductance, salinity, and hardness were characteristic of streams in this ecoregion. Nutrient levels were generally low and within standards. Estimated flows for the August 22 and September 13 dry events were 44.3 cfs and 40.6 cfs, respectively.

E. coli 30-day geometric means of 222 and 290 MPN / 100 mL exceeded the warm season standard of 126 MPN / 100 mL, indicating the influence of warm-blooded animals.

Concentrations of dissolved lead and zinc were below detection limits. Concentrations of dissolved cadmium and copper were detectable, but below reporting limits and therefore not statistically reliable.

This site does not meet EPD guidelines for biological monitoring.

E. Site 5 – East Bank of Chattahoochee River Power Easement, Upstream of WPCP

With a drainage area of approximately 3,540 square miles (9,180 square kilometers), Site 5 is approximately 220 feet upstream of the City's water pollution control plant discharge. The reach of the Chattahoochee River in which this site is located is classified as a drinking water stream and designated on the EPD 305(b)/303(d) list of streams as not supporting classification for fishing due to antimony in fish tissue. Data from Site No. 5 reflects non-point source impacts from the City of West Point and the City of Lanett, discharge of the Lanett water pollution control plant, and varying tailwater conditions. Varying discharges from West Point Dam, however, appear to have more profound effects on water quality than local conditions. This site is located in a cleared power easement, with wooded but partially cleared residential properties immediately upstream. A summary of sampling results for Site 5 is shown in Table II-11, and trends for selected water quality parameters are shown in Table II-12.

Table II-11 Water Quality Testing Results for Site 5

Parameter	*Units*	*Standard*	*Maximum*	*Minimum*	*Median*	*Average*
In Situ						
Air Temperature	°C		30.0	18.3	28.3	26.6
Water Temperature	°C	32.2	27.7	14.7	25.9	24.8
Dissolved Oxygen	mg/L	5.0/4.0	8.38	1.90	3.10	3.62
Dissolved Oxygen % Saturation			83.2	23.9	39.2	43.2
pH	standard units	6.0 - 8.5	7.54	6.04	6.63	6.72
Salinity	ppt		0.05	0.04	0.05	0.05
Specific Conductance	µS/cm		113	89	104	104
Turbidity	NTU	10	19.9	2.5	3.6	6.0
Chemical						
Alkalinity	mg/L as $CaCO_3$		35.2	29.1	31.1	31.8
BOD_5	mg/L	5	<2.0	<2.0	<2.0	<2.0
COD	mg/L		15.10	<5.64	7.59	9.44
Ammonia adjusted standard	mg/L	Varies	1.890	1.270		
Ammonia as N	mg/L	1.270	<0.133	<0.133	<0.133	<0.133
Total Kjeldahl Nitrogen	mg/L	4	0.68	0.59	0.62	0.63
Nitrate-Nitrite as N	mg/L		3.250	0.454	0.563	1.422
Ortho-phosphate as P	mg/L	0.1	0.0100	<0.0080	0.0080	0.0087
Total Phosphorous	mg/L	0.1	<0.046	<0.046	<0.046	<0.046
Total Suspended Solids	mg/L	25	3.2	1.2	1.9	2.1
Total Hardness	mg/L as $CaCO_3$		28.60	26.20	26.20	27.00
Metals						
Cadmium (Dissolved)	µg/L	0.280	<0.0693			
Copper (Dissolved)	µg/L	3.073	<0.9690			
Lead (Dissolved)	µg/L	0.629	<0.6620			
Zinc (Dissolved)	µg/L	40.905	<4.3500			
Bacteriological						
E. coli Geometric Mean 1	MPN	126	46			
E. coli Geometric Mean 2	MPN	126	48			
Fecal Coliform Geometric Mean 1	CFU		74			
Fecal Coliform Geometric Mean 2	CFU		78			

Table II-12 – Water Quality Trends for Site 5

Average Results	*2020*	*2021*	*2022*
Dissolved Oxygen (mg/l)	8.2	5.6	3.6
Specific Conductance (µS/cm)	83	83	104
Turbidity (NTU)	5.9	9.1	6.0
TKN (mg/l as N)	BRL	0.66	0.63
NH_3 (mg/l as N)	BRL	BRL	BRL
P total (mg/l as P)	0.140	BRL	BRL
Cadmium, Dissolved (µg/L)	BRL	BRL	BRL
Copper, Dissolved (µg/L)	BRL	BRL	BRL
Lead, Dissolved (µg/L)	BRL	BRL	BRL
Zinc, Dissolved (µg/L)	BRL	BRL	BRL

Bacteriological Geometric Means	*2020*	*2021*	*2022*
E. coli Geo Mean (MPN/ 100 ml)	39	30	46
E. coli Geo Mean (MPN/ 100 ml)	2409	57	48
Fecal Geo Mean (count/ 100 ml)	35	124	74
Fecal Geo Mean (count/ 100 ml)	3258	330	78

BRL - below reporting limit

In 2022, most pollutant indicators were within Georgia water quality standards. Accounting for expected variations between wet and dry events, turbidity, BOD_5 and total suspended solids results were consistent with unimpaired waters. Alkalinity, specific conductance, salinity, and hardness were characteristic of streams in this ecoregion. Nutrient levels were low and within standards. Estimated flows for the August 22 and September 13 dry events were 789 cfs and 760 cfs, respectively.

Median and average dissolved oxygen concentrations were 3.10 and 3.62 mg/L, respectively. All warm season measurements were less than the 4 mg/L daily average standard, with a low measurement of 1.90 mg/L in June.

E. coli 30-day geometric means of 46 and 48 MPN / 100 mL, indicating the influence of warm-blooded animals, were very low and well below the warm season standard of 126 MPN / 100 mL.

Concentrations of dissolved cadmium, copper, lead, and zinc were below detection limits.

This site does not meet EPD guidelines for biological monitoring.

F. Summary

In summary, sites monitored in 2022 generally met water quality standards in Georgia.

The West Point service area of less than 10 square miles represents a very small portion of two very large watersheds in this study – the Chattahoochee River system (3,540 square miles upstream of Site 1) and Long Cane Creek (80.6 square miles upstream of Site 4). The majority of stream impacts reflected in this study are therefore upstream of the City or related to operations of West Point Dam.

Site 1, on the Chattahoochee River, is upstream of the cities of West Point and Lanett. Site 5 is generally downstream of both cities and the Lanett water pollution control plant. Water quality results at these sites, however, will not generally correlate with impacts of local rain events. Volumes of water released through the dam, about three miles upstream, are much more significant and are subject to seasonal water quality in the lake. Low coliform concentrations at Site 1 and Site 5 likely reflected high volumes of water released through the dam. Low warm season dissolved oxygen concentrations at these sites may have reflected effects of stratification in the lake.

Sites 2 and 3 are located on intermittent streams because these sites are the best available to monitor local non-point source pollutants within the City service area. Several water quality parameters, like dissolved oxygen, pH, and coliform counts, however, should be considered in the context of stream flows and natural conditions at the time of sampling.

Site 4, on an unimpounded perennial stream, produced more typical results.

Levels of *E. coli* are monitored because they indicate the influence of warm-blooded animals and potential presence of human pathogens. At the two tailwaters

sites, geometric means were below the warm season standard of 126 MPN / 100 mL. *E. coli* geometric means at the other sites exceeded the warm season standard at least slightly. Means at Site 3 were relatively low. Sources of coliforms may be natural, as domestic sources are not evident at Site 3 and Site 4. Site 2, with significantly higher levels of coliforms than other sites, is subject to possible domestic sources, such as pets at the park. Natural sources, such as geese, may also be present. A longer period of monitoring will be useful in establishing trends.

Regarding natural water quality, DNR Rule 391-3-6-.03 for Designated Uses and Water Quality Standards, states, "It is recognized that certain natural waters of the State may have a quality that will not be within the general or specific requirements contained herein. These circumstances do not constitute violations of water quality standards. This is especially the case for the criteria for dissolved oxygen, temperature, pH and bacteria. NPDES permits and best management practices will be the primary mechanisms for ensuring that discharges will not create a harmful situation. Monitoring programs have documented bacterial levels in excess of the criteria in many streams and rivers in urban areas, agricultural areas, and even in areas not extensively impacted by man such as national forest areas. This is not a unique situation to Georgia as similar levels of bacteria have been documented in streams across the nation."

As development continues in the service area, best management practices described in Section III of this report will address local impacts.

G. Summary of Changes in the Watershed Protection Plan

No changes are recommended.

III. Best Management Practice Implementation

The City of West Point has adopted ordinances outlined in its Watershed Protection Plan. It continues to enforce city codes pertaining to land disturbance, stream protection and land use. The City is Local Issuing Authority LIA-141-03 and administers requirements of Georgia Soil and Sedimentation Act within the city limits. The Planning and Zoning Department enforces building and land use codes, including those for erosion and sedimentation control.

The Public Works and Utilities Division provides services for wastewater, sanitation, stormwater, and streets. Division personnel operate, maintain, and improve wastewater treatment facilities to protect water quality downstream. Personnel continually inspect and repair the City's wastewater collection and stormwater facilities.

