

March 4, 2014

Monitoring Data Analysis for January 7, 2013 – February 16, 2014

Gills Creek Monitoring Sites

During this monitoring period, typical diurnal patterns were discerned in the data from all monitoring stations. Dissolved oxygen, water temperature, and pH all displayed a diurnal cycle. As is typically observed, colder temperatures this month results in high dissolved oxygen levels, with all stations experiencing an average level of over 11 mg/L dissolved oxygen. No water quality violations were observed in any of the monitored parameters during this observation period.

Over this monitoring period 10 storms were observed, where a storm is defined as at least 0.1" of precipitation separated from other storm events by at least three hours of dry conditions. During this monitoring period, Columbia experienced two severe winter storm events, one occurring on January 28-29th, and a second storm occurring from February 12-13th. The impact of these events was observed in several water quality parameters, and is discussed below.

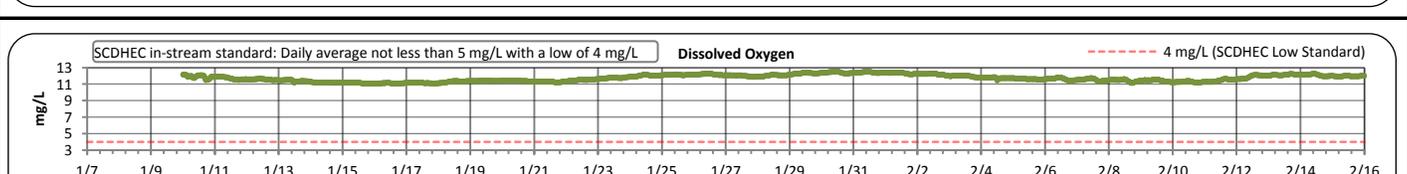
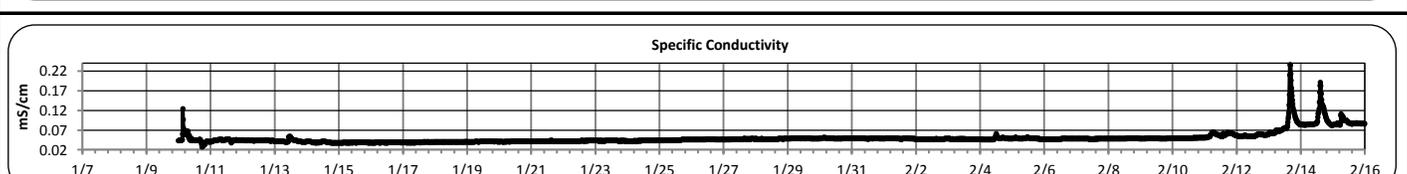
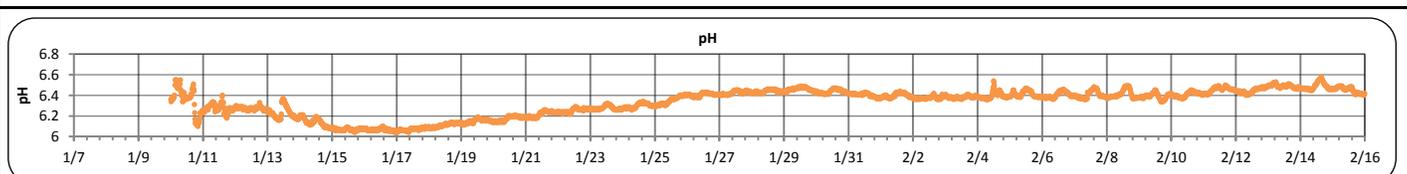
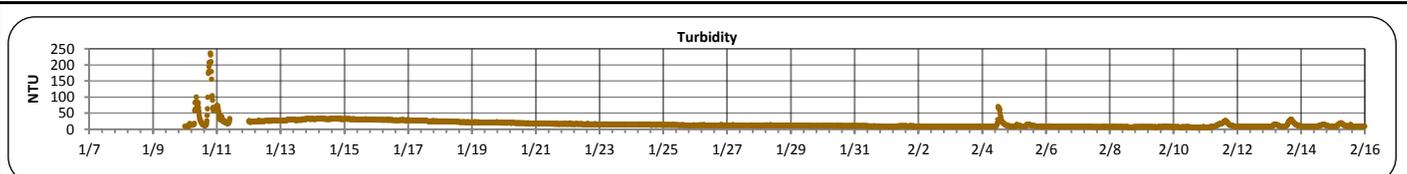
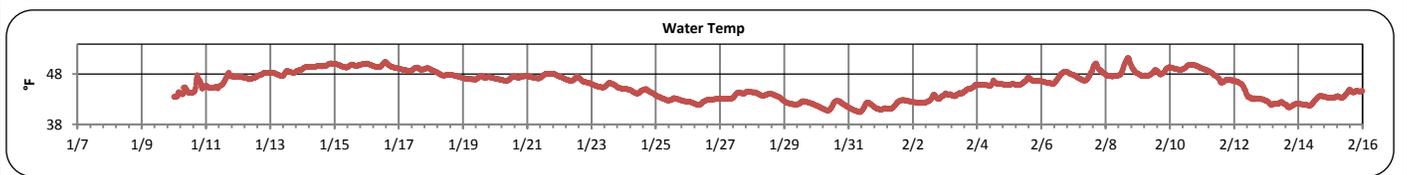
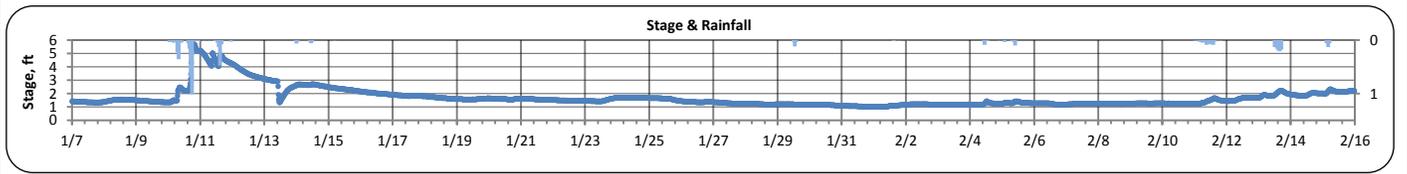
During this monitoring period, several atypical events were observed. The first of these was seen on January 13th, when the stage at GILA dropped very rapidly, almost certainly as a result of the discharge from Forest Lake being suddenly reduced. Interestingly, coincident with the reduction in stage, the measured pH and specific conductivity at GILA increased while the dissolved oxygen decreased. A likely explanation for this change in water quality is provided by Eightmile Branch, the tributary that enters Gills Creek shortly upstream of GILA. As the flow from the main branch of Gills Creek was significantly reduced, the water entering from Eightmile Branch constitutes a much larger percentage of the total flow at GILA, causing the water quality associated with the tributary flow to be the determining factor in data collected at GILA. Essentially, with the flow from Forest Lake stymied, GILA was recording water quality data heavily under the influence of Eightmile Branch. Eightmile Branch appears to have higher pH and specific conductivity levels and lower dissolved oxygen levels than the main branch of Gills Creek. While these observations have not been confirmed, this is the most likely explanation for the observed data anomaly on January 13th.

