Revised

Total Maximum Daily Load

Evaluation

for

Two Segments of Buffalo Creek
and
Tributary to Buffalo Creek

Near Carrollton, Georgia

in the

Tallapoosa River Basin

for

Copper

Submitted to:
The U.S. Environmental Protection Agency
Region 4
Atlanta, Georgia

Submitted by:
The Georgia Department of Natural Resources
Environmental Protection Division
Atlanta, Georgia

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EXECUTIVE SUMMARY

The State of Georgia assesses its water bodies for compliance with water quality criteria established for their designated uses as required by the Federal Clean Water Act (CWA). Assessed water bodies are placed into one of three categories, supporting designated use, not supporting designated use, or assessment pending, depending on water quality assessment results. These water bodies are found on Georgia's 305(b) list, as required by that section of the CWA that defines the assessment process, and are published in *Water Quality in Georgia* (GA EPD, 2014).

Some of the 305(b) partially and not supporting water bodies are also assigned to Georgia's 303(d) list, also named after that section of the CWA. Water bodies on the 303(d) list are required to have a Total Maximum Daily Load (TMDL) evaluation for the water quality constituent(s) in violation of the water quality standard. The TMDL process establishes the allowable loading of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and instream water quality conditions. This allows water quality-based controls to be developed to reduce pollution and to restore and maintain water quality.

The State of Georgia has identified three (3) stream segments located in the Tallapoosa River Basin as impaired for copper. The water use classification of the impacted streams is Fishing. The general and specific water quality criteria for Fishing streams are stated in Georgia's *Rules and Regulations for Water Quality Control*, Chapter 391-3-6-.03, Sections (5) and (6).

The calculation of the copper load at any point in a stream requires the copper concentration and stream flow. The availability of water quality and flow data varies considerably among the listed segments. The Mass Balance Approach was used to determine the current copper load and TMDL. The copper load and required reduction for the listed streams are summarized in the table below based on the instream pH and hardness.

Total Dissolved Copper TMDL Summary for the Impaired Stream Segments in the Tallapoosa River Basin

Stream Segment	Criteria	Current Load	pH	WLA	WLA_{SW}	LA	MOS	TMDL	Reduction
Buffalo Creek, Downstream Southwire GAR031501080602	Acute	ΣQ x 5.2 µg/L for all conditions and flows	6.8	ΣQ_{WLA} x 5.9 µg/L for all conditions and flows	ΣQ_{WLAsw} x 5.9 µg/L for all conditions and flows	4.60 $X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 5.9 µg/L for all conditions and flows	Implicit	4.60 $X10^{-3}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 5.9 µg/L for all conditions and flows	-
			6.9	ΣQ_{WLA} x 7.0 µg/L for all conditions and flows	ΣQ_{WLAsw} x 7.0 µg/L for all conditions and flows	5.47 $X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 7.0 µg/L for all conditions and flows	Implicit	5.47 $X10^{-3}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 7.0 µg/L for all conditions and flows	-
			7.0	ΣQ_{WLA} x 8.3 µg/L for all conditions and flows	ΣQ_{WLAsw} x 8.2 µg/L for all conditions and flows	6.45 $X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 8.3 µg/L for all conditions and flows	Implicit	6.45 $X10^{-3}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 8.3 µg/L for all conditions and flows	-
			7.1	ΣQ_{WLA} x 9.6 µg/L for all conditions and flows	ΣQ_{WLAsw} x 9.6 µg/L for all conditions and flows	7.53 $X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 9.6 µg/L for all conditions and flows	Implicit	7.53 $X10^{-3}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 9.6 µg/L for all conditions and flows	-
			7.2	ΣQ_{WLA} x 11.2 µg/L for all conditions and flows	ΣQ_{WLAsw} x 11.2 µg/L for all conditions and flows	8.74 $X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 11.2 µg/L for all conditions and flows	Implicit	8.74 $X10^{-3}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 11.2 µg/L for all conditions and flows	-
			7.3	ΣQ_{WLA} x 12.9 µg/L for all conditions and flows	ΣQ_{WLAsw} x 12.9 µg/L for all conditions and flows	1.01 $X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 12.9 µg/L for all conditions and flows	Implicit	1.10 $X10^{-3}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 12.9 µg/L for all conditions and flows	-
			7.4	ΣQ_{WLA} x 14.7 µg/L for all conditions and flows	ΣQ_{WLAsw} x 14.7 µg/L for all conditions and flows	1.15 $X10^{-2}$ kg/day for 1Q10 ΣQ_{LA} x 14.7 µg/L for all conditions and flows	Implicit	1.15 $X10^{-2}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 14.7 µg/L for all conditions and flows	-
			7.5	ΣQ_{WLA} x 16.6 µg/L for all conditions and flows	ΣQ_{WLAsw} x 16.6 µg/L for all conditions and flows	1.30 $X10^{-2}$ kg/day for 1Q10 ΣQ_{LA} x 16.6 µg/L for all conditions and flows	Implicit	1.30 $X10^{-2}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 16.6 µg/L for all conditions and flows	-
			7.6	ΣQ_{WLA} x 18.7 µg/L for all conditions and flows	ΣQ_{WLAsw} x 18.7 µg/L for all conditions and flows	1.46 $X10^{-2}$ kg/day for 1Q10 ΣQ_{LA} x 18.7 µg/L for all conditions and flows	Implicit	1.46 $X10^{-2}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 18.7 µg/L for all conditions and flows	-

Stream Segment	Criteria	Current Load	pH	WLA	WLA_{SW}	LA	MOS	TMDL	Reduction
Buffalo Creek, Downstream Southwire GAR031501080602	Chronic	ΣQ x 5.2 µg/L for all conditions and flows	6.8	ΣQ_{WLA} x 3.7 µg/L for all conditions and flows	ΣQ_{WLAsw} x 3.7 µg/L for all conditions and flows	4.51 $X10^{-3}$ kg/day for 7Q10 ΣQ_{LA} x 3.7 µg/L for all conditions and flows	Implicit	4.51 $X10^{-3}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 3.7 µg/L for all conditions and flows	29.7%
			6.9	ΣQ_{WLA} x 4.3 µg/L for all conditions and flows	ΣQ_{WLAsw} x 4.3 µg/L for all conditions and flows	5.36 $X10^{-3}$ kg/day for 7Q10 ΣQ_{LA} x 4.3 µg/L for all conditions and flows	Implicit	5.36 $X10^{-3}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 4.3 µg/L for all conditions and flows	16.4%
			7.0	ΣQ_{WLA} x 5.1 µg/L for all conditions and flows	ΣQ_{WLAsw} x 5.1 µg/L for all conditions and flows	6.32 $X10^{-3}$ kg/day for 7Q10 ΣQ_{LA} x 5.1 µg/L for all conditions and flows	Implicit	6.32 $X10^{-3}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 5.1 µg/L for all conditions and flows	1.5%
			7.1	ΣQ_{WLA} x 6.0 µg/L for all conditions and flows	ΣQ_{WLAsw} x 6.0 µg/L for all conditions and flows	7.39 $X10^{-3}$ kg/day for 7Q10 ΣQ_{LA} x 6.0 µg/L for all conditions and flows	Implicit	7.39 $X10^{-3}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 6.0 µg/L for all conditions and flows	-
			7.2	ΣQ_{WLA} x 6.9 µg/L for all conditions and flows	ΣQ_{WLAsw} x 6.9 µg/L for all conditions and flows	8.57 $X10^{-3}$ kg/day for 7Q10 ΣQ_{LA} x 6.9 µg/L for all conditions and flows	Implicit	8.57 $X10^{-3}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 6.9 µg/L for all conditions and flows	-
			7.3	ΣQ_{WLA} x 8.0 µg/L for all conditions and flows	ΣQ_{WLAsw} x 8.0 µg/L for all conditions and flows	9.85 $X10^{-3}$ kg/day for 7Q10 ΣQ_{LA} x 8.0 µg/L for all conditions and flows	Implicit	9.85 $X10^{-3}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 8.0 µg/L for all conditions and flows	-
			7.4	ΣQ_{WLA} x 9.1 µg/L for all conditions and flows	ΣQ_{WLAsw} x 9.1 µg/L for all conditions and flows	1.13 $X10^{-2}$ kg/day for 7Q10 ΣQ_{LA} x 9.1 µg/L for all conditions and flows	Implicit	1.13 $X10^{-2}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 9.1 µg/L for all conditions and flows	-
			7.5	ΣQ_{WLA} x 10.3µg/L for all conditions and flows	ΣQ_{WLAsw} x 10.3 µg/L for all conditions and flows	1.28 $X10^{-2}$ kg/day for 7Q10 ΣQ_{LA} x 10.3 µg/L for all conditions and flows	Implicit	1.28 $X10^{-2}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 10.3 µg/L for all conditions and flows	
			7.6	ΣQ_{WLA} x 11.6µg/L for all conditions and flows	ΣQ_{WLAsw} x 11.6 µg/L for all conditions and flows	1.44 $X10^{-2}$ kg/day for 7Q10 ΣQ_{LA} x 11.6 µg/L for all conditions and flows	Implicit	1.44 $X10^{-2}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 11.6 µg/L for all conditions and flows	-

Stream Segment	Criteria	Current Load	pH	WLA	WLA_{SW}	LA	MOS	TMDL	Reduction
Buffalo Creek, Upstream Little Tallapoosa River GAR031501080601	Acute	ΣQ x 6.3 µg/L for all conditions and flows	6.8	ΣQ_{WLA} x 5.9 µg/L for all conditions and flows	ΣQ_{WLAsw} x 5.9 µg/L for all conditions and flows	$6.22 X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 5.9 µg/L for all conditions and flows	Implicit	$6.22 X10^{-3}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 5.9 µg/L for all conditions and flows	6.6%
			6.9	ΣQ_{WLA} x 7.0 µg/L for all conditions and flows	ΣQ_{WLAsw} x 7.0 µg/L for all conditions and flows	$7.39 X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 7.0 µg/L for all conditions and flows	Implicit	$7.39 X10^{-3}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 7.0 µg/L for all conditions and flows	-
			7.0	ΣQ_{WLA} x 8.3 µg/L for all conditions and flows	ΣQ_{WLAsw} x 8.2 µg/L for all conditions and flows	$8.71 X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 8.2 µg/L for all conditions and flows	Implicit	$8.71 X10^{-3}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 8.2 µg/L for all conditions and flows	-
			7.1	ΣQ_{WLA} x 9.6 µg/L for all conditions and flows	ΣQ_{WLAsw} x 9.6 µg/L for all conditions and flows	$1.02 X10^{-2}$ kg/day for 1Q10 ΣQ_{LA} x 9.6 µg/L for all conditions and flows	Implicit	$1.02 X10^{-2}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 9.6 µg/L for all conditions and flows	-
			7.2	ΣQ_{WLA} x 11.2 µg/L for all conditions and flows	ΣQ_{WLAsw} x 11.2 µg/L for all conditions and flows	$1.18 X10^{-2}$ kg/day for 1Q10 ΣQ_{LA} x 11.2 µg/L for all conditions and flows	Implicit	$1.18 X10^{-2}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 11.2 µg/L for all conditions and flows	-
			7.3	ΣQ_{WLA} x 12.9 µg/L for all conditions and flows	ΣQ_{WLAsw} x 12.9 µg/L for all conditions and flows	$1.36 X10^{-2}$ kg/day for 1Q10 ΣQ_{LA} x 12.9 µg/L for all conditions and flows	Implicit	$1.36 X10^{-2}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 12.9 µg/L for all conditions and flows	-
			7.4	ΣQ_{WLA} x 14.7 µg/L for all conditions and flows	ΣQ_{WLAsw} x 14.7 µg/L for all conditions and flows	$1.55 X10^{-2}$ kg/day for 1Q10 ΣQ_{LA} x 14.7 µg/L for all conditions and flows	Implicit	$1.55 X10^{-2}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 14.7 µg/L for all conditions and flows	-
			7.5	ΣQ_{WLA} x 16.6 µg/L for all conditions and flows	ΣQ_{WLAsw} x 16.6 µg/L for all conditions and flows	$1.76 X10^{-2}$ kg/day for 1Q10 ΣQ_{LA} x 16.6 µg/L for all conditions and flows	Implicit	$1.76 X10^{-2}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 16.6 µg/L for all conditions and flows	-
			7.6	ΣQ_{WLA} x 18.7 µg/L for all conditions and flows	ΣQ_{WLAsw} x 18.7 µg/L for all conditions and flows	$1.98 X10^{-2}$ kg/day for 1Q10 ΣQ_{LA} x 18.7 µg/L for all conditions and flows	Implicit	$1.98 X10^{-2}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 18.7 µg/L for all conditions and flows	-