The City maintains its storm water system, especially in impervious downtown areas, to minimize adverse effects of runoff. On the west bank of the river, restoration and revegetation continue in a 15-acre former lumber yard the City acquired previously. Wood from past operations and most debris have been removed.

In 2022, the City continued trail improvements in River Park, 350 acres of City-owned land along the Chattahoochee River, which is deed-protected to prevent development. The City is widening trails and improving views of the river and diverse park areas, employing structural BMPs. The park provides safe access to visitors and learning opportunities for local schools, colleges, and community groups like the Future Farmers of America and Scouts.

The City of West Point continued participation with and financial support for the Chattahoochee Riverkeeper, which has been instrumental in addressing significant, long-term water quality concerns. Collaborative efforts include monitoring of water quality in West Point Lake and continued efforts to address heavy loads of sediment to the Chattahoochee River from Oseligee Creek in Alabama. In association with the City and other stakeholders, the River Keeper took the lead to investigate address sources of problems in this creek. These efforts contributed to a 2022 settlement with a civil penalty

filed in a district court by the United States Department of Justice to resolve violations of the Clean Water Act and a stormwater permit during construction of a solar farm. The River Keeper continues to work with local contractors and property owners to reduce sediment transport and maintain compliance with applicable laws.

Each year, the City sponsors the Chattahoochee River Valley Rally in West Point, a Riverkeeper event. The May 7, 2022 event included a 3-mile paddle from West Point Dam to the West Point Downtown River Park. Paddlers arriving at the park and the public enjoyed live music, food, beverages, and fun activities. To provide participants with information about the river and watershed protection, the River Keeper and other environmental groups set up booths. To increase future participation, plans for 2023 include two paddling events to target both families and more experienced paddlers. The River Keeper continued public outreach through social media and its membership newsletter.

IV. Annual Test Data

The Georgia Environmental Protection Division's Excel Watershed Assessment and Protection Plan Data Submittal Form is included on electronic media submitted with this report.

V. References

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Appendix

2022 Water Quality Monitoring Report, City of West Point, Watershed Protection Plan Monitoring.

Vanasse Hangen Brustlin, Inc.

vhb + CCR Environmental
joining forces

2022 MONITORING REPORT

LONG-TERM WATER QUALITY MONITORING

CITY OF WEST POINT, HARRIS/TROUP COUNTIES, GEORGIA

Prepared for:

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1.0 INTRODUCTION

Water quality monitoring was performed at various locations in and around the City of West Point in Troup County under the City's Watershed Monitoring Plan approved by the Georgia Environmental Protection Division (GEPD). This report summarizes monitoring efforts for 2022.

2.0 STUDY AREA DESCRIPTION

The study area is located in the Southern Outer Piedmont Sub-ecoregion (45b) of Georgia (Griffith *et al.*, 2001). Five (5) monitoring stations were selected to evaluate water quality in the watershed. These sites were selected to represent watershed inputs (*e.g.*, NPDES discharges) into the study streams and effects of land use in the drainage area. Site locations and designations were as follows:

Site 1: East Bank of Chattahoochee River at CSX RR bridge (32.880028°, -85.178508°);
Site 2: Confluence of Unnamed tributaries to River at West Point Park (32.879144°, -85.176514°);
Site 3: Unnamed intermittent tributary to Long Cane Creek, north of SR18 (32.879306°, -85.153819°);
Site 4: Long Cane Creek at power easement road, upstream of SR 18 (32.879617°, -85.152175°);
Site 5: East bank of Chattahoochee River at power easement upstream of WPCP discharge (32.856467°, -85.179242°).

3.0 METHODOLOGY

Two "dry" events and one "wet" event were sampled. The dry event is one which had no rainfall for 72 hours prior to sampling. A wet event was defined as 0.2 inches or more of rain with dry conditions (no measurable precipitation) for at least 72 hours prior. Rainfall and stream gaging information were tracked (real-time) primarily using the USGS website (https://dashboard.waterdata.usgs.gov/app/nwd/) for the Chattahoochee River at West Point, Georgia (USGS 02339500). Metals' sampling was performed using "clean metals" collection methods.

Samples were generally collected from mid-stream and in the middle of the water column in visibly flowing water at Sites 2 – 4, which is in moderately-sized to small streams. At Sites 1 and 5 (on the mainstem of the Chattahoochee River), sampling was done near the water's edge from the bank. The dry sampling events at these two sites were conducted during periods of non-generation to minimize the influence of the lake releases on the water quality in the river.

Single, discreet grab samples were collected for the dry events. The wet sampling event also was performed by collecting a single sample that targeted the rising limb of the hydrograph, whenever possible. Additionally, the wet sampling event was performed using "clean metals" collection methods. Immediately upon collection, the water sample was placed on ice for transport to the laboratory. Proper transfer protocol, including use of chain-of-custody forms, was utilized for all water quality samples.

Flow conditions, *in situ* water quality (*i.e.*, temperature [air and water], pH, specific conductance, turbidity, dissolved oxygen [DO], percent saturation DO [DO%], and salinity) and physical stream conditions were noted at each collection location. The *in situ* water quality levels were measured using a YSI Pro Plus meter for all parameters, except turbidity, which was measured via a LaMotte Turbidimeter 2020*we*.

During sampling, stream flow (in cubic feet per second [cfs]) was determined at Sites 2 – 4 using the area/velocity method for open channel flow measurement. Depths and velocities were measured at known distances across the channel. Water depths were measured using a top setting wading rod, and velocities were measured using a Rickly USGS Price AA current meter and digitizer. Flows in the Chattahoochee River (Sites 1 and 5) were determined from the nearby USGS gage.

Samples from all study sites were analyzed in the laboratory (EPD-approved) for the following parameters: nitrate-nitrite, ammonia, total Kjeldahl nitrogen (TKN), total phosphorus and orthophosphate (TP and OP), total suspended solids (TSS), 5-day biological oxygen demand (BOD_5), chemical oxygen demand (COD), alkalinity, and hardness. All samples also were analyzed for dissolved metals (lead [Pb], copper [Cu], zinc [Zn], and cadmium [Cd]).

In addition to the water chemistry sampling described above, fecal coliform and *Escherichia coli* (*E.coli*) sampling was conducted during two periods at all of the sampling sites. During each sampling period, a total of four grab samples were collected on a regular schedule within a 30-day period, and a geometric mean was calculated for the four samples. No sample was collected within 24 hours of another sample. The two sample periods were in the recreational months of May through October to correspond with GEPD fecal coliform water quality standards. Each sampling event was characterized as "dry" or "wet".

4.0 RESULTS

The two dry sampling events were conducted on August 22 and September 13, 2022. The wet sampling event was performed on November 30, 2022, and the approximate rainfall measured at the nearby USGS gaging station for that day was approximately 3.1 inches (USGS, 2022).

The bacteriological sampling events occurred in June/July and August/September. The June/July sampling dates occurred on June 27 and July 5, 13, and 20; August/September

sampling dates were on August 22 and September 6, 13, and 20. Four of the eight sampling events were considered "wet" (July 6, 13, 20 and September 6 samples), while the remaining sampling events were considered "dry".

As previously stated, no hydropower generation was occurring during the dry sampling events, and only a minimum flow release was occurring from the dam. During these two days, recorded flows from the USGS gage were 789 and 760 cubic feet per second (cfs) during sampling, respectively, and flow measurements taken at Sites 2, 3 and 4 ranged from 0.3 to 44.3 cfs (Table 1) (USGS, 2022). No flow measurements were taken at Sites 2, 3 and 4 during the wet event due to potentially unsafe conditions caused by high water levels.

Overall, water quality parameters in the Chattahoochee River (Sites 1 and 5) mostly were different (often with lower levels) than in the other study streams (Sites 2 – 4).

4.1 Laboratory Data

A complete list of water quality parameters measured during the study, the analytical methods used by the laboratory, the methods' detection and reporting limits (MDL and RL, respectively), and state standards for these parameters are presented in Table 2. Numerous parameters do not have state standards. Also, some parameter levels were measured and reported between the MDL and RL (*i.e.*, below quantification limits) and are, therefore, deemed less reliable than the other data. A summary of the laboratory's water chemistry results for 2022 is presented in Table 3.

4.1.1 Nutrients

Overall nutrient levels at the study sites were fairly low to moderate. Nitrogen levels generally were higher than phosphorus levels. Many samples had parameter levels below their MDLs. Nutrient levels in the Chattahoochee River (Sites 1 and 5) frequently were different than in the other study streams (Sites 2 – 4) and tended to be a bit lower.

Nitrate-nitrite levels ranged from below the MDL (0.015) to 3.250 milligrams per liter (mg/L). Site 3 had considerably lower nitrate-nitrite levels than the other study locations with a median level of 0.030 mg/L versus 0.151 to 0.66 mg/L at the other sites. During the wet event, samples at Sites 1 and 5 had their highest nitrate-nitrite levels, whereas Sites 2 – 4 had their lowest levels.