The remaining unusual events observed in the Gills Creek Watershed during this monitoring period related to the 2 instances of severe weather. During the snow and ice events, SCDOT applied sand and salt heavily onto roadways. These salts then washed into Gills Creek, causing elevated specific conductivity levels at all monitoring stations. During the first snow event on January 28-29th, specific conductivity was slightly elevated in the streams. This event was less severe and the snow melted slowly, resulting in little observed runoff entering streams. However, the following week, on February 4th, a rain event moved through the watershed, and runoff from this event appears to have carried residual salts from roads into Gills Creek. During the ice storm on February 12th and 13th, specific conductivity values were increased to over 5 times their background levels, indicating the heavy salt loads that SCDOT was applying to roadways.

Additionally, GILA and GILB each experienced one period of inaccurate data during this monitoring interval. At each of these sites, the storm event that occurred on January 10th appears to have moved sediment into the sonde wells. This caused turbidity values to be abnormally elevated. The reliability of this data was in question, and so at each site, the data during this period was removed to avoid introducing a bias to the dataset.

Gills Creek A (Jan 7, 2014 -- Feb 16, 2014)

PARAMETER	DESCRIPTION	CONTINUOUS WATER QUALITY PARAMETERS:	SUMMARY STATISTICS				
			MINIMUM OBSERVED	MAXIMUM OBSERVED	MEDIAN OBSERVED	MEAN OBSERVED	STANDARD DEVIATION
STREAM NAME:	Gills Creek	STAGE (FT):	1.0	5.7	1.5	1.7	0.7
LOCATION:	Forest Drive Bridge	TEMPERATURE (°F):	40	51	46	46	3
ADDRESS:	4840 Forest Drive, Columbia, SC 29206	TURBIDITY (NTU):	6	237	12	16	14
COORDINATES:	34.019826, -80.963566	pH:	6.0	6.6	6.4	6.3	0.1
TMDL/IMPAIRMENT:	Fecal & Dissolved Oxygen	SPECIFIC CONDUCTIVITY (mS/cm):	0.027	0.236	0.047	0.051	0.017
NEIGHBORING LANDUSE:	Residential and commercial	DISSOLVED OXYGEN (mg/L):	11.0	12.6	11.7	11.7	0.4
APPROX. DRAINAGE AREA:	48 square miles						
SPATIAL LOCATION:	Most upstream site						
TOTAL NO. STORMS OVER 0.1 INCH:	11						
MAX. DAILY RAINFALL:	2.8 inches						
TOTAL RAINFALL (FOR PERIOD):	6.4 inches						



Note: Data gaps appear when the sonde is removed for calibration or when the flow depth is below the sensors

**Continuous Water Quality
Monitoring Periodic Report**

Gills Creek A (Jan 7, 2014 -- Feb 16, 2014)

Explanation of Statistics:

MINIMUM OBSERVED	The minimum of the values recorded by the datasonde in 15 minute intervals.
MAXIMUM OBSERVED	The maximum of the values recorded by the datasonde in 15 minute intervals.
MEDIAN OBSERVED	The median of all the values recorded by the datasonde in 15 minute intervals.
MEAN OBSERVED	The average of all the values recorded by the datasonde in 15 minute intervals.
STANDARD DEVIATION	The standard deviation of all the values recorded by the datasonde in 15 minute intervals.