Stream Segment	Criteria	Current Load	pH	WLA	WLA_{SW}	LA	MOS	TMDL	Reduction
Buffalo Creek, Upstream Little Tallapoosa River GAR031501080601	Chronic	ΣQ x 6.3 µg/L for all conditions and flows	6.8	ΣQ_{WLA} x 3.7 µg/L for all conditions and flows	ΣQ_{WLAsw} x 3.7 µg/L for all conditions and flows	6.09 $X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 3.7 µg/L for all conditions and flows	Implicit	$6.09X10^{-3}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 3.7 µg/L for all conditions and flows	42.0%
			6.9	ΣQ_{WLA} x 4.3 µg/L for all conditions and flows	ΣQ_{WLAsw} x 4.3 µg/L for all conditions and flows	7.25 $X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 4.3 µg/L for all conditions and flows	Implicit	7.25 $X10^{-3}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 4.3 µg/L for all conditions and flows	31.0%
			7.0	ΣQ_{WLA} x 5.1 µg/L for all conditions and flows	ΣQ_{WLAsw} x 5.1 µg/L for all conditions and flows	8.55 $X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 5.1 µg/L for all conditions and flows	Implicit	8.55 $X10^{-3}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 5.1 µg/L for all conditions and flows	18.7%
			7.1	ΣQ_{WLA} x 6.0 µg/L for all conditions and flows	ΣQ_{WLAsw} x 6.0 µg/L for all conditions and flows	9.99 $X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 6.0 µg/L for all conditions and flows	Implicit	9.99 $X10^{-3}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 6.0 µg/L for all conditions and flows	4.9%
			7.2	ΣQ_{WLA} x 6.9 µg/L for all conditions and flows	ΣQ_{WLAsw} x 6.9 µg/L for all conditions and flows	1.16 $X10^{-2}$ kg/day for 1Q10 ΣQ_{LA} x 6.9 µg/L for all conditions and flows	Implicit	1.16 $X10^{-2}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 6.9 µg/L for all conditions and flows	-
			7.3	ΣQ_{WLA} x 8.0 µg/L for all conditions and flows	ΣQ_{WLAsw} x 8.0 µg/L for all conditions and flows	1.33 $X10^{-2}$ kg/day for 1Q10 ΣQ_{LA} x 8.0 µg/L for all conditions and flows	Implicit	1.33 $X10^{-2}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 8.0 µg/L for all conditions and flows	
			7.4	ΣQ_{WLA} x 9.1 µg/L for all conditions and flows	ΣQ_{WLAsw} x 9.1 µg/L for all conditions and flows	1.52 $X10^{-2}$ kg/day for 1Q10 ΣQ_{LA} x 9.1 µg/L for all conditions and flows	Implicit	1.52 $X10^{-2}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 9.1 µg/L for all conditions and flows	-
			7.5	ΣQ_{WLA} x 10.3µg/L for all conditions and flows	ΣQ_{WLAsw} x 10.3 µg/L for all conditions and flows	1.72 $X10^{-2}$ kg/day 1.73 for 1Q10 ΣQ_{LA} x 10.3 µg/L for all conditions and flows	Implicit	1.72 $X10^{-2}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 10.3 µg/L for all conditions and flows	-
			7.6	ΣQ_{WLA} x 11.6µg/L for all conditions and flows	ΣQ_{WLAsw} x 11.6 µg/L for all conditions and flows	1.94 $X10^{-2}$ kg/day kg/day for 1Q10 ΣQ_{LA} x 11.6 µg/L for all conditions and flows	Implicit	1.94 $X10^{-2}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 11.6 µg/L for all conditions and flows	-

Stream Segment	Criteria	Current Load	Hardness as mg/L $CaCO_3$	WLA	WLA_{SW}	LA	MOS	TMDL	Reduction
Tributary to Buffalo Creek GAR031501080604	Acute	ΣQ x 30.6µg/L for all conditions and flows	15	ΣQ_{WLA} x 2.3 µg/L for all conditions and flows	ΣQ_{WLAsw} x 2.3 µg/L for all conditions and flows	1.04X10^{-4} kg/day for 1Q10 ΣQ_{LA} x 2.3 µg/L for all conditions and flows	Implicit	1.04 X10^{-4} kg/day + WLA for 1Q10 ΣQ_{Total} x 2.3 µg/L for all conditions and flows	92.6%
			20	ΣQ_{WLA} x 3.0 µg/L for all conditions and flows	ΣQ_{WLAsw} x 3.0 µg/L for all conditions and flows	1.37 X10^{-4} kg/day for 1Q10 ΣQ_{LA} x 3.0 µg/L for all conditions and flows	Implicit	1.37 X10^{-4} kg/day + WLA for 1Q10 ΣQ_{Total} x 3.0 µg/L for all conditions and flows	90.4%
			25	ΣQ_{WL} x 3.6 µg/L for all conditions and flows	ΣQ_{WLAsw} x 3.6 µg/L for all conditions and flows	1.69 X10^{-4} kg/day for 1Q10 ΣQ_{LA} x 3.6 µg/L for all conditions and flows	Implicit	1.69 X10^{-4} kg/day + WLA for 1Q10 ΣQ_{Total} x 3.6 µg/L for all conditions and flows	88.1%
			30	ΣQ_{WLA} x 4.3 µg/L for all conditions and flows	ΣQ_{WLAsw} x 4.3 µg/L for all conditions and flows	2.00 X10^{-4} kg/day for 1Q10 ΣQ_{LA} x 4.3 µg/L for all conditions and flows	Implicit	2.00 X10^{-4} kg/day + WLA for 1Q10 ΣQ_{Total} x 4.3 µg/L for all conditions and flows	85.9%
			35	ΣQ_{WLA} x 5.0 µg/L for all conditions and flows	ΣQ_{WLAsw} x 5.0 µg/L for all conditions and flows	2.32 X10^{-4} kg/day for 1Q10 ΣQ_{LA} x 5.0 µg/L for all conditions and flows	Implicit	2.32 X10^{-4} kg/day + WLA for 1Q10 ΣQ_{Total} x 5.0 µg/L for all conditions and flows	83.7%

Stream Segment	Criteria	Current Load	Hardness as mg/L $CaCO_3$	WLA	WLA_{SW}	LA	MOS	TMDL	Reduction
Tributary to Buffalo Creek GAR031501080604	Chronic	ΣQ x 30.6µg/L for all conditions and flows	15	ΣQ_{WLA} x 1.8 µg/L for all conditions and flows	ΣQ_{WLAsw} x 1.8 µg/L for all conditions and flows	1.30 X10^{-4} kg/day for 7Q10 ΣQ_{LA} x 1.8 µg/L for all conditions and flows	Implicit	1.30 X10^{-4} kg/day + WLA for 7Q10 ΣQ_{Total} x 1.8 µg/L for all conditions and flows	94.2%
			20	ΣQ_{WLA} x 2.3 µg/L for all conditions and flows	ΣQ_{WLAsw} x 2.3 µg/L for all conditions and flows	1.66 X10^{-4} kg/day for 7Q10 ΣQ_{LA} x 2.3 µg/L for all conditions and flows	Implicit	1.66 X10^{-4} kg/day + WLA for 7Q10 ΣQ_{Total} x 2.3 µg/L for all conditions and flows	92.6%
			25	ΣQ_{WLA} x 2.7 µg/L for all conditions and flows	ΣQ_{WLAsw} x 2.7 µg/L for all conditions and flows	2.00 X10^{-4} kg/day for 7Q10 ΣQ_{LA} x 2.7 µg/L for all conditions and flows	Implicit	2.00 X10^{-4} kg/day + WLA for 7Q10 ΣQ_{Total} x 2.7 µg/L for all conditions and flows	91.0%
			30	ΣQ_{WLA} x 3.2 µg/L for all conditions and flows	ΣQ_{WLAsw} x 3.2 µg/L for all conditions and flows	2.34 X10^{-4} kg/day for 7Q10 ΣQ_{LA} x 3.2 µg/L for all conditions and flows	Implicit	2.34 X10^{-4} kg/day + WLA for 7Q10 ΣQ_{Total} x 3.2 µg/L for all conditions and flows	89.5%
			35	ΣQ_{WLA} x 3.7 µg/L for all conditions and flows	ΣQ_{WLAsw} x 3.7 µg/L for all conditions and flows	2.67 X10^{-4} kg/day for 7Q10 ΣQ_{LA} x 3.7 µg/L for all conditions and flows	Implicit	2.67 X10^{-4} kg/day + WLA for 7Q10 ΣQ_{Total} x 3.7 µg/L for all conditions and flows	88.1%

ΣQ_{WLA} is the sum of all current, potential and future NPDES regulated point source discharges to the watershed, including both continuous and storm water discharges.

1.0 INTRODUCTION

1.1 Background

The State of Georgia assesses its water bodies for compliance with water quality criteria established for their designated uses as required by the Federal Clean Water Act (CWA). Assessed water bodies are placed into one of three categories, supporting designated use, not supporting designated use, or assessment pending, depending on water quality assessment results. These water bodies are found on Georgia's 305(b) list, as required by that section of the CWA that defines the assessment process, and are published in *Water Quality in Georgia* (EPD, 2014).

Some of the 305(b) partially and not supporting water bodies are also assigned to Georgia's 303(d) list, named after that section of the CWA. Water bodies on the 303(d) list are denoted by a Category of 5, and are required to have a Total Maximum Daily Load (TMDL) evaluation for the water quality constituent(s) in violation of the water quality criteria. The TMDL process establishes the allowable pollutant loadings or other quantifiable parameters for a water body based on the relationship between pollutant sources and in-stream water quality conditions. This allows water quality-based controls to be developed to reduce pollution and restore and maintain water quality.