The ammonia levels were below the MDLs (0.133 mg/L) for all samples, except for the sample (0.160 mg/l) collected from Site 1 during the September dry event.

Levels of TKN ranged from 0.14 to 1.07 mg/L and were fairly similar between sites with median levels ranging from approximately 0.6 to 0.9 mg/L.

Levels of TP ranged from below the MDL (0.046) to 0.184 mg/L. Levels of TP were below the MDL for all samples, except for the wet samples at Sites 2 – 4.

Levels of OP ranged from below the MDLs (0.0080) to 0.0430 mg/L. Like TP, levels of OP were lowest at Sites 1 and 5. Overall, wet samples mostly had higher OP levels than the dry samples.

4.1.2 Metals

The ranges of dissolved metals' levels were as follows: cadmium levels were from below the MDL (0.0693) to 0.0729 micrograms per liter (µg/L); copper levels ranged from below the MDL (0.969) to 3.48 µg/L; lead levels were from below the MDL (0.662) to 0.698 µg/L; zinc levels ranged from below the MDL (4.35) to 8.87 µg/L.

Most sites had metals' levels below their MDLs, and all sites had levels below their RLs. Site 2 mostly had the highest metals' levels.

4.1.3 Other Non-Bacteriological Parameters

Levels of TSS were frequently low and similar between sites, ranging from below the MDL (0.8 to 1.3) to 135.0 mg/L. Most dry samples had TSS levels below the MDLs. Sites 1 and 5 had the lowest and similar TSS levels (average levels of 2.6 and 2.1 mg/L, respectively), whereas Sites 2 and 4 had the highest levels, averaging 12.4 and 48.6 mg/L, respectively. The wet sample had higher TSS levels than the dry samples.

Levels of BOD_5 were below the MDL (2.0 mg/L) for all sites/events, except for the wet sample at Sites 2 and 4 (levels of 2.3 to 2.5 mg/L, respectively).

Levels of COD ranged from below the MDL (5.64) to 46.3 mg/L. Half of the dry samples were below the MDL. Most wet samples had higher COD levels than the dry samples.

Alkalinity and hardness levels were quite similar with averages ranging from 8.7 to 69.8 mg/L and 6.72 to 69.50 mg/L, respectively. Site 2 had the highest levels of alkalinity and hardness, and Sites 1 and 5 had the lowest levels. At Sites 2 – 4, wet samples had considerably lower alkalinity and hardness levels than the dry samples.

4.1.4 Bacteriological Parameters

Fecal coliform levels for individual samples ranged from 10 to 36,000 fecal coliform colonies (units) per 100 milliliters (cfu/100 mL), and geometric means ranged from 22.1 to 1,587.5 cfu/100 mL (Table 4). *E. coli* levels were similar to the fecal coliform levels but generally lower as would be expected. Levels for individual samples ranged from 10 to 1,700 most probable number (of colonies) per 100 milliliters (MPN/100 mL), and geometric means ranged from 20.7 to 606.7 MPN/100 mL.

Site 4 had the single highest fecal coliform and *E. coli* levels (3,600 cfu/100 mL and 1,700 MPN/100 mL, respectively), but Site 2 had the overall highest bacteria levels. Sites 1 and 5 had considerably lower bacterial levels than the other sites. "Wet" event samples typically had the highest bacteria levels.

4.2 *In Situ* Parameters

A summary of the *in situ* water quality data are presented in Table 5. The range of *in situ* parameters was as follows: air temperature ranged from 17.8 to 32.2 degrees Celsius (ºC); water temperature ranged from 14.5 to 28.4 ºC; pH ranged from 5.75 to 7.72 standard units (s.u.); specific conductance ranged from 19 to 179 microsiemens per centimeter (µS/cm); turbidity ranged from 2.0 to 52.8 nephelometric turbidity units (NTU); DO ranged from 1.90 to 9.05 mg/L; DO saturation ranged from 23.9 to 90.6%; salinity levels ranged from 0.04 to 0.07 parts per thousand (ppt).

Many parameters were fairly similar among sites, although parameters at Sites 1 and 5 frequently differed somewhat from the other study locations. The average air temperature at all sites was approximately 27 ºC. Average water temperatures were slightly higher at Sites 1 and 5 (25-26 ºC) than at the other sites (22–23 ºC). Average pH levels were slightly higher at Sites 1 and 5 than at the other sites (6.70 to 6.85 s.u. versus 6.43 to 6.84 s.u.). Average specific conductance levels were considerably higher at Site 2 (159 µS/cm) than at the other sites (76-106 µS/cm). Average turbidity levels were similar and lower at Sites 1 and 5 than at the other sites (4.3 and 6.0 NTU versus 7.5-21.0 NTU). Average turbidity levels were much lower in dry samples than in wet samples (7.2 NTU versus 13.8 NTU), and levels also were lower at Sites 1 and 5 than at Sites 2 – 4 (4.3 and 6.0 NTU versus 7.5–21.0 NTU). Average levels of DO and DO% were moderate to low at Sites 1 – 3 and 5 (3.62–4.90 mg/L and 43.2-60.2%, respectively) but considerably higher at Site 4 (7.04 mg/L and 83.1%, respectively). Finally, average salinity levels were considerably higher at Site 2 (0.07 ppt) than at the rest of the sites (0.04-0.05 ppt).

5.0 DISCUSSION

5.1 Laboratory Data

5.1.1 Nutrients

While some level of nutrients are essential to life, excess nutrients in an aquatic system can cause a variety of adverse affects, including algal growth, depressed oxygen levels (eutrophication), and toxicity to humans and animals. Nitrogen and phosphorus in the various forms, including nitrate, nitrite, ammonia (ammoniacal nitrogen), and total phosphorus, are the primary nutrients affecting water quality.

Nitrogen has many forms, and total nitrogen is the sum of the organic and inorganic forms of nitrogen. Total Kjeldahl nitrogen is the measure of organically bound nitrogen plus ammonia. High TKN levels generally result from sewage or manure discharges. The inorganic forms of nitrogen include nitrate, nitrite, and ammonia. Nitrate (NO_3) is a highly soluble, stable form of nitrogen in water and is easily transported in streams and groundwater. Nitrite (NO_2) is a relatively short-lived form of nitrogen in water, because it is quickly converted to nitrate by bacteria. Ammonia is the least stable form of nitrogen in water. Ammonia is found in water in two forms - the ammonium ion (NH_4+) and the un-ionized ammonia gas (NH_3). Total ammonia is the sum of ammonium and un-ionized ammonia. The dominant form depends primarily on the pH of the water (and temperature to a lesser extent). As pH decreases, the ammonium form predominates, whereas the ammonia form predominates as pH increases. Un-ionized ammonia (NH_3) is much more toxic to aquatic organisms than the ammonium ion (NH_4+).

Total phosphorus (TP) is a measure of all the forms of phosphorus, dissolved or particulate, that is found in a sample. Ortho phosphorus (OP) is the dissolved, bioavailable form that can be rapidly assimilated by plants and cause algal blooms. Phosphorus is often the nutrient responsible for eutrophication.

In 2000-1, the USEPA developed and published nutrient criteria for 17 ecoregions across the country. The intent of these criteria was to provide the states and tribes with baseline conditions of minimally impacted surface waters in order to help identify problem (eutrophic) areas and evaluate eutrophication reduction efforts. These ecoregional nutrient criteria developed by the USEPA were to serve as a basis for state and tribal water quality criteria for achieving and protecting their specified designated uses. The results for streams and rivers in the ecoregion in which this project is located, *i.e.,* Ecoregion IX, are as follows: 0.037 mg/L of TP and 0.69 mg/L of total nitrogen (TN) (USEPA, 2000). Total nitrogen is TKN + nitrate + nitrite.

The USGS (1999), reporting on the quality of the nation's waters, reported the following estimates of national background nutrient concentrations in streams:

- total nitrogen = 1.0 mg/L;
- nitrate = 0.6 mg/L;
- ammonia = 0.1 mg/L;
- total phosphorus = 0.1 mg/L.

Waters with nutrients levels greater than these national background concentrations are considered to be affected by human activities. The Federal Interagency Stream Restoration Working Group (1998) reported total nitrogen levels in a relatively undisturbed watershed (90% forested) at 0.06-0.19 mg/L, in untreated wastewater at 35 mg/L, and in urban runoff at 3-10 mg/L. The USEPA has established a maximum contaminant level (MCL) of 10 milligram per liter (mg/L) for nitrate as nitrogen (NO_3-N) and a Maximum Contaminant Level (MCL) of 1 mg/L for nitrite as nitrogen (NO_2-N) in drinking water (USEPA, 2002). The USEPA also has established ammonia criteria (dependent on temperature and pH) for protection of mussels and early life

stages of fish. Acute ammonia criteria (at pH 8 and 25°C) for mussels is 2.9 mg/L and for salmon is 5.6 mg/L, while chronic criteria is 0.26 mg/L and 1.2 mg/L for mussels and early life stages of fish, respectively (USEPA 1999 and 2009). Other sources have cited unpolluted waters generally having levels of less than 1 mg/L of ammonia and nitrite, and nitrate levels rarely exceed 10 mg/L with levels of less than 1 mg/L frequently observed during high primary production (PLMS, 2006).