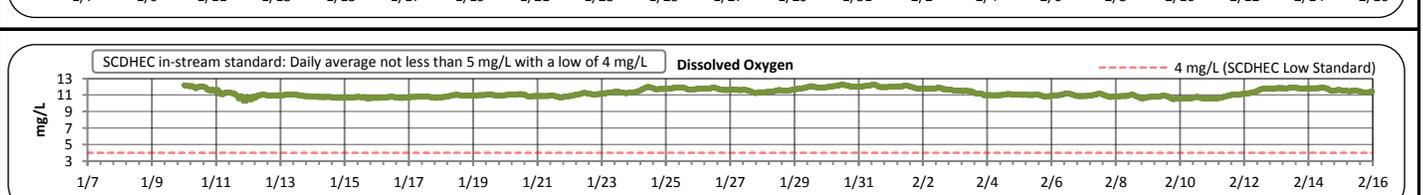
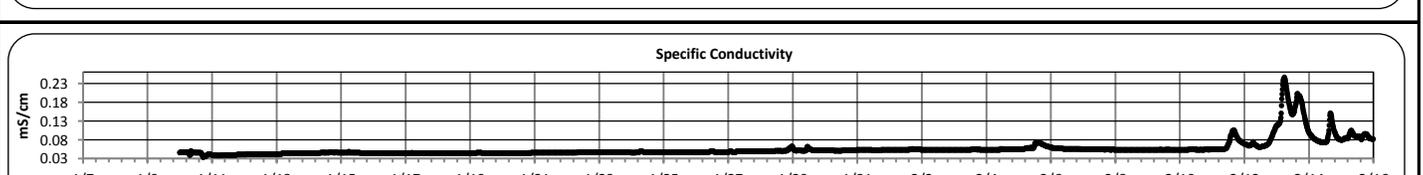
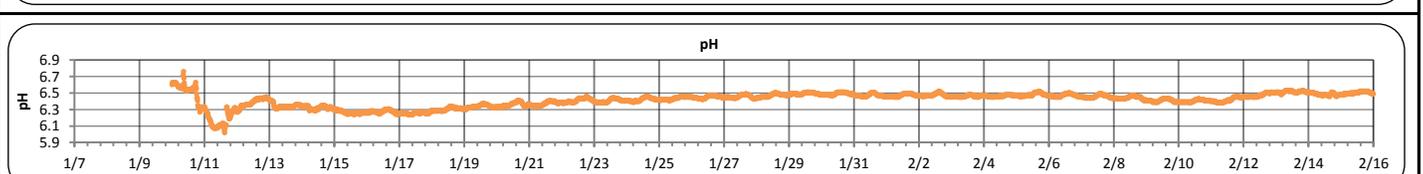
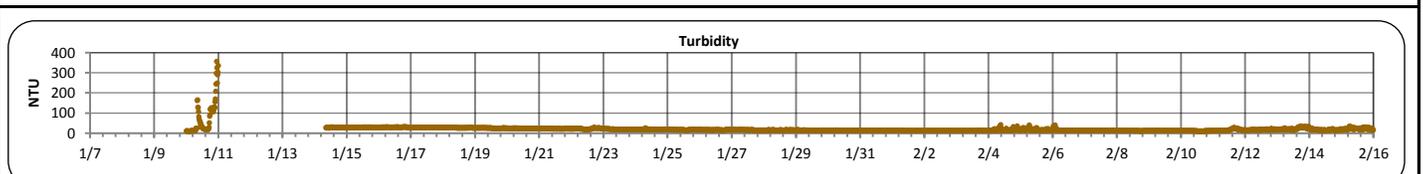
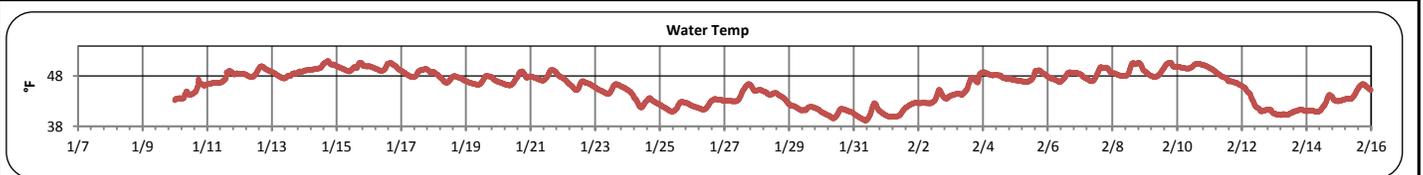
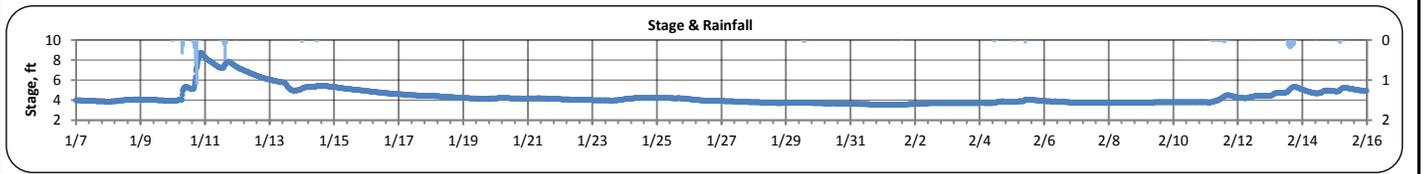
Grab Sample Data:

Analyte (units)	Sample 1		Sample 2		Sample 3	
	1/10/2014		1/10/2014		1/10/2014	
	Time	Result	Time	Result	Time	Result
<i>Escherichia coli</i> (MPN/100mL)	9:05	718.4	10:22	1,120	11:50	291
Total Suspended Solids (mg/L)	9:05	98	10:23	16	11:51	7.3
Total Phosphorus (mg/L)	9:05	0.1	10:21	0.028	11:50	0.02
Total Nitrogen (mg/L)	9:05	0.604	10:21	0.47	11:50	0.478