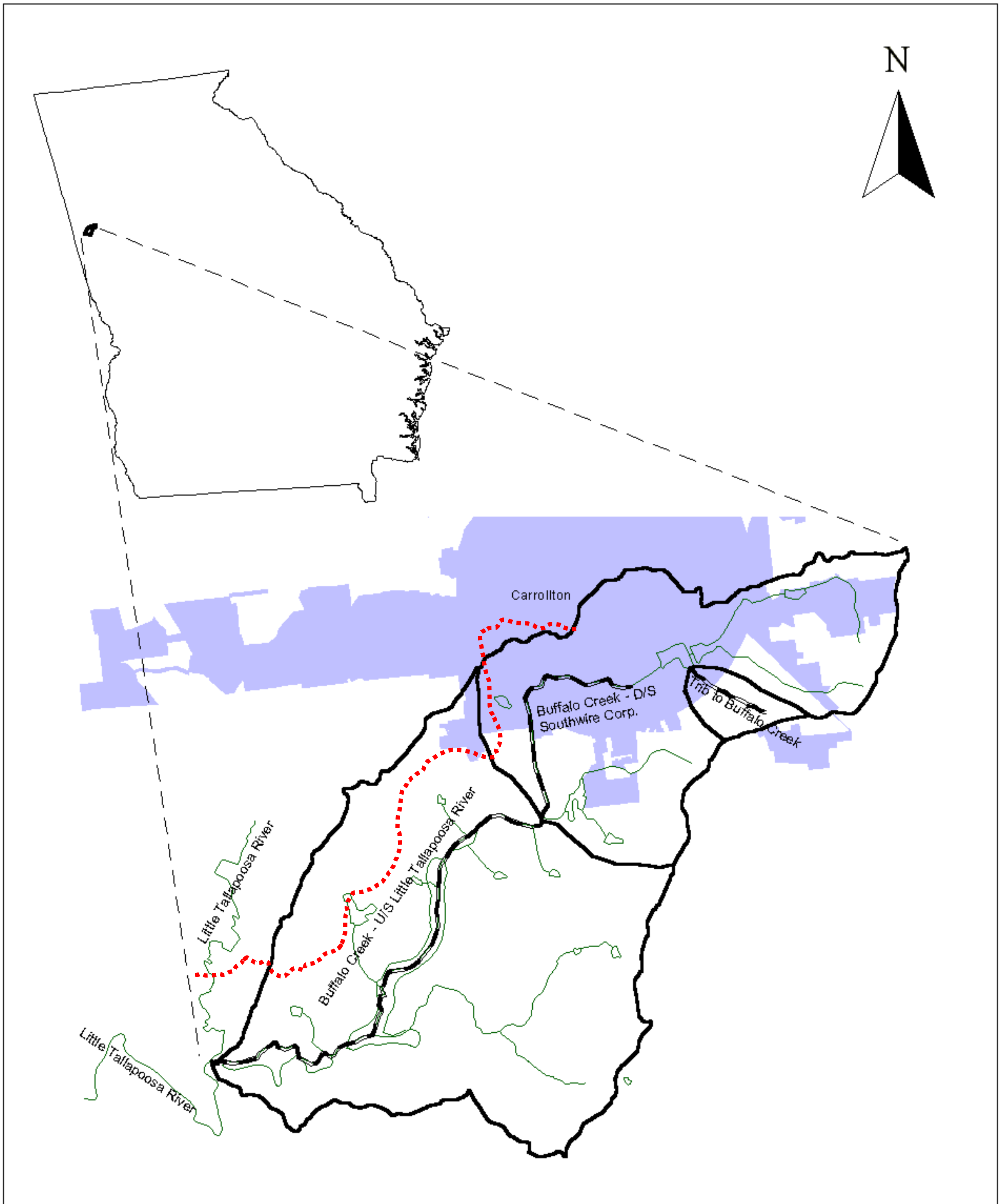
On the 2002 303(d) list, the State of Georgia has identified three segments in the Tallapoosa River Basin as not supporting their designated use due to exceedances of water quality standards for copper. Table 1 presents the streams in the Tallapoosa River Basin that were included on the 2002 303(d) list for exceedance of the copper criteria.

Table 1. Water Bodies Listed on the 2002 303(d) for Copper in the Tallapoosa River Basin

Water body	Reach ID	Status	Water Use	Segment	Criterion Violated	Miles
Buffalo Creek	GAR031501080602	Not Supporting	Fishing	Downstream Southwire Corp. (Carroll Co.)	Cu	3
Buffalo Creek	GAR031501080601	Not Supporting	Fishing	Upstream Little Tallapoosa River (Carroll Co.)	FC, Cu	6
Tributary to Buffalo Creek	GAR031501080604	Not Supporting	Fishing	Carrollton (Carroll County)	Cu	1

1.2 Watershed Description

The Buffalo Creek watershed is located in the Tallapoosa River Basin in Carroll County, Georgia, near the City of Carrollton. Carrollton is southwest of the metropolitan Atlanta area, on the western border of Georgia. Buffalo Creek was listed from downstream of Southwire Corporation to the confluence with the Little Tallapoosa River and is broken into two segments for listing purposes. The drainage area above the confluence of the Little Tallapoosa River is approximately 28 square miles. The area of the watershed for the segment downstream of Southwire Corporation is 11 square miles. The listed tributary to Buffalo Creek's watershed area is estimated to be approximately 0.7 square miles (see Figure 1).



TMDL Evaluation - Copper Tallapoosa River Basin	Figure 1. Buffalo Creek Watersheds

The landuse is predominately a mixture of pasture and forest. This area is developing and becoming more urban. Table 2 lists the land cover distribution and associated percent land cover for each watershed. All the watersheds are part of the Southern Upper Piedmont Ecoregion and are in the Southern Piedmont Soil Province.

Table 2. Land Cover Distribution

Watershed	Land Cover in Acres (Percentage)													
	Open Water	Low Intensity Residential	High Intensity Residential	High Intensity Commercial/Industrial/ Transportation	Bare Rock/Sand/Clay	Quarries/Strip Mines/Gravel Pits	Transitional	Forest	Row Crops	Pasture/Hay	Other Grasses (Urban/Recreational ;e.g. parks/lawns)	Woody Wetlands	Emergent Herbaceous Wetlands	Total
Tributary to Buffalo Creek	8	0	16	45	0	0	0	373	28	23	7	4	0	504
	(1.6)	(0.0)	(3.2)	(8.9)	(0.0)	(0.0)	(0.0)	(74.0)	(5.6)	(4.6)	(1.4)	(0.8)	(0.0)	(100.0)
Buffalo Creek (upper)	147	0	725	694	0	0	39	3440	376	911	252	23	0	6608
	(2.2)	(0.0)	(11.0)	(10.5)	(0.0)	(0.0)	(0.6)	(52.1)	(5.7)	(13.8)	(3.8)	(0.3)	(0.0)	(100.0)
Buffalo Creek (lower)	144	0	125	86	0	0	0	5635	1014	3662	73	769	22	11532
	(1.2)	(0.0)	(1.1)	(0.7)	(0.0)	(0.0)	(0.0)	(48.9)	(8.8)	(31.8)	(0.6)	(6.7)	(0.2)	(100.0)

1.3 Regional Water Planning Councils

The 2008 Comprehensive State-wide Water Management Plan established Georgia's ten Regional Water Planning Councils (RWPCs). The boundaries of these ten RWPCs, in addition to the Metropolitan North Georgia Water Planning District or MNGWPD, established under a separate statute, are shown in Figure 2. The listed segments are located within the boundary of the Middle Chattahoochee Regional Council. In 2011, each RWPC developed and adopted Regional Water Plans, which identify ranges of actions or management practices to help meet the state's water quality challenges. Implementation of these plans is critical to meeting Georgia's water resource challenges. The specific regional plan(s) applicable to this TMDL are discussed in Sections 6 and 7.

1.4 Water Quality Standard

The water use classification for all of these segments is Fishing. The fishing classification, as stated in *Georgia's Rules and Regulations for Water Quality Control*, Chapter 391-3-6-.03(6)(c), is established to protect the "propagation of fish, shellfish, game and other aquatic life; secondary contact recreation in and on the water; or for any other use requiring water of a lower quality."

Chapter 391-3-6-.03 of Georgia's Rules and Regulations, Revised- August 2016, establishes criteria for metals that apply to all waters of the State. Instream concentrations of metals shall not exceed the established acute or chronic criteria under critical conditions except in accordance with site specific effluent limitations developed in accordance with procedures presented in Chapter 391-3-6-.06 of Georgia's Rules and Regulations, Revised-August 2016.

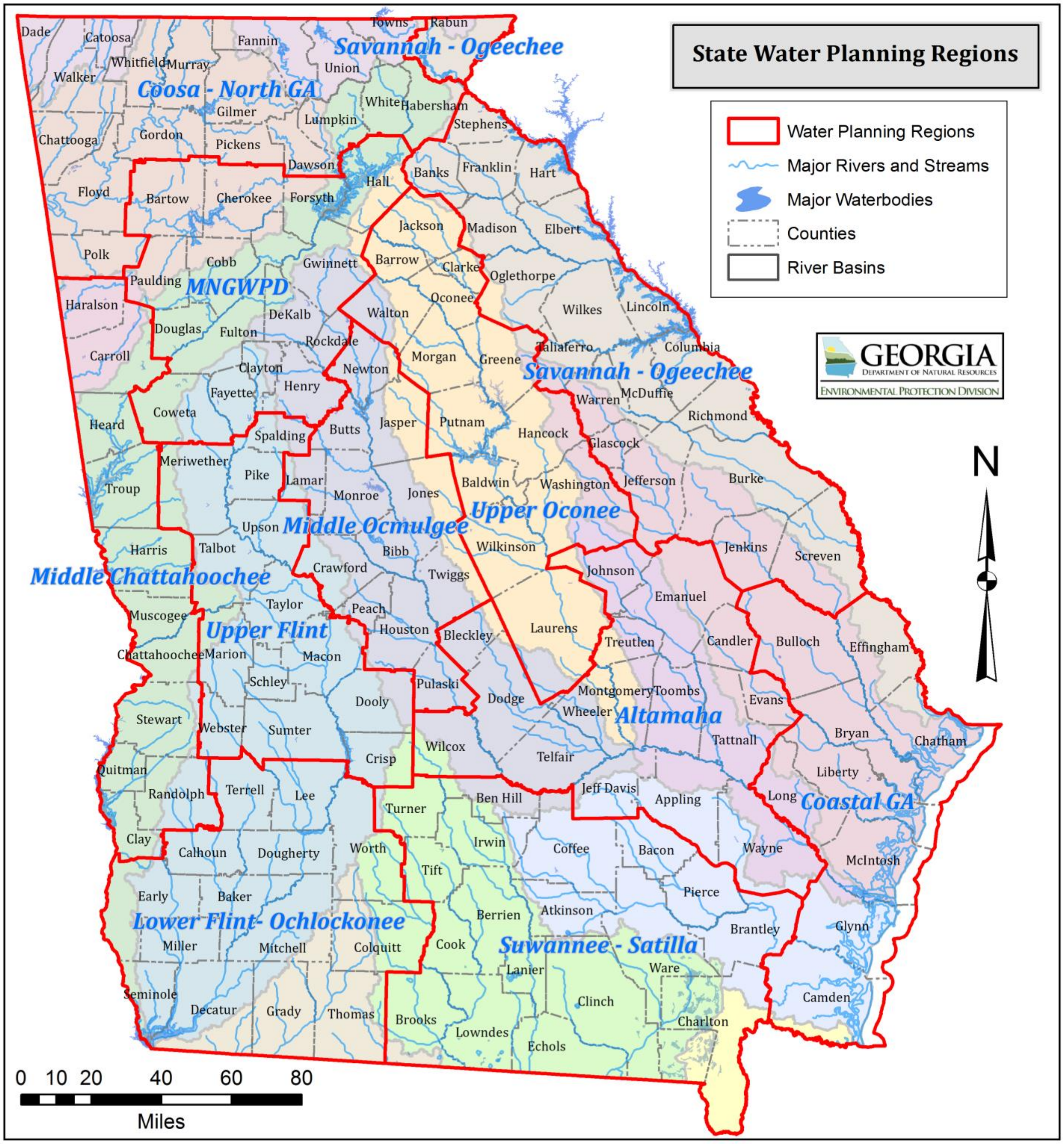


Figure 2. Boundaries of the Regional Water Planning Councils and the Metropolitan North Georgia Water Planning District