Total phosphorus levels in a relatively undisturbed watershed (90% forested) have been reported at 0.006-0.012 mg/L, whereas phosphorus levels of 10 mg/L have been measured in untreated wastewater (FISRWG, 1998). The FISRWG (1998) also reported urban runoff levels for total phosphorus levels of 0.2-1.7 mg/L. Another source reported unpolluted waters as having total phosphorus levels below 0.1 mg/L (PLMS, 2006). To combat eutrophication, the USEPA recommends that total phosphate should not exceed 0.05 mg/L (as phosphorus) in a stream at a point where it enters a lake or reservoir, and that it should not exceed 0.1 mg/L in streams that do not discharge directly into lakes or reservoirs (Mueller and Helsel, 1999).

Overall, nutrient levels varied and were moderate to low. Most nitrate-nitrite levels were < 0.6 mg/L (except for one very elevated level of 3.25 mg/L at Site 5 during wet sample). Ammonia levels were low, and all but one sample had levels below the MDL. All TKN levels were ≤1.0 mg/L. Most TN levels were somewhat elevated (> 1.0 mg/L), and only two samples had TN levels that did not exceed the USEPA-recommended Ecoregion IX level of 0.69 mg/L (USEPA, 2000). All but three wet samples had TP levels below the MDL, and only two (wet) samples had TP levels > 0.1 mg/L (0.124 and 01.85 mg/L at Sites 2 and 4, respectively). All samples with levels below the MDL appeared to be below the USEPA-recommended TP level of 0.037 mg/L (USEPA, 2000), but this cannot be definitively determined since they were reported by the laboratory as < 0.046 mg/L. All samples had low OP levels < 0.05 mg/L.

5.1.2 Metals

Metals are found naturally in the earth's crust/geology, where they dissolve into water during contact. Metals can also enter surface and ground water through contamination or pollution from a variety of man-made sources. Trace levels of metals are essential to sustain life, but at elevated levels, metals can become poisonous or toxic.

As previously reported, metals' analyses were only done during the wet event (November 30). For determining violations of state standards for metals' levels at the sites, the dissolved instream concentrations of metals measured in the laboratory for each sample were adjusted using the Dissolved Metals Calculator provided by the GEPD. The Dissolved Metals Calculator adjusts the dissolved metals levels using the hardness levels in the samples to allow for accurate comparison to the state's acute and chronic numeric criteria.

Copies of the Dissolved Metals Calculator sheets are attached. All sites had lead levels that exceeded the state's chronic criteria. Whether the state's lead criterion was truly exceeded is

uncertain since the MDL value of 0.662 µg/L was used to calculate the chronic criterion level at all sites except Site 2 (0.698 µg/L), and the actual lead level at these sites was below 0.662 mg/L. The state's chronic criterion for copper was exceeded at Sites 2 and 3, and the acute criterion for copper also was exceeded at Site 3. These exceedances, especially at Site 3, appear to be greatly influenced by the very low hardness levels found at these locations. No other samples had metals' levels in exceedance of the state's acute or chronic criteria.

5.1.3 Other Non-Bacteriological Parameters

Levels of the other non-bacteriological laboratory parameters, *i.e.*, BOD_5, COD, TSS, hardness, and alkalinity, were fairly low during the study. High levels of these parameters can be toxic to aquatic life.

Biological oxygen demand (BOD) is a measure of the quantity of oxygen consumed by microorganisms during the decomposition of organic matter. BOD_5 is a measure of the oxygen consumed in a sealed container over a 5-day period. Chemical oxygen demand (COD) is a measure of the oxygen required to oxidize all organic matter into carbon dioxide and water. COD is always higher than BOD, because COD does not differentiate between biologically available and inert organic matter. Boyacioglo *et al.* (2005) reported BOD and COD standards of 4 and 25 mg/L, respectively, or less for high quality waters (Class I) and standards of greater than 20 mg/L and greater than 70 mg/L, respectively, for highly polluted waters (Class IV). Hue (2007) reported surface water standards for rivers for BOD and COD of 4 and 10 mg/L, respectively, and standards for lakes and reservoirs of 25 and 35 mg/L, respectively.

All but two wet samples had BOD_5 levels (2.1 and 2.2 mg/L) below the MDL/RL (2 mg/L). Most COD levels were ≤10 mg/L, and only two (wet) samples had a COD levels > 25 mg/L (*i.e.,* 32.9 mg/L at Site 2 and 46.30 mg/L at Site 4).

Total suspended solids (TSS) are the portion of total solids retained by a 2-micron mesh filter (APHA, 1998). Levels of TSS of 25 mg/L or less are considered optimal, levels of 25 to 80 mg/L are acceptable, and levels >80 to 400 mg/L are poor for protection of aquatic life (Green.org website, 2005). Only two (wet) samples had TSS levels > 25 mg/L, *i.e.,* 35.6 mg/L at Site 2 and 135 mg/L at Site 4.

Alkalinity is a measure of the capacity of an aqueous solution to neutralize acids, or in other words, the water's buffering capacity. Alkalinity is primarily the measure of the amount of the bases bicarbonate (HCO_3^-) and carbonate (CO_3^{2-}) in the water. These bicarbonates and carbonates are critical to the production shell and skeletal material for mollusks and other aquatic animals and to a stream's ability to neutralize acidic pollution from rainfall or wastewater. Alkalinity helps regulate the pH of a water body and also the metal content in the water. Bicarbonate and carbonate ions in water can remove toxic metals (*e.g.,* lead, arsenic, and cadmium) by precipitating the metals out of solution. Typically, alkalinity levels in freshwater streams range from approximately 20 to 200 mg/L, and levels below 10 mg/L indicate that the

system is poorly buffered and is very susceptible to changes in pH from natural and human-caused sources (BASIN, 2007). Average alkalinity levels during this study ranged from approximately 30.6 to 54.7 mg/L, indicating moderately buffered conditions in these streams.

Hardness is the measure of mineral content (metal ions) in the water. The predominant metal ions usually are calcium and magnesium, and hardness is usually expressed in terms of mg/L of calcium carbonate. Sources of calcium usually are limestone or mineral deposits of $CaSO_4$, and the predominant source of magnesium is dolomite, $CaMg(CO_3)_2$. Water with a hardness level of less than 75 mg/L is considered "soft" water (Sawyer and McCarty, 1967). Hardness levels in this study generally were low (maximum of 69.50 mg/L), so all sites would be considered to have soft water.

5.1.4 Bacteriological Parameters

Fecal bacteria are naturally occurring organisms that inhabit the gastrointestinal tract of warm-blooded animals, including humans. *E. coli* is a particular type of fecal bacterium. The United States Environmental Protection Agency (USEPA) originally selected fecal coliform as an indicator of sanitary quality of water for recreational, industrial, agricultural and water supply purposes, but in 1986, the USEPA recommended that *E. coli* be used as an indicator of fecal contamination in freshwater used for recreational purposes. This USEPA standard was set at a geometric mean concentration of 126 colonies per 100 milliliters of water. *E. coli* was selected because of its strong correlation in freshwater with swimming-related gastroenteritis rates. In August of 2022, the USEPA approved GDNR's revised water quality standards that included the 126 counts per 100 mL geometric mean for *E. coli* as a replacement for the existing state bacterial standard, which was a geometric mean of 200 cfu/100 mL for fecal coliform in freshwater during the recreational months of May through October. Additionally, the new standard stated that there should be no greater than a ten percent excursion frequency of an *E. coli* statistical threshold value (STV) of 410 counts per 100 mL in the same 30-day interval (GDNR, 2022).

Both bacteriological sampling periods were collected within the recreational months of May through October. Sites 1 and 5 had geometric means for *E. coli* well below the new state standard during both sampling periods, whereas the other sites had *E. coli* levels above the new state standard during both sampling periods.

5.2 *In Situ* Parameters

Most of the *in situ* parameters measured at the monitoring stations were within state standards and acceptable levels for protection of aquatic biota (USEPA, 1986; GDNR, 2021). Water temperatures were normal, and none exceeded the state standard of 32° C.

The pH of a solution is the measure of its acidity or basicity, and the pH scale corresponds to the concentration of hydronium ions in that solution. Levels of pH at the study sites generally were

near neutral (7.0 s.u.) and within the state standard criteria range of 6.0 to 8.5 s.u., except for one measurement of 5.75 s.u. at Site 2 on September 13, 2022.