Note: There was confusion at the lab when analyzing some of the bacteria samples. The *E. coli* value at 9:05 was analyzed for fecal coliform and converted to *E. coli* using the following equation approved by SCDHEC: $\text{Log}_{10}(\text{E. coli}) = 0.0491 + 0.9583 * \text{Log}_{10}(\text{Fecal Coliform})$

Gills Creek B (Jan 7, 2014 -- Feb 16, 2014)

PARAMETER	DESCRIPTION	CONTINUOUS WATER QUALITY PARAMETERS:	SUMMARY STATISTICS				
			MINIMUM OBSERVED	MAXIMUM OBSERVED	MEDIAN OBSERVED	MEAN OBSERVED	STANDARD DEVIATION
STREAM NAME:	Gills Creek	STAGE (FT):	3.5	8.7	4.0	4.4	0.9
LOCATION:	Devine Street bridge	TEMPERATURE (°F):	39	51	47	46	3
ADDRESS:	4716 Devine Street Columbia, SC 29209	TURBIDITY (NTU):	10	357	16	20	18
COORDINATES:	33.989656, -80.97433	pH:	6.0	6.8	6.4	6.4	0.1
TMDL/IMPAIRMENT:	Fecal & Dissolved Oxygen	SPECIFIC CONDUCTIVITY (mS/cm):	0.033	0.246	0.051	0.057	0.023
NEIGHBORING LANDUSE:	Residential and commercial	DISSOLVED OXYGEN (mg/L):	10.3	12.3	11.1	11.3	0.5
APPROX. DRAINAGE AREA:	59 square miles						
SPATIAL LOCATION:	Middle site						
TOTAL NO. STORMS OVER 0.1 INCH:	11						
MAX. DAILY RAINFALL:	2.7 inches						
TOTAL RAINFALL (FOR PERIOD):	6.4 inches						



Note: Data gaps appear when the sonde is removed for calibration or when the flow depth is below the sensors

**Continuous Water Quality
Monitoring Periodic Report**

Gills Creek B (Jan 7, 2014 -- Feb 16, 2014)

Explanation of Statistics:

MINIMUM OBSERVED	The minimum of the values recorded by the datasonde in 15 minute intervals.
MAXIMUM OBSERVED	The maximum of the values recorded by the datasonde in 15 minute intervals.
MEDIAN OBSERVED	The median of all the values recorded by the datasonde in 15 minute intervals.
MEAN OBSERVED	The average of all the values recorded by the datasonde in 15 minute intervals.
STANDARD DEVIATION	The standard deviation of all the values recorded by the datasonde in 15 minute intervals.