Chapter 391-3-6-.03 provides the following definitions for acute and chronic criteria: “Acute criteria” corresponds to EPA’s definition for Criteria Maximum Concentration (CMC), which is defined in 40CFR 131.36 as the highest concentration of a pollutant to which aquatic life can be exposed for a short period of time (1-hour average) without deleterious effects. “Chronic criteria” corresponds to EPA’s definition for Criteria Continuous Concentration (CCC), which is defined in 40CFR 131.36 as the highest concentration of a pollutant to which aquatic life can be exposed for an extended period of time (4 days) without deleterious effects. The established acute criteria and chronic criteria for dissolved copper are as follows:

$$\text{acute criteria for dissolved copper} = \left(e^{(0.9422[\ln(\text{hardness})] - 1.700)}\right)(0.96)\ \mu g/L$$
$$\text{chronic criteria for dissolved copper} = \left(e^{(0.8545[\ln(\text{hardness})] - 1.702)}\right)(0.96)\ \mu g/L$$

The hardness used in the above equations is expressed in mg/L as $CaCO_3$.

In 2016, the State adopted and EPA approved a site specific copper criteria for Buffalo Creek, from Richards Lake Dam to confluence with Little Tallapoosa River, using the Biotic Ligand Model (BLM) under Chapter 391-3-6-.03(5)(e)(ii) of Georgia’s Rules and Regulations, Revised August 2016. The site specific acute and chronic criteria are given below:

$$\text{acute criteria for dissolved copper} = 4.9X10^{8}\ e^{\left(-0.5\left(\left(\frac{(\ln(pH)-2.316)}{-0.1816}\right)^{2}+\left(\frac{(\ln(DOC)-32.18)}{-5.453}\right)^{2}\right)\right)}$$
$$\text{chronic criteria for dissolved criteria} = 3.043X10^{8}\ e^{\left(-0.5\left(\left(\frac{(\ln(pH)-2.316)}{-0.1816}\right)^{2}+\left(\frac{(\ln(DOC)-32.18)}{-5.453}\right)^{2}\right)\right)}$$

This regulation cited above requires that instream concentrations of dissolved copper shall not exceed the acute criteria at 1Q10 or higher stream flow conditions, and shall not exceed the chronic criteria at 7Q10 or higher stream flow conditions.

2.0 WATER QUALITY ASSESSMENT

The Buffalo Creek segment downstream of Southwire and the unnamed tributary listings for copper resulted from EPD samples collected in the early 1990s. Data collected in 2001 confirmed these listings, as well as resulted in the listing of another segment of Buffalo Creek for copper, starting at the bottom of the originally listed segment and extending 6 miles to the confluence with the Little Tallapoosa River. The Little Tallapoosa meets its use criteria downstream of this confluence.

The water quality data for the listed segments used for the 2002 listing are provided in Table 3. Also provided are the calculated translator, the assumed dissolved copper concentration, and the acute and chronic criteria. The calculated translator is a function of the instream total suspended solids (TSS).

Table 3. Copper Data Collected from Tallapoosa River Basin

Location	Date	Measured Total Recoverable Copper (μg/L)	Calculated Translator (Total Recoverable to Dissolved)	Corresponding Dissolved Copper (μg/L)	Total Hardness (mg/L as $CaCO_3$)	Acute Criterion (μg/L)*	Chronic Criterion (μg/L)*
Buffalo Creek Downstream Southwire	5/8/01	10	2.0	4.9	25	3.6	2.7
	6/18/01	13	2.5	5.2	25	3.6	2.7
Buffalo Creek Upstream Little Tallapoosa R	5/8/01	13	2.9	4.5	30	4.3	3.2
	6/18/01	18	2.9	6.3	28	4.1	3.0
Tributary to Buffalo Creek upstream of Highway 166	3/28/01	90	3.0	30.3	464	57.1	33.2
	6/12/01	55	3.2	17.0	24	3.5	2.6
Tributary to Buffalo Creek downstream of Highway 166	3/28/01	95	3.0	32	326	41	25
	6/12/01	92	3.0	30.6	24	3.5	2.6

*The acute and chronic criteria are based the hardness equation, which was the criteria applicable at the time

At the Southwire Copper Division, the wastewater treatment system collects and treats storm water from the manufacturing and material handling areas. The facility is a net consumer of water. As a result, total volumes discharged are slightly less than the total volume of storm water collected. With a total retention capacity of approximately 18 million gallons, the Copper Division discharges intermittently, depending upon the rainfall intensity and duration. Neither the Southwire Copper Division nor the previously permitted Southwire Wire Plant were discharging during or several days prior to the sampling events listed in Table 3 (Southwire, 2003).

3.0 SOURCE ASSESSMENT

An important part of the TMDL analysis is the identification of the potential sources of pollutants. A source assessment characterizes the known and suspected sources of copper in the watershed for development of the TMDL. Sources are broadly classified as either point or nonpoint sources. A point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Nonpoint sources are diffuse, and generally, but not always, involve accumulation of pollutants on land surfaces that wash off as a result of storm events.

3.1 Point Source Assessment

Title IV of the Clean Water Act establishes the National Pollutant Discharge Elimination System (NPDES) permit program. There are two basic categories of NPDES permits: 1) municipal and industrial wastewater treatment facilities, and 2) regulated storm water discharges.

3.1.1 Wastewater Treatment Facilities

In general, industrial and municipal wastewater treatment facilities have NPDES permits with effluent limits. These permit limits are either based on federal and state effluent guidelines (technology-based limits) or on water quality standards (water quality-based limits).

The United States Environmental Protection Agency (USEPA) has developed technology-based guidelines, which establish a minimum standard of pollution control for municipal and industrial discharges without regard for the quality of the receiving waters. These are based on Best Practical Control Technology Currently Available (BPT), Best Conventional Control Technology (BCT), and Best Available Technology Economically Achievable (BAT). The level of control required by each facility depends on the type of discharge and the pollutant.

The USEPA and the States have also developed numeric and narrative water quality standards. Typically, these standards are based on the results of aquatic toxicity tests and/or human health criteria and include a margin of safety. Water quality-based effluent limits are set to protect the receiving stream. These limits are based on water quality standards that have been established for a stream based on its intended use and the prescribed biological and chemical conditions that must be met to sustain that use.

For purposes of this TMDL, NPDES permitted wastewater treatment facilities are considered point sources, and include municipal, industrial, private, and federal facilities. As of July 2017, there is only one NPDES permitted wastewater treatment facility located within the impaired stream segments watersheds. Table 4 provides a list of the facilities that had NPDES permits and includes their copper limits.

The Southwire Wire Plant had a combined storm and process water sewer system initially installed in the 1950s to allow recycling of storm water from process building roofs (Southwire, 2003). It was separated in 2015, and the process water and storm water were covered under separate permits. Southwire (Wire Plant) submitted a NPDES Permit (GA0001139) Notice of Termination for the process water in July 2017.

Table 4. NPDES Facilities in the Buffalo Creek Watershed

Facility Name	Permit No.	Receiving Water	NPDES Permit Limits			
			Flow[1] (MGD)	Daily Max Copper (lbs/day)	Total Heavy Metals[4] (μg/L)	PH
Southwire (Wire Plant)	GA0001139 Notice of Termination submitted July 2017	Buffalo Creek	02a, 03a, 04a, 06a- Combine sewer overflows Low stream flow conditions			
			Monitor	0.329[3]	NA	>5.0 and <9.0
			02b, 03b, 04b, 06b- Combine sewer overflows High stream flow conditions			
			Monitor	Monitor	NA	>5.0 and <9.0
Southwire (CDS) 002	GA0001571	Buffalo Creek	Monitor[2]	Monitor	1000	>6.0 and <9.0

[1] Monitoring is required only when a discharge is occurring
[2] Wastewater treatment plant and commingled storm water
[3] Applies when actual discharge flow and receiving stream flow result in a daily average instream wastewater concentration (IWC) of 13.2% or greater.
[4] Total Heavy Metals is defined as the sum of cadmium, total chromium, copper, lead, nickel, silver, and zinc.

3.1.2 Regulated Storm Water Discharges

Certain sources of storm water runoff are covered under the NPDES Permit Program. It is considered a diffuse source of pollution. Unlike other NPDES permits that establish end-of-pipe pollutant limits, storm water NPDES permits establish controls intended to reduce the quantity of pollutants storm water picks up and carries into storm sewer systems during rainfall events. Currently, regulated storm water discharges include those associated with industrial activities, construction sites one acre or greater, large and medium municipal separate storm sewer systems (MS4s), and small MS4s serving urbanized areas.

3.1.2.1 Industrial General Storm Water NPDES Permit

Storm water discharges associated with industrial activities are currently covered under Georgia's General Industrial Storm Water NPDES Permit (GAR050000). This permit requires visual monitoring of storm water discharges, site inspections, implementation of Best Management Practices (BMPs), preparation of a Storm Water Pollution Prevention Plan (SWPPP), and annual reporting (EPD, 2014a). The Industrial General Permit (IGP) requires that storm water discharging into an impaired stream segment or within one linear mile upstream of, and within the same watershed as, any portion of an impaired stream segment identified as "not supporting" its designated use(s), must satisfy the requirements of Appendix C of the permit if the pollutant(s) of concern for which the impaired stream segment has been listed may be exposed to storm water as a result of industrial activity at the site. If a facility is covered under Appendix C of the IGP, then benchmark monitoring for the pollutant(s) of concern is required. There are two facilities in the Buffalo Creek watershed covered under the IGP considered to have the potential for discharging copper based on their SIC Code (3357) and Sector designation (F3), and these facilities require benchmark monitoring (Table 5).