Conductivity is a measure of water's ability to conduct electricity, and thus a measure of the water's ionic activity and content. The higher the concentration of ionic (dissolved) constituents, the higher the conductivity will be. Conductivity changes as temperature increases or decreases; therefore, specific conductance is often used because it normalizes the conductivity to a standard temperature of 25 ºC. Conductivity/specific conductance generally is a good (indirect) measure of the concentration of salinity and TDS, including chloride, iron, calcium, magnesium, sodium, potassium, bicarbonate, sulfate, nitrate, and phosphate, and can be used as an indicator of water pollution (BASIN website, 2002; Ourlake.org website, 2002). While conductivity/specific conductance often is largely influenced by the geology of the waterbody's watershed, there also are anthropogenic activities which can have substantial impacts on water's conductivity/specific conductance, such as industrial effluents and non-point source pollution. The City of Boulder (Colorado) monitored a variety of parameters, including specific conductance, in Boulder Creek as it passed the City's Wastewater Treatment Plant and found substantial increases in specific conductance levels (up to 600 microsiemens/cm) due to the plant effluent discharge (BASIN website, 2002). Wenner *et al.* (2003) found that elevated specific conductance levels were good indicators of pollution in Piedmont streams in Georgia and that minimally impacted streams in this area had specific conductance values around 50 µS/cm. Sites 3 and 4 had average specific conductance levels somewhat above 50 µS/cm (76 to 86 µS/cm, respectively), indicating the likely presence of some pollutants, whereas Sites 1, 2, 5 had somewhat higher average levels (106 to 159 µS/cm), which indicated more probable pollutants at these locations.

Turbidity refers to the clarity of the water. The cloudier or hazier that the water appears, the more turbid it is. Common causes of turbidity include suspended sediment or phytoplankton. Sediment in waterways has a variety of detrimental effects on aquatic biota, including smothering fish eggs and benthic macroinvertebrates, clogging fish gills, reducing feeding and growth, and reducing photosynthetic activity (Kerr, 1995; Kundell and Rasmussen, 1995; Waters, 1995). Studies in the Piedmont and Blue Ridge sections of Georgia have shown a strong correlation between turbidity levels and their negative impacts of fish communities (Meyers *et al.*, 1999; Walters *et al.*, 2001). Significant impacts to fish communities in these studies were shown at base flow turbidity levels of 10 NTU. While this study did not specifically target base flows, many sampling events were performed during dry periods when base flows were present. Sites 1, 2, and 5 had all but two samples with turbidity levels below 10 NTU, whereas Sites 3 and 4 had most turbidity levels exceeding 10 NTU (average levels of 16.7 and 21.0 NTU, respectively), which indicated sedimentation issues at these locations. Prior to the 10 NTU criteria, a Georgia Board of Regent's Scientific Panel had recommended a 25 NTU instream limit for the protection of aquatic communities in streams with a "fishing" classification (Kundell and Rasmussen, 1995). Only four samples had turbidity levels above 25 NTU (three of these were at Site 4).

Dissolved oxygen (DO) is the amount of gaseous oxygen (O_2) dissolved in an aqueous solution, *e.g.*, water. Adequate DO levels are essential for the existence of most aquatic life. The state

standard for DO in the study area is a daily average of 5.0 mg/L and no less than 4.0 mg/L at all times. Sites 1, 2, 3, and 5 had numerous DO levels below 5.0 mg/L, and all four of these sites had *average* DO levels below 5.0 mg/L. Additionally, Site 5 had all but one DO level below 4.0 mg/L and an average DO level of 3.62 mg/L. Only Site 4 did not have any violations of the state's DO standards.

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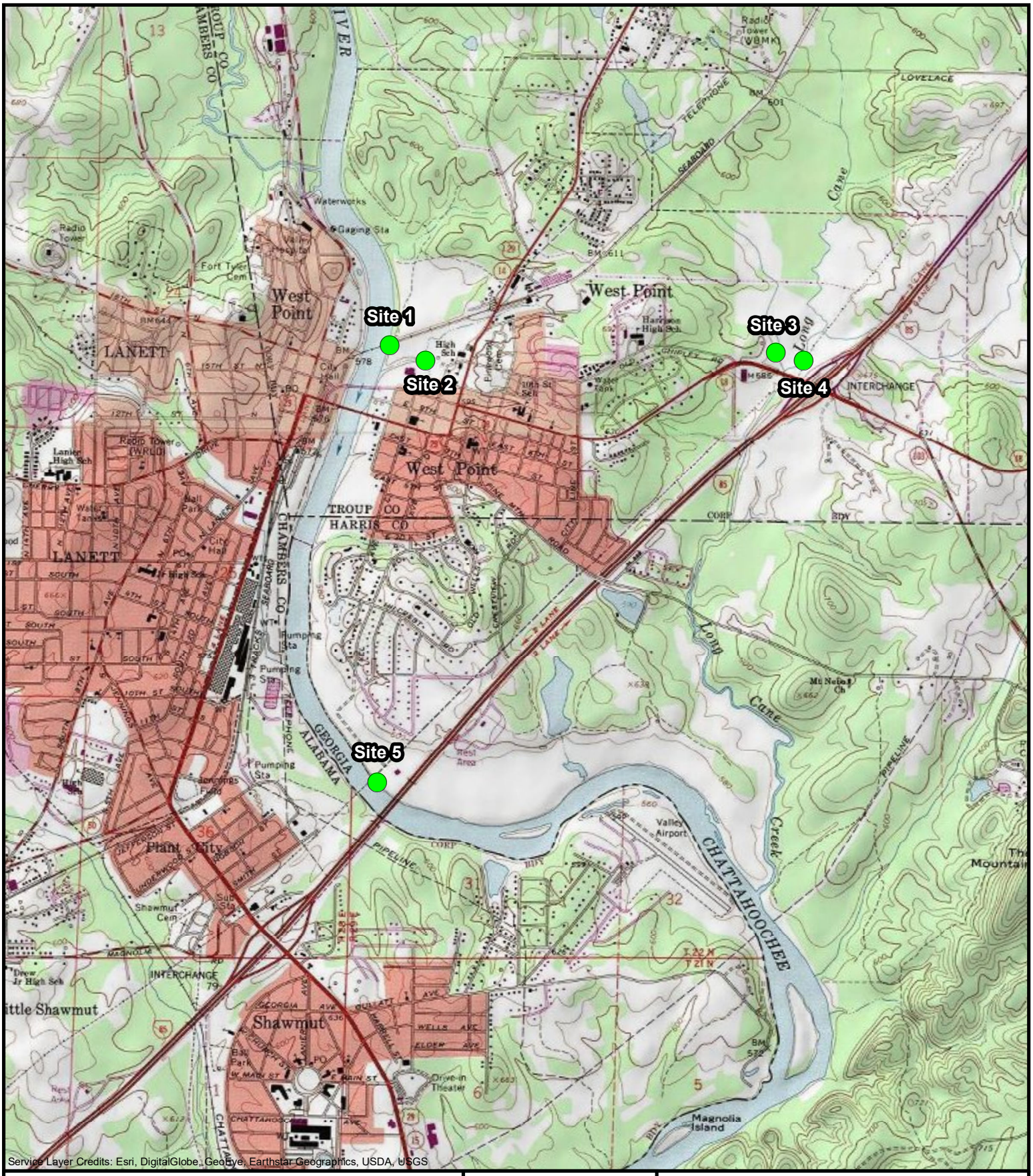

Figure 1. 2022 Monitoring Stations
Water Quality Monitoring
City of West Point
Troup and Harris counties, Georgia

N

0 0.25 0.5 1 Mile

Jan. 2023

Legend

Monitoring Stations

vhb + CCR Environmental
joining forces

Table 1. Summary of Flow Data Measured in West Point in 2022

Site #	Date	Flow (cfs)
1	8/22/22	789*
	9/13/22	760*
2	8/22/22	0.3
	9/13/22	0.3
3	8/22/22	Trickle flow
	9/13/22	Trickle flow
4	8/22/22	44.3
	9/13/22	40.6
5	8/22/22	789*
	9/13/22	760*

**No generation; minimum flow release from dam*

Table 2. State Water Quality Criteria for Warm Water Streams with Fishing Use Classification (GDNR, 2022) with Analytical Method, Detection Limit, and Reporting Limit for Parameters Measured

Parameter	State Standard	Analytical Method	Detection Limit*	Reporting Limit*
In Situ				
pH	6.0-8.5 Standard Units	n.a.	0.1 s.u.	0.1 s.u.
Dissolved Oxygen (DO)[a]	Daily Average of 5.0 mg/L	n.a.	0.01 mg/L	0.01 mg/L
Temperature	NTE 90°F (32°C)	n.a.	0.1 °	0.1 °
Conductivity and Specific Conductance	None	n.a.	0.1 mS/cm	0.1 mS/cm
Turbidity[b]	None	n.a.	0.1 NTU	0.1 NTU
Bacteriological				
E. coli[c]	May-Oct: 126 MPN/100 mL Nov-April: 265 MPN/100 mL	SM9223B	1-10 MPN/100 mL[d]	1-10 MPN/100 mL[d]
Nutrients and Other				
Biological Oxygen Demand	None	SM5210B	2-6.7 mg/L	2-6.7 mg/L
Chemical Oxygen Demand	None	E410.4	5.64 mg/L	10.00 mg/L
Nitrate-Nitrite Nitrogen	None	E353.2	0.015 mg/L	0.050 mg/L mg/L
Ammoniacal Nitrogen (ammonia)	None	E350.1	0.133 mg/L	0.200 mg/L
Total Kjeldahl Nitrogen	None	E351.2	0.07 mg/L	0.10 mg/L
Total Phosphorous	None[e]	E365.1	0.046 mg/L	0.050 mg/L
Orthophosphate	None	E365.1	0.0080 mg/L	0.0100 mg/L
Total Suspended Solids	None	SM2540D	0.8-1.3 mg/L	3.2-5.3 mg/L
Hardness	None	SM2340B	0.04 mg/L	1.00 mg/L
Alkalinity	None	SM2320B	3.00 mg/L	3.00 mg/L
Metals[f, g]				
Cadmium	0.93/0.43 mg/L	E200.8	0.0693 mg/L	0.7000 mg/L
Copper	7.0/5.0 mg/L	E200.8	0.969 mg/L	5.00 mg/L
Lead	30.0/1.2 mg/L	E200.8	0.662 mg/L	1.00 mg/L
Zinc	65.0/65.0 mg/L	E200.8	4.35 mg/L	10.00 mg/L

*Method Detection and Reporting Limits can vary slightly, dependent upon sample-specific matrix interference.