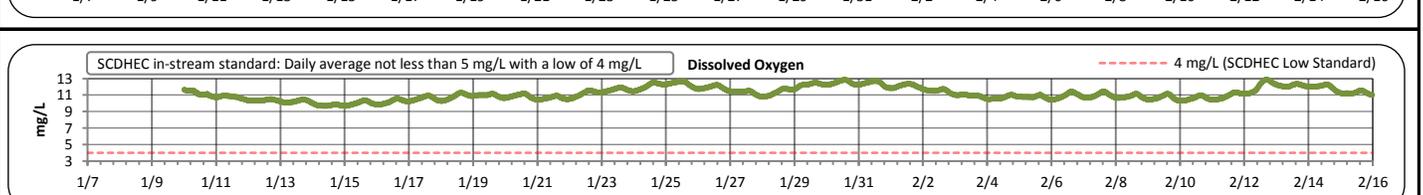
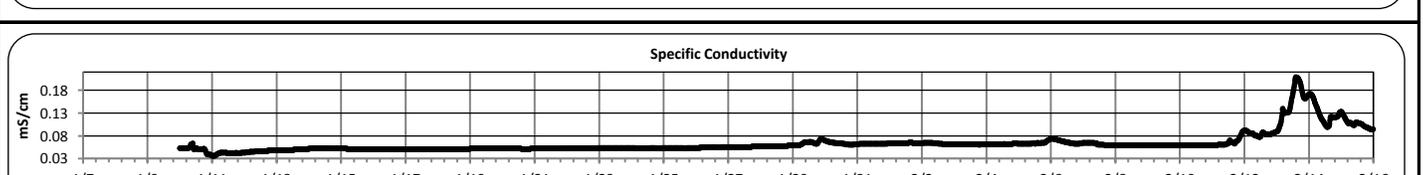
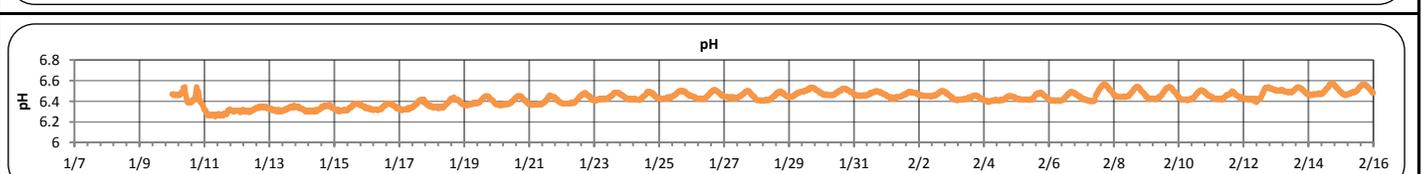
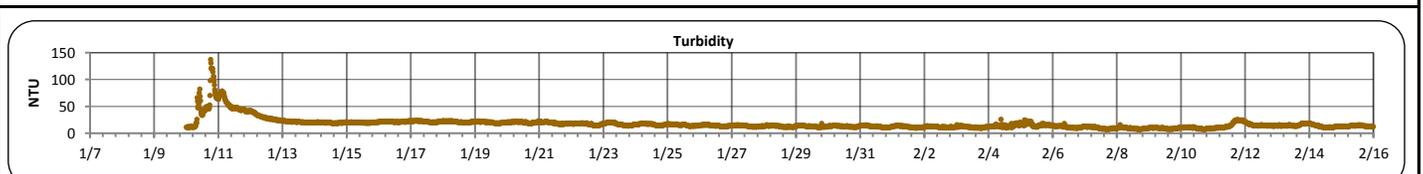
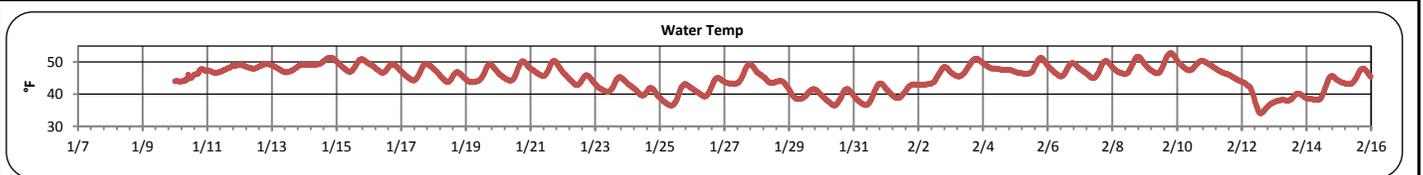
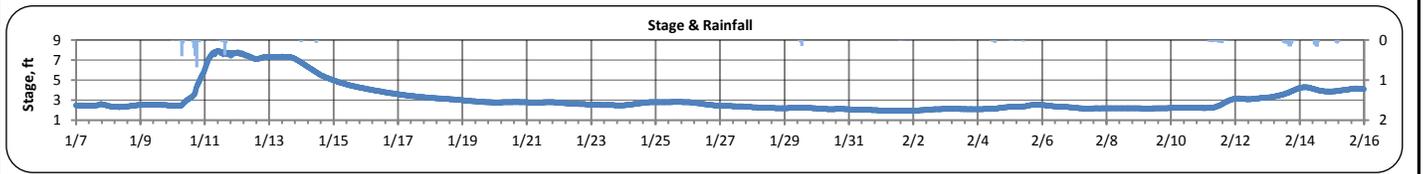
Sampled Data:

Analyte (units)	Sample 1		Sample 2		Sample 3	
	1/10/2014		1/10/2014		1/10/2014	
	Time	Result	Time	Result	Time	Result
<i>Escherichia coli</i> (MPN/100mL)	9:20	539	10:43	1120	12:15	614
Total Suspended Solids (mg/L)	9:20	90	10:43	34	12:16	20
Total Phosphorus (mg/L)	9:20	0.075	10:42	0.046	12:15	0.036
Total Nitrogen (mg/L)	9:20	0.515	10:42	0.465	12:15	0.518

Note: There was confusion at the lab when analyzing some of the bacteria samples. The *E. coli* value at 9:20 was analyzed for fecal coliform and converted to *E. coli* using the following equation approved by SCDHEC: $\text{Log}_{10}(\text{E. coli}) = 0.0491 + 0.9583 * \text{Log}_{10}(\text{Fecal Coliform})$

Gills Creek C (Jan 7, 2014 -- Feb 16, 2014)

PARAMETER	DESCRIPTION	CONTINUOUS WATER QUALITY PARAMETERS:	SUMMARY STATISTICS				
			MINIMUM OBSERVED	MAXIMUM OBSERVED	MEDIAN OBSERVED	MEAN OBSERVED	STANDARD DEVIATION
STREAM NAME:	Gills Creek	STAGE (FT):	1.9	7.9	2.6	3.2	1.4
LOCATION:	Bluff Road bridge	TEMPERATURE (°F):	34	53	46	45	4
ADDRESS:	3009 Bluff Rd. Columbia, SC 29209	TURBIDITY (NTU):	7	137	14	17	11
COORDINATES:	33.948043, -80.9889	pH:	6.3	6.6	6.4	6.4	0.1
TMDL/IMPAIRMENT:	Fecal & Dissolved Oxygen	SPECIFIC CONDUCTIVITY (mS/cm):	0.036	0.209	0.059	0.064	0.023
NEIGHBORING LANDUSE:	Residential and commercial	DISSOLVED OXYGEN (mg/L):	9.7	12.9	11.0	11.2	0.7
APPROX. DRAINAGE AREA:	64 square miles						
SPATIAL LOCATION:	Most downstream site						
TOTAL NO. STORMS OVER 0.1 INCH:	11						
MAX. DAILY RAINFALL:	2.0 inches						
TOTAL RAINFALL (FOR PERIOD):	5.6 inches						



Note: Data gaps appear when the sonde is removed for calibration or when the flow depth is below the sensors

**Continuous Water Quality
Monitoring Periodic Report**

Gills Creek C (Jan 7, 2014 -- Feb 16, 2014)

Explanation of Statistics:

MINIMUM OBSERVED	The minimum of the values recorded by the datasonde in 15 minute intervals.
MAXIMUM OBSERVED	The maximum of the values recorded by the datasonde in 15 minute intervals.
MEDIAN OBSERVED	The median of all the values recorded by the datasonde in 15 minute intervals.
MEAN OBSERVED	The average of all the values recorded by the datasonde in 15 minute intervals.
STANDARD DEVIATION	The standard deviation of all the values recorded by the datasonde in 15 minute intervals.

Sampled Data:

Analyte (units)	Sample 1		Sample 2		Sample 3		Sample 4	
	1/10/2014		1/10/2014		1/10/2014		1/10/2014	
	Time	Result	Time	Result	Time	Result	Time	Result
<i>Escherichia coli</i> (MPN/100mL)	8:48	92	9:37	180	10:50	539	12:04	179.5
Total Suspended Solids (mg/L)	8:48	39	9:37	77	10:50	44	12:04	34.0
Total Phosphorus (mg/L)	8:48	0.058	9:37	0.11	10:50	0.16	12:04	0.061
Total Nitrogen (mg/L)	8:48	0.493	9:37	0.8	10:50	0.68	12:04	0.56

Note: There was confusion at the lab when analyzing some of the bacteria samples. The *E. coli* values were analyzed for fecal coliform and converted to *E. coli* using the following equation approved by SCDHEC: $\text{Log}_{10}(\text{E. coli}) = 0.0491 + 0.9583 * \text{Log}_{10}(\text{Fecal Coliform})$