Table 5. Facilities with a General Storm Water NPDES Permit

Facility Name	SIC Code	Sector No.	Type of Business	Facility Status	Receiving Watersheds and Streams	NOI No.	NOI Type (1)
Cofer Technology Center	4581	S1	Air Transportation Facilities	Active	Buffalo Creek	1346	NEE
Airgas Merchant Gases (FKA: Holox, Inc.)	2813	C2	Industrial Inorganic Chemicals	Inactive	Buffalo Creek	2481	NOI
Houghton International, Inc.	2992	D2	Miscellaneous Products of Petroleum and Coal	Active	Buffalo Creek	322	NOI
Air Medical Group Holdings LLC DBA Air Evac EMS INC	4522	S1	Air Transportation Facilities	Active	Buffalo Creek	12853	NOI
Southwire Company - Machinery Division	3357	F3	Rolling, Drawing, and Extruding of Nonferrous Metals	Active	Buffalo Creek	350	NOI
Southwire Company - Wire Mills	3357	F3	Rolling, Drawing, and Extruding of Nonferrous Metals	Active	Buffalo Creek	351	NOI

Source: Nonpoint Source Program, GA DNR, 2017
(1) NOI Type: NOI – Notice of Intent
NEE – No Exposure Exclusion

3.1.2.2 MS4 NPDES Permits

The collection, conveyance, and discharge of diffuse storm water to local water bodies by a public entity are regulated in Georgia by the NPDES MS4 permits. These MS4 permits have been issued under two phases. Phase I MS4 permits cover medium and large cities, and counties with populations over 100,000. Each individual Phase I MS4 permit requires the prohibition of non-storm water discharges (i.e., illicit discharges) into the storm sewer systems and controls to reduce the discharge of pollutants to the maximum extent practicable, including the use of management practices, control techniques and systems, as well as design and engineering methods (Federal Register, 1990). A site-specific Storm Water Management Plan (SWMP) outlining appropriate controls is required by and referenced in the permit. A program to monitor and control pollutants in storm water discharges from industrial facilities, construction sites, and highly visible pollutant sources that exist within the MS4 area must be implemented under the permit. Additionally, monitoring of not supporting streams, public education and involvement, post-construction storm water controls, low impact development, and annual reporting requirements must all be addressed by the permittee on an ongoing basis.

Small MS4s serving urbanized areas are required to obtain a storm water permit under the Phase II storm water regulations. An urbanized area is defined as an area with a residential population of at least 50,000 people and an overall population density of at least 1,000 people per square mile. Thirty (30) counties, fifty-six (56) communities, seven (7) Department of Defense facilities, and the Georgia Department of Transportation (GDOT) are permitted under the Phase II regulations in Georgia. All municipal Phase II permitees are authorized to discharge under Storm Water General Permit GAG610000. Department of Defense facilities are authorized to discharge under Storm Water General Permit GAG480000. GDOT owned or operated facilities are authorized to discharge under Storm Water General Permit GAG410000. Under these general permits, each permittee must design and implement a SWMP that incorporates BMPs that focus on public education and involvement, illicit discharge detection and elimination, construction site runoff control, post-construction storm water management, and pollution prevention in municipal operations.

The land use types that are considered urbanized and include regulated storm sewer systems are 1) developed open space, 2) developed low intensity, 3) developed medium intensity, 4) developed high intensity, 5) utility swaths, and 6) golf courses. Carroll County has an MS4 permit, but it only covers the unincorporated areas around Villa Rica and Temple. Neither the City of Carrollton nor the unincorporated area around Carrollton are not covered by an MS4 permit.

3.2 Nonpoint Source Assessment

In general, nonpoint sources cannot be identified as entering a water body through a discrete conveyance at a single location. In urban areas, a large portion of the storm water contribution may enter waterways as point sources from MS4 NPDES permitted outfalls, or from industrial sites covered under the Georgia Industrial General Permit. The remainder of the storm water runoff comes from nonpoint sources.

Potential nonpoint sources include the following:

- Storm water runoff as overland flow from improper disposal of waste materials;
- Storm water runoff from private outfalls not covered under NPDES MS4 permits;
- Storm water runoff from industrial sites not currently included under the Georgia General Industrial Permit;
- Deposition of particulates from air emissions;
- Leaking or overflowing sanitary sewer lines;
- Failing septic systems;
- Leachate from landfills within the watershed;
- Contaminated groundwater seepage.

3.2.1 Air Deposition

The furnace operations at the Southwire Company copper smelter were sources of fugitive and stack air emissions, and thus sources of copper deposition to the land until the year 2000 (Southwire, 2003).

3.2.2 Solid Waste Disposal Facilities

Leachate from landfills may contain dissolved copper or copper compounds that could at some point reach surface waters. Sanitary landfills receive household wastes that may include household and yard chemicals and relatively small amounts of construction and demolition wastes generated from private homeowner activities. The large portion of waste generated from construction and demolition activities are sent to landfills designated for these materials. Designated construction/demolition landfills receive the vast majority of wastes from these activities. Older sanitary landfills were not lined and most have been closed. Those landfills that are not lined and remain active, operate as construction/demolition landfills. Also, landfills associated with mining operations are usually not lined and ground water monitoring is not required (EPD, 2016). Currently, active sanitary landfills are lined and have leachate collection systems. All landfills, excluding inert landfills, are now required to install environmental monitoring systems for groundwater and methane sampling.

There are two inactive landfills in the Buffalo Creek Watershed, the Southwire Company landfill and the McGukin-Cedar Heights Road landfill. The erosion control measures Southwire Company has put in place for its inactive landfill and non-detection of copper in downgradient ground water samples indicates the landfill is not likely contributing copper to the watershed. At this time, it is unknown whether the inactive McGukin-Cedar Heights Road landfill is contributing copper to the watershed.

3.2.3 Resource Conservation and Recovery Act (RCRA) Site Remediation

Southwire has been involved with Resource Conservation and Recovery Act (RCRA) site remediation. Southwire has worked with the GA EPD Hazardous Waste Management Branch to define and schedule the RCRA activities. A total of twenty solid waste management units (SWMUs) and two hazardous waste management units (HWMUs) potentially impacted by metals were identified at the Southwire Copper Division facility. A total of 17 SWMUs potentially impacted by metals were identified at the Southwire Wire Mill facility. Each of these units have been evaluated to determine the extent of soil, surface water, and groundwater impacts.

In 2000, smelting operations were permanently discontinued, thereby eliminating fugitive and stack air emissions. In addition, due to the shutdown of the smelter, secondary copper scrap and refinery intermediate materials that had been stored and handled during daily smelter operations have been completely removed from the site. Smelter and tank house equipment have been decontaminated, demolished, and completely removed from the site (Southwire 2003).

Southwire has completed several remediation efforts in the headwaters and streambed of a tributary to Buffalo Creek, which enters Richards Lake from the southeast. This work included excavation of impacted and non-impacted soils and sediments from portions of the tributary to the Buffalo Creek drainage area (SWMU 17). In 1999, a soil and streambed remediation project was completed to remove slag material from Southwire Copper Division smelting operations that had been used as structural fill material on Oak Mountain Academy property in the 1970s. Impacted areas were horizontally and vertically delineated and slag and contaminated soils and sediments were removed. The streambed from the Oak Mountain Academy property towards Richards Lake was also remediated (Southwire, 2003). Several roads and materials handling areas around the Southwire Copper Division facility were remediated by removing impacted soils and backfilling with clean structural fill in 2000. The areas were then paved with concrete to further prevent storm water contact with underlying soils, to allow improved housekeeping, and to ease clean-up of any future spills (Southwire, 2003).

Southwire improved the facility’s ability to capture and manage storm water on the active areas of the Copper Division. Stormwater conveyances within the facility proper were constructed, and a lined 10-million gallon stormwater retention pond was constructed in 2000 on the northern side of the facility. Impacted soils and sediments were delineated and removed prior to excavation activities for the storm water pond (Southwire, 2003).

From 2011 to 2014, Southwire initiated several interim corrective measures (ICMs) and construction projects to improve overall surface water quality and address areas with potential risk. ICMs included:

- The excavation and removal of a former waste oil pit;
- The further excavation and removal of granular slag and impacted soils in two areas of the Copper Division Process area;
- The excavation of impacted sediments within a low-lying area downgradient of the Copper Division and installation of a seep (groundwater) collection system within the tributary to Buffalo Creek;
- The excavation and lining of various drainage channels throughout the facility including tributaries to Buffalo Creek; and
- Stormwater Improvements to the Copper Division.

Recent stormwater improvement projects at Southwire have included the construction of a 5-million gallon stormwater pond designed to collect storm water from the western side of the Copper Division Process Area that historically discharged to Buffalo Creek via downgradient drainage ditches.

As a result of the completed storm water and drainage improvements, untreated storm water from the Copper Division Process Area is no longer discharged to Richards Lake via the tributary to the Buffalo Creek drainage area, and the overall water quality of Richards Lake, Buffalo Creek, and the tributary to Buffalo Creek has improved. Since 1997, copper concentrations have decreased approximately 85 to 90% in Buffalo Creek downstream of Southwire and approximately 90% in the tributary to Buffalo Creek (Southwire, 2001).

3.3 Additional Potential Sources

A wide range of products that contain copper are produced and commonly used in our modern society. Some of the more familiar examples include:

- Electronics, electrical wiring
- Household plumbing
- Pigments, dyes
- Pharmaceuticals
- Fertilizers, pesticides
- Bronze, brass fixtures, decorative items
- Brake pads

There are several routes by which copper may be introduced into waterways. In general, runoff from parking lots and streets can contain elevated levels from brake dust left by motor vehicles. Sanitary sewer line breaks and overflows can contain copper from household products and copper plumbing. Runoff from landscaped areas and agricultural areas treated with excessive amounts of fertilizers and pesticides containing copper can be a significant source.

4.0 TMDL DEVELOPMENT APPROACH

An important component of TMDL development is to establish relationships between source loadings and in-stream water quality. In this section, the mathematical modeling techniques used to develop the TMDL are discussed. The process of developing copper TMDLs for the Tallapoosa River Basin listed segments includes the determination of the following:

- The current critical copper load to the stream under existing conditions;
- The TMDL for similar conditions under which the current load was determined; and
- The percent reduction in the current critical copper load necessary to achieve the TMDL.

4.1 Steady-State Mass Balance Approach

Steady-state models are applied for "critical" environmental conditions that represent extremely low assimilative capacity. Critical environmental conditions correspond to drought flows. The assumption behind steady-state modeling is that point and nonpoint source discharge concentrations that protect water quality during low-flow critical conditions will be protective for the large majority of environmental conditions that occur. Mass balance equations are used to model the critical conditions and calculate allocations.

4.2 Critical Conditions

The critical flow conditions for these TMDLs occur when the ratio of effluent or contaminated storm water to stream flow is the greatest. The TMDLs are presented in two ways: first, as total daily mass loads for the low flow conditions; and second, as loads as a function of the total flow at any given time.

In the first case, total daily mass loads for the 1-day, 10-year minimum (1Q10), and 7-day, 10-year minimum (7Q10) low flow conditions are given. These are the assumed critical conditions for aquatic life. The 1Q10 is the lowest one-day flow with a recurrence of once in 10 years determined hydrologically. The 7Q10 is the minimum average flow for seven consecutive days with a 10- year recurrence interval determined hydrologically. The 1Q10 and acute criteria provide protection of the acute standard, and the 7Q10 and chronic criteria provide protection of the chronic standard.

Available flow data for the impaired stream segments is limited. Therefore, the 1Q10 and 7Q10 critical flows were developed using 1Q10 and 7Q10 flow data determined by the USGS for several nearby streams (Gotvald, 2016). These streams have relatively similar watershed characteristics, including land use, slope, and drainage area. The critical stream flows for the impaired stream segments are estimated by calculating the average productivity values (i.e., ratio of flow to drainage area) for the 1Q10 and 7Q10 flows of the nearby streams and multiplying these values by the impaired stream segments drainage areas. These calculations are presented in Appendix A. Table 6 provides the critical flow data for the listed segments.

For the second case, the TMDLs are expressed as equations that show the loads as a function of flow at any given time. Since instantaneous samples are used to evaluate compliance with the standards, as well as the need for a TMDL, this flow dependent load, or concentration approach, is more meaningful. This approach takes into account seasonal variability and makes it easier to evaluate compliance with the TMDL.