[a]Daily average of 5.0 mg/L and no less than 4.0 mg/L at all times for water supporting warm water species of fish. [b]"All waters should be free from materials related to…discharges which produce turbidity…which interfere with legitimate water uses. All waters shall be free from turbidity which results in a substantial visual contrast in a water body due to a man-made activity." [c]Limits are geometric means for at least four samples collected over a 30-day period at intervals not less than 24 hours. No single sample of the four geomean samples is to exceed 410 or 861 counts/100ml for May through October or November through April, respectively. [d]Dependent on dilution factor, i.e., x1, x10, or x100. Detection and Reporting Limits shown at lowest dilution (x1). [e]USEPA recommends levels not to exceed 0.05 mg/L in streams at the point where entering reservoirs and 0.10 mg/L for streams not directly entering a reservoir. [f]Metals expressed in terms of the dissolved fraction in the water column. [g]Criterion is for acute/chronic levels based on hardness of 50 mg/L $CaCO_3$.

Table 3. Summary of Water Chemistry Results from West Point in 2022

Analyses	Units	Method Detection Limit	Reporting Limit	Event	Date	Site #				
						1	**2**	**3**	**4**	**5**
Nitrate-nitrite	mg/L	0.0151	0.020	Dry	8/22/22	0.456	0.666	0.053	0.151	0.454
				Dry	9/13/22	0.517	0.758	0.030	0.195	0.563
				Wet	11/30/22	0.815	0.194	0.015	0.015	3.250
					Max	**0.815**	**0.758**	**0.053**	**0.195**	**3.250**
					Min	**0.456**	**0.194**	**0.015**	**0.015**	**0.454**
					Median	**0.517**	**0.666**	**0.030**	**0.151**	**0.563**
					Average	**0.596**	**0.539**	**0.032**	**0.120**	**1.422**
Ammonia	mg/L	0.133	0.200	Dry	8/22/22	<0.133	<0.133	<0.133	<0.133	<0.133
				Dry	9/13/22	0.160	<0.133	<0.133	<0.133	<0.133
				Wet	11/30/22	<0.133	<0.133	<0.133	<0.133	<0.133
					Max	**0.160**	**<0.133**	**<0.133**	**<0.133**	**<0.133**
					Min	**<0.133**	**<0.133**	**<0.133**	**<0.133**	**<0.133**
					Median	**<0.133**	**<0.133**	**<0.133**	**<0.133**	**<0.133**
					Average	**0.142**	**<0.133**	**<0.133**	**<0.133**	**<0.133**
Total Kjeldahl (TKN)	mg/L	0.07	0.10	Dry	8/22/22	0.60	0.62	0.66	0.50	0.62
				Dry	9/13/22	0.67	0.88	0.99	0.56	0.59
				Wet	11/30/22	0.14	1.07	0.58	0.92	0.68
					Max	**0.67**	**1.07**	**0.99**	**0.92**	**0.68**
					Min	**0.14**	**0.62**	**0.58**	**0.50**	**0.59**
					Median	**0.60**	**0.88**	**0.66**	**0.56**	**0.62**
					Average	**0.47**	**0.86**	**0.74**	**0.66**	**0.63**
Total Phosphorous	mg/L	0.046	0.050	Dry	8/22/22	<0.046	<0.046	<0.046	<0.046	<0.046
				Dry	9/13/22	<0.046	<0.046	<0.046	<0.046	<0.046
				Wet	11/30/22	<0.046	0.124	0.059	0.185	<0.046
					Max	**<0.046**	**0.124**	**0.059**	**0.185**	**<0.046**
					Min	**<0.046**	**<0.046**	**<0.046**	**<0.046**	**<0.046**
					Median	**<0.046**	**<0.046**	**<0.046**	**<0.046**	**<0.046**
					Average	**<0.046**	**0.072**	**0.050**	**0.092**	**<0.046**

**Where laboratory values were below MDL, the MDL value was used to calculate median and average*

Table 3. Summary of Water Chemistry Results from West Point in 2022

Analyses	Units	Method Detection Limit	Reporting Limit	Event	Date	Site #				
						1	**2**	**3**	**4**	**5**
Orthophosphate	mg/L	0.0080	0.0100	Dry	8/22/22	<0.0080	<0.0080	0.0240	0.0380	<0.008
				Dry	9/13/22	<0.0080	<0.008	0.0210	0.0430	<0.008
				Wet	11/30/22	<0.0080	0.0410	0.0320	0.0340	0.0100
					Max	**<0.0080**	**0.0410**	**0.0320**	**0.0430**	**0.0100**
					Min	**<0.0080**	**<0.0080**	**0.0210**	**0.0340**	**<0.0080**
					Median	**<0.0080**	**<0.0080**	**0.0240**	**0.0380**	**0.0080**
					Average	**<0.0080**	**0.0190**	**0.0257**	**0.0383**	**0.0087**
Total Suspended Solids (TSS)	mg/L	0.8-1.3	6.7	Dry	8/22/22	<1.3	<0.8	7.6	9.9	1.9
				Dry	9/13/22	<0.8	<0.8	6.4	<0.8	1.2
				Wet	11/30/22	5.6	35.6	18.8	135.0	3.2
					Max	**5.6**	**35.6**	**18.8**	**135.0**	**3.2**
					Min	**<0.8**	**<0.8**	**6.4**	**<0.8**	**1.2**
					Median	**<1.3**	**<0.8**	**7.6**	**9.9**	**1.9**
					Average	**2.6**	**12.4**	**10.9**	**48.6**	**2.1**
Biochemical Oxygen Demand (BOD) - 5 Day	mg/L	2.0	2.0	Dry	8/22/22	<2.0	<2.0	<2.0	<2.0	<2.0
				Dry	9/13/22	<2.0	<2.0	<2.0	<2.0	<2.0
				Wet	11/30/22	<2.0	2.3	<2.0	2.5	<2.0
					Max	**<2.0**	**2.3**	**<2.0**	**2.5**	**<2.0**
					Min	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**
					Median	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**
					Average	**<2.0**	**2.1**	**<2.0**	**2.2**	**<2.0**
Chemical Oxygen Demand (COD)	mg/L	5.64	10.0	Dry	8/22/22	12.20	<5.64	14.50	16.80	7.59
				Dry	9/13/22	<5.64	<5.64	9.90	<5.64	<5.64
				Wet	11/30/22	10.60	32.90	21.80	46.30	15.10
					Max	**12.20**	**32.90**	**21.80**	**46.30**	**15.10**
					Min	**<5.64**	**<5.64**	**9.90**	**<5.64**	**<5.64**
					Median	**10.60**	**<5.64**	**14.50**	**16.80**	**7.59**
					Average	**9.48**	**14.73**	**15.40**	**22.91**	**9.44**

**Where laboratory values were below MDL, the MDL value was used to calculate median and average*

Table 3. Summary of Water Chemistry Results from West Point in 2022

Analyses	Units	Method Detection Limit	Reporting Limit	Event	Date	Site #				
						1	**2**	**3**	**4**	**5**
Alkalinity	mg/L	3.0	3.0	Dry	8/22/22	32.9	69.8	41.4	38.6	35.2
				Dry	9/13/22	29.7	63.9	41.6	44.4	29.1
				Wet	11/30/22	34.6	30.5	8.7	16.6	31.1
					Max	**34.6**	**69.8**	**41.6**	**44.4**	**35.2**
					Min	**29.7**	**30.5**	**8.7**	**16.6**	**29.1**
					Median	**32.9**	**63.9**	**41.4**	**38.6**	**31.1**
					Average	**32.4**	**54.7**	**30.6**	**33.2**	**31.8**
Hardness	mg/L	0.04	1.00	Dry	8/22/22	25.20	69.50	31.00	32.60	26.20
				Dry	9/13/22	25.60	66.70	33.10	38.90	26.20
				Wet	11/30/22	27.60	25.60	6.72	13.70	28.60
					Max	**27.60**	**69.50**	**33.10**	**38.90**	**28.60**
					Min	**25.20**	**25.60**	**6.72**	**13.70**	**26.20**
					Median	**25.60**	**66.70**	**31.00**	**32.60**	**26.20**
					Average	**26.13**	**53.93**	**23.61**	**28.40**	**27.00**
Dissolved Cadmium	µg/L	0.0693	0.7000	Wet	11/30/22	<0.0693	<0.0693	<0.0693	0.0729	<0.0693
Dissolved Copper	µg/L	0.969	5.000		11/30/22	<0.969	3.480	1.520	1.400	<0.969
Dissolved Lead	µg/L	0.662	1.000		11/30/22	<0.662	0.698	<0.662	<0.662	<0.662
Dissolved Zinc	µg/L	4.35	10.00		11/30/22	<4.35	8.87	4.98	<4.35	<4.35