Table 6. Minimum Flows Associated with Copper Impaired Segments in the Tallapoosa River Basin

Stream Segment	1Q10		7Q10	
	cfs	MGD	cfs	MGD
Buffalo Creek, Downstream Southwire	0.319	0.206	0.504	0.326
Buffalo Creek, Upstream Tallapoosa River	0.432	0.279	0.682	0.441
Tributary to Buffalo Creek	0.019	0.012	0.030	0.019

The acute and chronic criteria for metals are expressed as the dissolved fraction. The criteria are calculated based on the hardness or pH and DOC of the receiving stream (see Section 1.4 for equations). A lower hardness or pH results in a higher proportion of metal in the dissolved form, resulting in a more conservative criterion.

Results for sample analyses of metals are commonly reported as a total (or total recoverable) concentration. Because the criteria are for the dissolved fraction of the metals, Georgia Regulation 391-3-6-.03(5)(e)(ii) (GA EPD, 2016) allows USEPA's "Guidance Document of Dynamic Modeling and Translators, August 1993" (USEPA, 1994) to be used for "translating" the total recoverable concentration to the dissolved form. In addition, Georgia Regulation 391-3-6-.06(4)(d)5.(ii)(b)(2) allows methods from this EPA guidance document to be used to translate dissolved criteria concentrations into total recoverable permit limits. Metals effluent permit limitations are required to be expressed as total recoverable metal per 40 CFR §122.45(c).

The translator is dependent on the instream TSS concentration. As the TSS concentration increases, a smaller percent of the metal is in the dissolved form. The equations used to calculate the translator are taken from EPA guidance (USEPA, 1994; USEPA, 1996). The ratio of the total measured metal concentration (C_t) to the calculated dissolved concentration (C_d) is the translator. The equations are provided below for reference.

$$C_t/C_d = 1 + K_d \times TSS \times (10^{-6} \text{ kg/mg})$$

Where: K_d = partition coefficient for copper (L/kg)
TSS = total suspended solids concentration (mg/L)

The partition coefficient for copper:

$$K_d = K_{po} \times TSS^a$$

Where: K_{po}* = 1.04×10^6
a * = -0.7436

* Note: It is important to note that the authors of EPA's "*Technical Guidance Manual*" derived the above values for the 'K_{po}' coefficient and the 'a' exponent based on the statistical analysis of 2,253 data records collected from rivers and streams distributed throughout the United States.

Instream TSS data are available for the listed segments. Table 7 shows the average TSS and corresponding translator, average hardness, pH, Dissolved Organic Carbon (DOC) concentration, and dissolved acute and chronic criterion for the each of the impaired stream segments.

Table 7. Critical Condition Hardness, TSS, pH, and DOC

Listed Segment	TSS (mg/L)	Translator	Total Hardness (mg/L as $CaCO_3$)	pH (SU)	Dissolved Organic Carbon (mg/L)	Dissolved Copper Chronic Criterion (µg/L)	Dissolved Copper Acute Criterion (µg/L)
Buffalo Creek, Downstream Southwire[1]	4.0	2.5	-	7.27	4.49	7.65[1]	12.32[1]
Buffalo Creek, Upstream Tallapoosa River[1]	3.7	2.5	-	6.98	4.63	5.11[1]	8.23[1]
Tributary to Buffalo Creek[2]	14	3.0	25	-	-	2.74[2]	3.64[2]

[1] Copper criteria for this segment is based on the BLM
[2] Copper criteria for this segment is based on the equation that uses hardness

5.0 ALLOCATIONS

A TMDL is the amount of a pollutant that can be assimilated by the receiving waterbody without exceeding the applicable water quality standard. The TMDLs for copper are based on the acute and chronic instream standards for this metal. A TMDL is the sum of the individual wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint source, as well as natural background (40 CFR 130.2) for a given waterbody. The TMDL must also include a margin of safety (MOS), either implicitly or explicitly, which accounts for the uncertainty in the relationship between pollutant loads and the water quality response of the receiving water body. TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measures. For copper, the TMDLs are expressed as mass per day and as a concentration.

A TMDL is expressed as follows:

$$\text{TMDL} = \Sigma\text{WLAs} + \Sigma\text{LAs} + \text{MOS}$$

The TMDL calculates the WLAs and LAs with margins of safety to meet the stream's water quality standards. The allocations are based on estimates that use the best available data and provide the basis to establish or modify existing controls so that water quality standards can be achieved. In developing a TMDL, it is important to consider whether adequate data exists to identify the sources, fate, and transport of the pollutant to be controlled.

TMDLs may be developed using a phased approach. Under a phased approach, the TMDL includes: 1) WLAs that confirm existing limits and controls or lead to new limits, and 2) LAs that confirm existing controls or include implementing new controls (USEPA, 1991). A phased TMDL requires additional data be collected to determine if load reductions required by the TMDL lead to the attainment of water quality standards.

The TMDL Implementation Plan establish a schedule or timetable for the installation and evaluation of point and nonpoint source control measures, data collection, assessment of water quality standard attainment, and if needed, additional modeling. Future monitoring of the listed segments' water quality will be used to evaluate this phase of the TMDL, and if necessary, to reallocate the loads.

5.1 Wasteload Allocations

5.1.1 Wastewater Treatment Facilities

The wasteload allocation (WLA) is the portion of the receiving water's loading capacity that is allocated to existing or future point sources represented by municipal and industrial wastewater treatment systems that have NPDES effluent limits. Currently, Southwire has NPDES-permitted wastewater treatment facilities in the Buffalo Creek watershed that have copper permit limits. The WLA loads will be calculated using the effluent flow. Since some NPDES permits do not have a flow limitation, a TMDL expressed only in mass per day is not appropriate. It is more accurate and conservative to assign a wasteload allocation as a concentration. The mass limit for any value of flow (Q) will then be calculated by multiplying the flow times concentration. The WLA requires the effluent concentration from each point source not exceed the allowable instream copper criteria at the end of pipe without any dilution. The WLA is represented by the equation:

$$WLA = \Sigma Q_{WLA} \times \text{Copper criterion (acute or chronic)}$$

where: ΣQ_{WLA} = sum of all current, potential, and future NPDES permitted wastewater treatment discharges

5.1.2 Regulated Storm Water Discharges

State and Federal Rules define storm water discharges covered by NPDES permits as point sources. However, storm water discharges are from diffuse sources and there are multiple storm water outfalls. Storm water sources (point and nonpoint) are different than traditional NPDES permitted sources in four respects: 1) they do not produce a continuous (pollutant loading) discharge; 2) their pollutant loading depends on the intensity, duration, and frequency of rainfall events, over which the permittee has no control; 3) the activities contributing to the pollutant loading may include various allowable activities of others, and control of these activities is not solely within the discretion of the permittee; and 4) they do not have wastewater treatment plants that control specific pollutants to meet numerical limits.

The intent of storm water NPDES permits is not to treat the water after collection, but to reduce the exposure of storm water to pollutants by implementing various controls. It would be infeasible and prohibitively expensive to try to control pollutant discharges from each storm water outfall. Therefore, storm water NPDES permits require the establishment of controls or BMPs to reduce pollutants from entering the environment.

There are three individual industrial NPDES permitted facilities in these watersheds. The Southwire Wire Plant currently has limitations for copper. These facilities are listed in Table 5 and the total WLA for all these facilities is given in Table 9 for either various instream pH levels and assuming an instream DOC concentration of 4.5 mg/L or for various instream hardness levels depending on the criteria that applies. If there are any other permitted sources of copper in the future, the WLA loads will be calculated using the effluent flow. Since the storm water permits do not have a flow limitation, a TMDL in mass per day is not appropriate. It is more accurate and conservative to assign a wasteload allocation as a concentration. The mass limit for any value of flow (Q) will then be calculated by multiplying flow times concentration.

The WLAsw requires that the effluent concentration from each point source not exceed the allowable instream copper criteria at the end of pipe without any dilution. Wasteload allocations for storm water discharges associated with industrial activities, covered under Georgia's General Industrial Storm Water NPDES Permit, are represented by the equation:

$$WLA_{SW} = Q_{WLAsw} \times \text{Copper criterion (acute or chronic)}$$

Where: WLA_{SW} = Wasteload Allocation for permitted storm water runoff from all industrial areas

Q_{WLAsw} = Permitted storm water runoff from all industrial areas

The wasteload allocations from storm water discharges (WLAsw) associated with municipal separate storm sewer systems (MS4s) are estimated based on the percentage of urban area in each watershed covered by the MS4 storm water permit. At this time, the portion of runoff from each watershed that goes directly to a permitted storm sewer or is non-permitted sheet flow or diffuse runoff has not been clearly defined. Thus, it is assumed that approximately 70 percent of storm water runoff from the regulated urban area is collected by the MS4. This can be represented by the following equation:

WLA_{SW} = Q_{WLAsw} x Copper criterion (acute or chronic)

where: WLA_{SW} = Wasteload Allocation for permitted storm water runoff from all MS4 urban areas
Q_{WLAsw} = Runoff from all MS4 urban areas conveyed through permitted storm water structures
$Q_{WLAsw} = \Sigma Q_{urban} \times 0.7$
ΣQ_{urban} = Sum of all storm water runoff from MS4 urban areas

For storm water permits, compliance with the terms and conditions of the permit is effective implementation of the WLA to the Maximum Extent Practicable (MEP), and demonstrates consistency with the assumptions and requirements of the TMDL. EPD acknowledges that progress with the assumptions and requirements of the TMDL by storm water permittees may take one or more permit iterations. Achieving the TMDL reductions may constitute compliance with a storm water management plan (SWMP) or a storm water pollution prevention plan (SWPPP), provided the MEP definition is met, even where the numeric percent reduction may not be achieved so long as reasonable progress is made toward attainment of water quality standards using an iterative BMP process.

5.2 Load Allocations

The load allocation (LA) is the portion of the receiving water's loading capacity that is attributed to existing or future nonpoint sources or to natural background sources. Nonpoint sources are identified in 40 CFR 130.6 as follows:

- Residual waste
- Land disposal
- Agricultural and silivicultural
- Mines
- Construction
- Saltwater intrusion
- Urban storm water (non-permitted)

It is not known how much of the copper comes from nonpoint sources. Generally, there are two types of load allocations in the creek: 1) loads associated with the accumulation of metals on land surfaces that are washed off during storm events, and; 2) loads independent of precipitation, such as seepage of contaminated groundwater, leachate from landfills, failing septic systems, leaking sewer system collection lines, and background loads. The allowable instream copper concentration and wasteload allocation data is used to calculate the load allocations. Available data suggests that copper introduced to the impaired stream segments are both from storm water runoff and from other sources not related to storm events. At this time, it is not possible to partition the various sources of load allocations. In the future, after additional data has been collected, it may be possible to partition the load allocation by source.

The LA for all flows and conditions can be described by the following equation:

$LA = Q_{LA}$ x Copper criterion (acute or chronic)

where: LA = Load Allocation
Q_{LA} = Flow from all nonpoint sources
$Q_{LA} = Q_{Total} - (\Sigma Q_{WLA} + \Sigma Q_{WLAsw})$
Q_{Total} = Total flow
ΣQ_{WLA} = Sum of all current, potential, and future NPDES permitted wastewater treatment discharges
ΣQ_{WLAsw} = Sum of runoff from all MS4 urban areas conveyed through permitted storm water structures

For the two segments on Buffalo Creek, various instream pH values assuming a DOC concentration of 4.5 mg/L were used to determine the copper criteria. These data along with historical low-flow data were used to determine the load allocations for the impaired stream segments under critical conditions. The allowable load to protect against the acute effects of dissolved copper is as follows:

Allowable load (kg/d) = Dissolved Cu acute criterion (µg/L) x 1Q10 (MGD) x Units' conversion

where: Units' conversion = 3.785×10^6 L/million gallon x 10^{-9} kg/µg = 3.785×10^{-3}

$$\text{Dissolved Cu acute criteria} = 4.9X10^8\ e^{\left(-0.5\left(\left(\frac{\ln(pH)-2.316}{-0.1816}\right)^2+\left(\frac{\ln(DOC)-32.18}{-5.453}\right)^2\right)\right)}$$

The allowable load to protect against the chronic effects of dissolved copper is as follows:

Allowable load (kg/d) = Dissolved Cu chronic criterion (µg/L) x 7Q10 (MGD) x Units' conversion

where: Units' conversion = 3.785×10^6 L/million gallon x 10^{-9} kg/µg = 3.785×10^{-3}

$$\text{Dissolved Cu chronic criteria} = 3.043X10^8\ e^{\left(-0.5\left(\left(\frac{\ln(pH)-2.316}{-0.1816}\right)^2+\left(\frac{\ln(DOC)-32.18}{-5.453}\right)^2\right)\right)}$$

For the segment in the tributary to Buffalo Creek, various instream hardness concentrations were used to determine the copper criteria. These data along with historical low-flow data were used to determine the load allocations for the impaired stream segments under critical conditions. The allowable load to protect against the acute effects of dissolved copper is as follows:

Allowable load (kg/d) = Dissolved Cu acute criterion (µg/L) x 1Q10 (MGD) x Units' conversion

where: Units' conversion = 3.785×10^6 L/million gallon x 10^{-9} kg/µg = 3.785×10^{-3}
Dissolved Cu acute criteria = $(e^{(0.9422[\ln(\text{hardness})] - 1.700)})(0.96)$ µg/L

The allowable load to protect against the chronic effects of dissolved copper is as follows:

Allowable load (kg/d) = Dissolved Cu chronic criterion (µg/L) x 7Q10 (MGD) x Units' conversion

where: Units' conversion = 3.785×10^6 L/million gallon x 10^{-9} kg/µg = 3.785×10^{-3}
Dissolved Cu chronic criteria = $(e^{(0.8545[\ln(\text{hardness})] - 1.702)})(0.96)$ µg/L

Table 8 provides the allowable LA for dissolved cooper using various instream hardness and pH values and an assumed instream DOC concentration of 4.5 mg/L.

Table 8. Load Allocations (LA) for Dissolved Copper under Critical Conditions for the Impaired Stream Segments in the Tallapoosa River Basin

Stream Segment	Criteria	Critical Flow (MGD)	pH	Dissolved Copper (µg/L)	Allowable Load Allocation (kg/day)[1]
Buffalo Creek, Downstream Southwire[1] GAR031501080602	Acute	0.206	6.8	5.88	$4.60 X10^{-3}$
			6.9	7.00	$5.47 X10^{-3}$
			7.0	8.25	$6.45 X10^{-3}$
			7.1	9.64	$7.53 X10^{-3}$
			7.2	11.18	$8.74 X10^{-3}$
			7.3	12.86	$1.01 X10^{-2}$
			7.4	14.69	$1.15 X10^{-2}$
			7.5	16.65	$4.60 X10^{-2}$
			7.6	18.74	$1.46 X10^{-3}$
	Chronic	0.325	6.8	3.65	$4.51 X10^{-3}$
			6.9	4.35	$5.36 X10^{-3}$
			7.0	5.12	$6.32 X10^{-3}$
			7.1	5.99	$7.39 X10^{-3}$
			7.2	6.94	$8.57 X10^{-3}$
			7.3	7.99	$9.85 X10^{-3}$
			7.4	9.12	$1.13 X10^{-2}$
			7.5	10.34	$1.28 X10^{-2}$
			7.6	11.64	$1.44 X10^{-2}$
Buffalo Creek, Upstream Tallapoosa River[1] GAR031501080601	Acute	0.279	6.8	5.88	$6.22 X10^{-3}$
			6.9	7.00	$7.39 X10^{-3}$
			7.0	8.25	$8.71 X10^{-3}$
			7.1	9.64	$1.02 X10^{-3}$
			7.2	11.18	$1.18 X10^{-2}$
			7.3	12.86	$1.36 X10^{-3}$
			7.4	14.69	$1.55 X10^{-2}$
			7.5	16.65	$1.76 X10^{-2}$
			7.6	18.74	$1.98 X10^{-2}$
	Chronic	0.441	6.8	3.65	$6.09 X10^{-3}$
			6.9	4.35	$7.25 X10^{-3}$
			7.0	5.12	$8.55 X10^{-3}$
			7.1	5.99	$9.99 X10^{-3}$
			7.2	6.94	$1.16 X10^{-2}$
			7.3	7.99	$1.33 X10^{-2}$
			7.4	9.12	$1.52 X10^{-2}$
			7.5	10.34	$1.72 X10^{-2}$
			7.6	11.64	$1.94 X10^{-2}$

Stream Segment	Criteria	Critical Flow (MGD)	Hardness as mg/L $CaCO_3$	Dissolved Copper (µg/L)	Allowable Load Allocation (kg/day)[2]
Tributary to Buffalo Creek[2] GAR031501080604	Acute	0.012	15	2.25	$1.04 X10^{-4}$
			20	2.95	$1.37 X10^{-4}$
			25	3.64	$1.69 X10^{-4}$
			30	4.32	$2.00 X10^{-4}$
			35	5.00	$2.32 X10^{-4}$
	Chronic	0.019	15	1.77	$1.30 X10^{-4}$
			20	2.26	$1.66 X10^{-4}$
			25	2.74	$2.00X10^{-4}$
			30	3.20	$2.34 X10^{-4}$
			35	3.65	$2.67 X10^{-4}$

[1] Copper criteria for this segment is based on the BLM
[2] Copper criteria for this segment is based on the equation that uses hardness

5.3 Seasonal Variation

The low flow critical conditions incorporated in this TMDL are assumed to represent the most critical design conditions and provide year-round protection of water quality. The flow of a stream will generally range from low flows during critical conditions to higher flows at other times. Runoff from storm events will contribute additional flow to the stream. Seasonal variability in flow is addressed by expressing the TMDL as a concentration, as well as a load associated with different flows.

5.4 Margin of Safety

The MOS is a required component of TMDL development. As specified by section 303(d) of the CWA, the margin of safety must account for any lack of knowledge concerning the relationship between effluent limitations and water quality. There are two basic methods for incorporating the MOS: 1) implicitly incorporate the MOS using conservative model assumptions to develop allocations, or 2) explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations.

The MOS was implicitly incorporated into the TMDLs through the use of the critical low flows, conservative hardness values, conservative DOC values, and maximum copper concentrations observed in the streams to determine required percent reductions. The implicit margin of safety for these TMDLs adequately accounts for the lack of knowledge concerning the relationship between effluent limitations and water quality. Also, the biotic ligand model used to establish the copper criteria for Buffalo Creek is designed to conservatively underestimate results from Water Effect Ratio studies upon which it is based.

5.5 Total Maximum Daily Load Results

The Buffalo Creek TMDLs for any condition are based on the flow of creek, instream pH, instream DOC concentration assumed to be 4.5 mg/L, as well as the permitted discharge flow. The Tributary to Buffalo Creek TMDL for any condition is based on the flow in the creek, instream pH, and permitted discharge flow. The TMDLs for copper at various instream pH and hardness levels are summarized in Table 9.

Table 9. Total Dissolved Copper TMDL Summary for the Impaired Stream Segments in the Tallapoosa River Basin

Stream Segment	Criteria	Current Load	pH	WLA	WLA_{SW}	LA	MOS	TMDL	Reduction
Buffalo Creek, Downstream Southwire GAR031501080602	Acute	ΣQ x 5.2 µg/L for all conditions and flows	6.8	ΣQ_{WLA} x 5.9 µg/L for all conditions and flows	ΣQ_{WLAsw} x 5.9 µg/L for all conditions and flows	$4.60 X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 5.9 µg/L for all conditions and flows	Implicit	$4.60 X10^{-3}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 5.9 µg/L for all conditions and flows	-
			6.9	ΣQ_{WLA} x 7.0 µg/L for all conditions and flows	ΣQ_{WLAsw} x 7.0 µg/L for all conditions and flows	$5.47 X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 7.0 µg/L for all conditions and flows	Implicit	$5.47 X10^{-3}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 7.0 µg/L for all conditions and flows	-
			7.0	ΣQ_{WLA} x 8.3 µg/L for all conditions and flows	ΣQ_{WLAsw} x 8.2 µg/L for all conditions and flows	$6.45 X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 8.3 µg/L for all conditions and flows	Implicit	$6.45 X10^{-3}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 8.3 µg/L for all conditions and flows	-
			7.1	ΣQ_{WLA} x 9.6 µg/L for all conditions and flows	ΣQ_{WLAsw} x 9.6 µg/L for all conditions and flows	$7.53 X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 9.6 µg/L for all conditions and flows	Implicit	$7.53 X10^{-3}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 9.6 µg/L for all conditions and flows	-
			7.2	ΣQ_{WLA} x 11.2 µg/L for all conditions and flows	ΣQ_{WLAsw} x 11.2 µg/L for all conditions and flows	$8.74 X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 11.2 µg/L for all conditions and flows	Implicit	$8.74 X10^{-3}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 11.2 µg/L for all conditions and flows	-
			7.3	ΣQ_{WLA} x 12.9 µg/L for all conditions and flows	ΣQ_{WLAsw} x 12.9 µg/L for all conditions and flows	$1.01 X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 12.9 µg/L for all conditions and flows	Implicit	$1.10 X10^{-3}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 12.9 µg/L for all conditions and flows	-
			7.4	ΣQ_{WLA} x 14.7 µg/L for all conditions and flows	ΣQ_{WLAsw} x 14.7 µg/L for all conditions and flows	$1.15 X10^{-2}$ kg/day for 1Q10 ΣQ_{LA} x 14.7 µg/L for all conditions and flows	Implicit	$1.15 X10^{-2}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 14.7 µg/L for all conditions and flows	-
			7.5	ΣQ_{WLA} x 16.6 µg/L for all conditions and flows	ΣQ_{WLAsw} x 16.6 µg/L for all conditions and flows	$1.30 X10^{-2}$ kg/day for 1Q10 ΣQ_{LA} x 16.6 µg/L for all conditions and flows	Implicit	$1.30 X10^{-2}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 16.6 µg/L for all conditions and flows	-
			7.6	ΣQ_{WLA} x 18.7 µg/L for all conditions and flows	ΣQ_{WLAsw} x 18.7 µg/L for all conditions and flows	$1.46 X10^{-2}$ kg/day for 1Q10 ΣQ_{LA} x 18.7 µg/L for all conditions and flows	Implicit	$1.46 X10^{-2}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 18.7 µg/L for all conditions and flows	-