**Where laboratory values were below MDL, the MDL value was used to calculate median and average*

Table 4. Summary of Bacteriological Results from West Point in 2022

Site #	Date	Event	Fecal Coliform (Colonies/100 mL)	*E. coli* (MPN/100 mL)
1	6/27/22	Dry	20	16
	7/5/22	Wet	10	16
	7/13/22	Wet	20	23
	7/20/22	Wet	60	31
	Geometric Mean		***22.1***	***20.7***
	8/22/22	Dry	50	23
	9/6/22	Wet	40	33
	9/13/22	Dry	30	24
	9/20/22	Dry	10	13
	Geometric Mean		***27.8***	***22.1***
2	6/27/22	Dry	900	370
	7/5/22	Wet	2800	1600
	7/13/22	Wet	1800	520
	7/20/22	Wet	1400	440
	Geometric Mean		***1587.5***	***606.7***
	8/22/22	Dry	2400	1600
	9/6/22	Wet	3300	520
	9/13/22	Dry	1200	550
	9/20/22	Dry	600	240
	Geometric Mean		***1545.3***	***575.7***
3	6/27/22	Dry	*No flow observed, so no samples collected*	
	7/5/22	Wet	110	130
	7/13/22	Wet	300	310
	7/20/22	Wet	260	97
	Geometric Mean		***204.7***	***157.5***
	8/22/22	Dry	520	330
	9/6/22	Wet	350	240
	9/13/22	Dry	130	110
	9/20/22	Dry	60	58
	Geometric Mean		***194.1***	***149.9***
4	6/27/22	Dry	180	100
	7/5/22	Wet	3600	1700
	7/13/22	Wet	320	110
	7/20/22	Wet	180	130
	Geometric Mean		***439.5***	***222.0***
	8/22/22	Dry	240	170
	9/6/22	Wet	1200	870
	9/13/22	Dry	270	190
	9/20/22	Dry	310	250
	Geometric Mean		***394.0***	***289.5***
5	6/27/22	Dry	30	10
	7/5/22	Wet	60	63
	7/13/22	Wet	170	66
	7/20/22	Wet	100	110
	Geometric Mean		***74.4***	***46.2***
	8/22/22	Dry	100	70
	9/6/22	Wet	380	160
	9/13/22	Dry	100	57
	9/20/22	Dry	10	8
	Geometric Mean		***78.5***	***47.5***

Table 5. Summary of *in situ* Data collected from West Point in 2022

Analyses	Units	Date	Site #				
			1	**2**	**3**	**4**	**5**
Air Temperature	°C	6/27/22	30.6	30.6	32.2	32.2	30.0
		7/5/22	27.2	27.2	32.2	32.2	30.0
		7/13/22	30.0	30.0	28.8	28.8	28.8
		7/20/22	31.1	31.1	28.8	28.8	29.4
		8/22/22	26.6	26.6	25.5	25.5	25.5
		9/6/22	29.4	29.4	28.3	28.3	28.3
		9/13/22	25.5	25.1	23.8	23.8	25.0
		9/20/22	23.8	23.8	24.4	24.4	24.4
		11/30/22	17.8	17.8	20.0	20.0	18.3
		MAX	**31.1**	**31.1**	**32.2**	**32.2**	**30.0**
		MIN	**17.8**	**17.8**	**20.0**	**20.0**	**18.3**
		MEDIAN	**27.2**	**27.2**	**28.3**	**28.3**	**28.3**
		AVERAGE	**26.9**	**26.8**	**27.1**	**27.1**	**26.6**
Water Temperature	°C	6/27/22	25.3	22.9	^	25.8	24.7
		7/5/22	26.4	23.7	24.6	26.8	25.7
		7/13/22	28.4	23.7	24.4	25.0	26.4
		7/20/22	28.0	24.5	24.6	25.7	26.8
		8/22/22	28.0	23.8	23.6	24.3	27.7
		9/6/22	27.8	24.7	23.3	24.1	26.0
		9/13/22	26.4	21.7	19.4	21.6	25.5
		9/20/22	25.9	21.7	19.6	21.1	25.9
		11/30/22	14.5	15.5	15.1	14.6	14.7
		MAX	**28.4**	**24.7**	**24.6**	**26.8**	**27.7**
		MIN	**14.5**	**15.5**	**15.1**	**14.6**	**14.7**
		MEDIAN	**26.4**	**23.7**	**23.5**	**24.3**	**25.9**
		AVERAGE	**25.6**	**22.5**	**21.8**	**23.2**	**24.8**
pH	standard units	6/27/22	7.01	6.73	^	7.33	6.91
		7/5/22	6.99	6.98	6.39	7.18	6.95
		7/13/22	6.67	6.37	6.39	6.41	6.45
		7/20/22	6.46	6.11	6.11	6.68	6.20
		8/22/22	6.67	6.46	6.43	6.74	6.63
		9/6/22	6.56	6.45	6.48	6.54	6.38
		9/13/22	6.25	5.75	5.84	6.44	6.04
		9/20/22	7.33	7.12	7.37	7.49	7.36
		11/30/22	7.72	7.42	6.40	6.75	7.54
		MAX	**7.72**	**7.42**	**7.37**	**7.49**	**7.54**
		MIN	**6.25**	**5.75**	**5.84**	**6.41**	**6.04**
		MEDIAN	**6.67**	**6.46**	**6.40**	**6.74**	**6.63**
		AVERAGE	**6.85**	**6.60**	**6.43**	**6.84**	**6.72**

^ =*No flow observed, so no samples or measurements collected*

Table 5. Summary of *in situ* Data collected from West Point in 2022

Analyses	Units	Date	Site #				
			1	**2**	**3**	**4**	**5**
Specific Conductance	µS/cm	6/27/22	99	170	^	97	99
		7/5/22	100	173	63	72	101
		7/13/22	102	168	84	87	102
		7/20/22	109	167	105	101	109
		8/22/22	104	168	82	86	104
		9/6/22	112	175	56	71	89
		9/13/22	112	176	94	111	112
		9/20/22	108	179	108	113	108
		11/30/22	107	57	19	35	113
		MAX	**112**	**179**	**108**	**113**	**113**
		MIN	**99**	**57**	**19**	**35**	**89**
		MEDIAN	**107**	**170**	**83**	**87**	**104**
		AVERAGE	**106**	**159**	**76**	**86**	**104**
Turbidity	NTU	6/27/22	7.9	2.4	^	10.0	8.7
		7/5/22	5.9	5.8	6.8	43.6	3.0
		7/13/22	3.3	5.5	14.3	13.8	3.6
		7/20/22	3.8	4.3	22.0	12.6	3.4
		8/22/22	3.0	3.2	22.6	15.0	3.9
		9/6/22	2.9	4.7	18.3	25.3	19.9
		9/13/22	2.6	3.1	21.2	8.4	2.5
		9/20/22	2.0	2.3	7.7	7.7	2.8
		11/30/22	6.9	36.7	20.4	52.8	6.3
		MAX	**7.9**	**36.7**	**22.6**	**52.8**	**19.9**
		MIN	**2.0**	**2.3**	**6.8**	**7.7**	**2.5**
		MEDIAN	**3.3**	**4.3**	**19.4**	**13.8**	**3.6**
		AVERAGE	**4.3**	**7.5**	**16.7**	**21.0**	**6.0**
Dissolved Oxygen	mg/L	6/27/22	3.94	4.40	^	6.57	1.90
		7/5/22	4.20	4.17	2.44	6.39	2.33
		7/13/22	4.64	5.04	4.94	6.79	3.10
		7/20/22	4.29	5.44	5.11	6.54	2.87
		8/22/22	4.30	5.31	4.70	6.94	3.02
		9/6/22	4.15	4.13	4.75	6.61	3.44
		9/13/22	5.16	4.70	4.55	7.63	3.85
		9/20/22	4.63	3.48	4.68	7.25	3.73
		11/30/22	9.05	7.41	6.72	8.65	8.38
		MAX	**9.05**	**7.41**	**6.72**	**8.65**	**8.38**
		MIN	**3.94**	**3.48**	**2.44**	**6.39**	**1.90**
		MEDIAN	**4.30**	**4.70**	**4.73**	**6.79**	**3.10**
		AVERAGE	**4.93**	**4.90**	**4.74**	**7.04**	**3.62**

^ =*No flow observed, so no samples or measurements collected*

Table 5. Summary of *in situ* Data collected from West Point in 2022

Analyses	Units	Date	Site #				
			1	**2**	**3**	**4**	**5**
Dissolved Oxygen Saturation	%	6/27/22	49.8	52.8	^	78.2	23.9
		7/5/22	52.8	51.5	29.9	81.6	29.0
		7/13/22	60.3	59.9	60.7	83.7	39.2
		7/20/22	55.9	65.9	62.9	81.6	36.5
		8/22/22	56.2	64.1	56.4	84.6	38.9
		9/6/22	53.7	50.7	58.1	79.9	43.1
		9/13/22	65.5	52.6	50.7	88.1	48.0
		9/20/22	57.4	42.5	52.1	83.0	46.6
		11/30/22	90.6	75.6	68.4	87.0	83.2
		MAX	**90.6**	**75.6**	**68.4**	**88.1**	**83.2**
		MIN	**49.8**	**42.5**	**29.9**	**78.2**	**23.9**
		MEDIAN	**56.2**	**52.8**	**57.3**	**83.0**	**39.2**
		AVERAGE	**60.2**	**57.3**	**54.9**	**83.1**	**43.2**
Salinity	ppt	6/27/22	0.06	0.08	^	0.04	0.05
		7/5/22	0.05	0.08	0.03	0.03	0.05
		7/13/22	0.05	0.08	0.04	0.04	0.05
		7/20/22	0.05	0.08	0.05	0.05	0.05
		8/22/22	0.05	0.08	0.04	0.04	0.05
		9/6/22	0.05	0.08	0.02	0.03	0.04
		9/13/22	0.05	0.08	0.04	0.05	0.05
		9/20/22	0.05	0.08	0.05	0.05	0.05
		11/30/22	0.05	0.03	0.01	0.02	0.05
		MAX	**0.06**	**0.08**	**0.05**	**0.05**	**0.05**
		MIN	**0.05**	**0.03**	**0.01**	**0.02**	**0.04**
		MEDIAN	**0.05**	**0.08**	**0.04**	**0.04**	**0.05**
		AVERAGE	**0.05**	**0.07**	**0.04**	**0.04**	**0.05**
Flow Conditions	*N = Normal*	6/27/22	N/CL	N/CL	DRY	N/ST	N/ST
	SE = Slightly Elevated	7/5/22	N/CL	N/CL	N/CL	N/T	N/CL
	E = Elevated	7/13/22	N/CL	N/CL	N/ST	N/ST	N/CL
	CL = Clear	7/20/22	N/CL	N/CL	N/T	N/ST	N/CL
	ST = Slightly Turbid	8/22/22	N/CL	N/CL	N/T	N/T	N/CL
	T = Turbid	9/6/22	SE/CL	SE/CL	E/ST	E/T	SE/ST
		9/13/22	N/CL	N/CL	N/CL	N/CL	N/CL
		9/20/22	N/CL	N/CL	N/CL	N/CL	N/CL
		11/30/22	E/ST	E/T	E/T	E/T	E/ST

^ =*No flow observed, so no samples or measurements collected*

DISSOLVED METALS CALCULATOR SHEETS

Calculation of Dissolved Instream Concentrations from Total Recoverable Data for Freshwater Streams

Site 1 (11/30/2022)

Hardness
27.6

TSS

Freshwater Streams

Metal	Kpo	a	Cd/Ct	Total Recoverable	Dissolved	Instream Critiera for Metals		
				Measured ug/l	Calculated (ug/l)	Acute ug/l	Chronic ug/l	Human Health
Arsenic	4.80E+05	-0.7286				340	150	50*
Cadmium	4.00E+06	-1.1307				0.575	0.100	
Cadmium	4.00E+06	-1.1307			0.0693	0.538	0.272	
Chromium III	3.36E+06	-0.9304				198.518	25.823	
Chromium VI	3.36E+06	-0.9304				16.000	11.000	
Copper	1.04E+06	-0.7436			0.9690	3.996	2.981	
Lead	2.80E+06	-0.8000			0.6620	15.517	0.605	
Mercury						1.4	0.012	
Nickel	4.90E+05	-0.5719				157.570	17.501	
Silver						0.351		
Zinc	1.25E+06	-0.7038			4.3500	39.367	39.689	

* If designated use is drinking water, criteria is 10

Calculation of Dissolved Instream Concentrations from Total Recoverable Data for Freshwater Streams

Site 2 (11/30/2022)

Hardness
25.6

TSS

Freshwater Streams

Metal	Kpo	a	Cd/Ct	Total Recoverable	Dissolved	Instream Critiera for Metals		
				Measured ug/l	Calculated (ug/l)	Acute ug/l	Chronic ug/l	Human Health
Arsenic	4.80E+05	-0.7286				340	150	50*
Cadmium	4.00E+06	-1.1307				0.534	0.095	
Cadmium	4.00E+06	-1.1307			0.0693	0.501	0.257	
Chromium III	3.36E+06	-0.9304				186.657	24.280	
Chromium VI	3.36E+06	-0.9304				16.000	11.000	
Copper	1.04E+06	-0.7436			3.4800	3.722	2.795	
Lead	2.80E+06	-0.8000			0.6980	14.258	0.556	
Mercury						1.4	0.012	
Nickel	4.90E+05	-0.5719				147.855	16.422	
Silver						0.309		
Zinc	1.25E+06	-0.7038			8.8700	36.937	37.239	

* If designated use is drinking water, criteria is 10

Calculation of Dissolved Instream Concentrations from Total Recoverable Data for Freshwater Streams

Site 3 (11/30/2022)

Hardness
6.72

TSS

Freshwater Streams

Metal	Kpo	a	Cd/Ct	Total Recoverable	Dissolved	Instream Critiera for Metals		
				Measured ug/l	Calculated (ug/l)	Acute ug/l	Chronic ug/l	Human Health
Arsenic	4.80E+05	-0.7286				340	150	50*
Cadmium	4.00E+06	-1.1307				0.145	0.037	
Cadmium	4.00E+06	-1.1307			0.0693	0.143	0.094	
Chromium III	3.36E+06	-0.9304				62.418	8.119	
Chromium VI	3.36E+06	-0.9304				16.000	11.000	
Copper	1.04E+06	-0.7436			1.5200	1.056	0.891	
Lead	2.80E+06	-0.8000			0.6620	3.109	0.121	
Mercury						1.4	0.012	
Nickel	4.90E+05	-0.5719				47.689	5.297	
Silver						0.031		
Zinc	1.25E+06	-0.7038			4.8900	11.893	11.990	

* If designated use is drinking water, criteria is 10

Calculation of Dissolved Instream Concentrations from Total Recoverable Data for Freshwater Streams

Site 4 (11/30/2022)

Hardness
13.7

TSS

Freshwater Streams

Metal	Kpo	a	Cd/Ct	Total Recoverable	Dissolved	Instream Critiera for Metals		
				Measured ug/l	Calculated (ug/l)	Acute ug/l	Chronic ug/l	Human Health
Arsenic	4.80E+05	-0.7286				340	150	50*
Cadmium	4.00E+06	-1.1307				0.290	0.062	
Cadmium	4.00E+06	-1.1307			0.0729	0.279	0.161	
Chromium III	3.36E+06	-0.9304				111.858	14.550	
Chromium VI	3.36E+06	-0.9304				16.000	11.000	
Copper	1.04E+06	-0.7436			1.4000	2.065	1.638	
Lead	2.80E+06	-0.8000			0.6620	7.025	0.274	
Mercury						1.4	0.012	
Nickel	4.90E+05	-0.5719				87.122	9.677	
Silver						0.105		
Zinc	1.25E+06	-0.7038			4.3500	21.747	21.925	

* If designated use is drinking water, criteria is 10

Calculation of Dissolved Instream Concentrations from Total Recoverable Data for Freshwater Streams

Site 5 (11/30/2022)

Hardness
28.6

TSS

Freshwater Streams

Metal	Kpo	a	Cd/Ct	Total Recoverable	Dissolved	Instream Critiera for Metals		
				Measured ug/l	Calculated (ug/l)	Acute ug/l	Chronic ug/l	Human Health
Arsenic	4.80E+05	-0.7286				340	150	50*
Cadmium	4.00E+06	-1.1307				0.595	0.103	
Cadmium	4.00E+06	-1.1307			0.0693	0.556	0.280	
Chromium III	3.36E+06	-0.9304				204.389	26.587	
Chromium VI	3.36E+06	-0.9304				16.000	11.000	
Copper	1.04E+06	-0.7436			0.9690	4.132	3.073	
Lead	2.80E+06	-0.8000			0.6620	16.150	0.629	
Mercury						1.4	0.012	
Nickel	4.90E+05	-0.5719				162.387	18.036	
Silver						0.374		
Zinc	1.25E+06	-0.7038			4.3500	40.573	40.905	

* If designated use is drinking water, criteria is 10