Stream Segment	Criteria	Current Load	pH	WLA	WLA_{SW}	LA	MOS	TMDL	Reduction
Buffalo Creek, Downstream Southwire GAR031501080602	Chronic	ΣQ x 5.2 µg/L for all conditions and flows	6.8	ΣQ_{WLA} x 3.7 µg/L for all conditions and flows	ΣQ_{WLAsw} x 3.7 µg/L for all conditions and flows	4.51 $X10^{-3}$ kg/day for 7Q10 ΣQ_{LA} x 3.7 µg/L for all conditions and flows	Implicit	4.51 $X10^{-3}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 3.7 µg/L for all conditions and flows	29.7%
			6.9	ΣQ_{WLA} x 4.3 µg/L for all conditions and flows	ΣQ_{WLAsw} x 4.3 µg/L for all conditions and flows	5.36 $X10^{-3}$ kg/day for 7Q10 ΣQ_{LA} x 4.3 µg/L for all conditions and flows	Implicit	5.36 $X10^{-3}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 4.3 µg/L for all conditions and flows	16.4%
			7.0	ΣQ_{WLA} x 5.1 µg/L for all conditions and flows	ΣQ_{WLAsw} x 5.1 µg/L for all conditions and flows	6.32 $X10^{-3}$ kg/day for 7Q10 ΣQ_{LA} x 5.1 µg/L for all conditions and flows	Implicit	6.32 $X10^{-3}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 5.1 µg/L for all conditions and flows	1.5%
			7.1	ΣQ_{WLA} x 6.0 µg/L for all conditions and flows	ΣQ_{WLAsw} x 6.0 µg/L for all conditions and flows	7.39 $X10^{-3}$ kg/day for 7Q10 ΣQ_{LA} x 6.0 µg/L for all conditions and flows	Implicit	7.39 $X10^{-3}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 6.0 µg/L for all conditions and flows	-
			7.2	ΣQ_{WLA} x 6.9 µg/L for all conditions and flows	ΣQ_{WLAsw} x 6.9 µg/L for all conditions and flows	8.57 $X10^{-3}$ kg/day for 7Q10 ΣQ_{LA} x 6.9 µg/L for all conditions and flows	Implicit	8.57 $X10^{-3}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 6.9 µg/L for all conditions and flows	-
			7.3	ΣQ_{WLA} x 8.0 µg/L for all conditions and flows	ΣQ_{WLAsw} x 8.0 µg/L for all conditions and flows	9.85 $X10^{-3}$ kg/day for 7Q10 ΣQ_{LA} x 8.0 µg/L for all conditions and flows	Implicit	9.85 $X10^{-3}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 8.0 µg/L for all conditions and flows	-
			7.4	ΣQ_{WLA} x 9.1 µg/L for all conditions and flows	ΣQ_{WLAsw} x 9.1 µg/L for all conditions and flows	1.13 $X10^{-2}$ kg/day for 7Q10 ΣQ_{LA} x 9.1 µg/L for all conditions and flows	Implicit	1.13 $X10^{-2}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 9.1 µg/L for all conditions and flows	-
			7.5	ΣQ_{WLA} x 10.3µg/L for all conditions and flows	ΣQ_{WLAsw} x 10.3 µg/L for all conditions and flows	1.28 $X10^{-2}$ kg/day for 7Q10 ΣQ_{LA} x 10.3 µg/L for all conditions and flows	Implicit	1.28 $X10^{-2}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 10.3 µg/L for all conditions and flows	
			7.6	ΣQ_{WLA} x 11.6µg/L for all conditions and flows	ΣQ_{WLAsw} x 11.6 µg/L for all conditions and flows	1.44 $X10^{-2}$ kg/day for 7Q10 ΣQ_{LA} x 11.6 µg/L for all conditions and flows	Implicit	1.44 $X10^{-2}$ kg/day + WLA for 7Q10 ΣQ_{Total} x 11.6 µg/L for all conditions and flows	-

Stream Segment	Criteria	Current Load	pH	WLA	WLA_{SW}	LA	MOS	TMDL	Reduction
Buffalo Creek, Upstream Little Tallapoosa River GAR031501080601	Acute	ΣQ x 6.3 µg/L for all conditions and flows	6.8	ΣQ_{WLA} x 5.9 µg/L for all conditions and flows	ΣQ_{WLAsw} x 5.9 µg/L for all conditions and flows	6.22 $X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 5.9 µg/L for all conditions and flows	Implicit	6.22 $X10^{-3}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 5.9 µg/L for all conditions and flows	6.6%
			6.9	ΣQ_{WLA} x 7.0 µg/L for all conditions and flows	ΣQ_{WLAsw} x 7.0 µg/L for all conditions and flows	7.39 $X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 7.0 µg/L for all conditions and flows	Implicit	7.39 $X10^{-3}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 7.0 µg/L for all conditions and flows	-
			7.0	ΣQ_{WLA} x 8.3 µg/L for all conditions and flows	ΣQ_{WLAsw} x 8.2 µg/L for all conditions and flows	8.71 $X10^{-3}$ kg/day for 1Q10 ΣQ_{LA} x 8.2 µg/L for all conditions and flows	Implicit	8.71 $X10^{-3}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 8.2 µg/L for all conditions and flows	-
			7.1	ΣQ_{WLA} x 9.6 µg/L for all conditions and flows	ΣQ_{WLAsw} x 9.6 µg/L for all conditions and flows	1.02 $X10^{-2}$ kg/day for 1Q10 ΣQ_{LA} x 9.6 µg/L for all conditions and flows	Implicit	1.02 $X10^{-2}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 9.6 µg/L for all conditions and flows	-
			7.2	ΣQ_{WLA} x 11.2 µg/L for all conditions and flows	ΣQ_{WLAsw} x 11.2 µg/L for all conditions and flows	1.18 $X10^{-2}$ kg/day for 1Q10 ΣQ_{LA} x 11.2 µg/L for all conditions and flows	Implicit	1.18 $X10^{-2}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 11.2 µg/L for all conditions and flows	-
			7.3	ΣQ_{WLA} x 12.9 µg/L for all conditions and flows	ΣQ_{WLAsw} x 12.9 µg/L for all conditions and flows	1.36 $X10^{-2}$ kg/day for 1Q10 ΣQ_{LA} x 12.9 µg/L for all conditions and flows	Implicit	1.36 $X10^{-2}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 12.9 µg/L for all conditions and flows	-
			7.4	ΣQ_{WLA} x 14.7 µg/L for all conditions and flows	ΣQ_{WLAsw} x 14.7 µg/L for all conditions and flows	1.55 $X10^{-2}$ kg/day for 1Q10 ΣQ_{LA} x 14.7 µg/L for all conditions and flows	Implicit	1.55 $X10^{-2}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 14.7 µg/L for all conditions and flows	-
			7.5	ΣQ_{WLA} x 16.6 µg/L for all conditions and flows	ΣQ_{WLAsw} x 16.6 µg/L for all conditions and flows	1.76 $X10^{-2}$ kg/day for 1Q10 ΣQ_{LA} x 16.6 µg/L for all conditions and flows	Implicit	1.76 $X10^{-2}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 16.6 µg/L for all conditions and flows	-
			7.6	ΣQ_{WLA} x 18.7 µg/L for all conditions and flows	ΣQ_{WLAsw} x 18.7 µg/L for all conditions and flows	1.98 $X10^{-2}$ kg/day for 1Q10 ΣQ_{LA} x 18.7 µg/L for all conditions and flows	Implicit	1.98 $X10^{-2}$ kg/day + WLA for 1Q10 ΣQ_{Total} x 18.7 µg/L for all conditions and flows	-

Stream Segment	Criteria	Current Load	pH	WLA	WLA_{SW}	LA	MOS	TMDL	Reduction
Buffalo Creek, Upstream Little Tallapoosa River GAR031501080601	Chronic	ΣQ x 6.3 µg/L for all conditions and flows	6.8	ΣQ_{WLA} x 3.7 µg/L for all conditions and flows	ΣQ_{WLAsw} x 3.7 µg/L for all conditions and flows	6.09 X10^{-3} kg/day for 1Q10 ΣQ_{LA} x 3.7 µg/L for all conditions and flows	Implicit	6.09X10^{-3} kg/day + WLA for 7Q10 ΣQ_{Total} x 3.7 µg/L for all conditions and flows	42.0%
			6.9	ΣQ_{WLA} x 4.3 µg/L for all conditions and flows	ΣQ_{WLAsw} x 4.3 µg/L for all conditions and flows	7.25 X10^{-3} kg/day for 1Q10 ΣQ_{LA} x 4.3 µg/L for all conditions and flows	Implicit	7.25 X10^{-3} kg/day + WLA for 7Q10 ΣQ_{Total} x 4.3 µg/L for all conditions and flows	31.0%
			7.0	ΣQ_{WLA} x 5.1 µg/L for all conditions and flows	ΣQ_{WLAsw} x 5.1 µg/L for all conditions and flows	8.55 X10^{-3} kg/day for 1Q10 ΣQ_{LA} x 5.1 µg/L for all conditions and flows	Implicit	8.55 X10^{-3} kg/day + WLA for 7Q10 ΣQ_{Total} x 5.1 µg/L for all conditions and flows	18.7%
			7.1	ΣQ_{WLA} x 6.0 µg/L for all conditions and flows	ΣQ_{WLAsw} x 6.0 µg/L for all conditions and flows	9.99 X10^{-3} kg/day for 1Q10 ΣQ_{LA} x 6.0 µg/L for all conditions and flows	Implicit	9.99 X10^{-3} kg/day + WLA for 7Q10 ΣQ_{Total} x 6.0 µg/L for all conditions and flows	4.9%
			7.2	ΣQ_{WLA} x 6.9 µg/L for all conditions and flows	ΣQ_{WLAsw} x 6.9 µg/L for all conditions and flows	1.16 X10^{-2} kg/day for 1Q10 ΣQ_{LA} x 6.9 µg/L for all conditions and flows	Implicit	1.16 X10^{-2} kg/day + WLA for 7Q10 ΣQ_{Total} x 6.9 µg/L for all conditions and flows	-
			7.3	ΣQ_{WLA} x 8.0 µg/L for all conditions and flows	ΣQ_{WLAsw} x 8.0 µg/L for all conditions and flows	1.33 X10^{-2} kg/day for 1Q10 ΣQ_{LA} x 8.0 µg/L for all conditions and flows	Implicit	1.33 X10^{-2} kg/day + WLA for 7Q10 ΣQ_{Total} x 8.0 µg/L for all conditions and flows	
			7.4	ΣQ_{WLA} x 9.1 µg/L for all conditions and flows	ΣQ_{WLAsw} x 9.1 µg/L for all conditions and flows	1.52 X10^{-2} kg/day for 1Q10 ΣQ_{LA} x 9.1 µg/L for all conditions and flows	Implicit	1.52 X10^{-2} kg/day + WLA for 7Q10 ΣQ_{Total} x 9.1 µg/L for all conditions and flows	-
			7.5	ΣQ_{WLA} x 10.3µg/L for all conditions and flows	ΣQ_{WLAsw} x 10.3 µg/L for all conditions and flows	1.72 X10^{-2} kg/day 1.73 for 1Q10 ΣQ_{LA} x 10.3 µg/L for all conditions and flows	Implicit	1.72 X10^{-2} kg/day + WLA for 7Q10 ΣQ_{Total} x 10.3 µg/L for all conditions and flows	-
			7.6	ΣQ_{WLA} x 11.6µg/L for all conditions and flows	ΣQ_{WLAsw} x 11.6 µg/L for all conditions and flows	1.94 X10^{-2} kg/day kg/day for 1Q10 ΣQ_{LA} x 11.6 µg/L for all conditions and flows	Implicit	1.94 X10^{-2} kg/day + WLA for 7Q10 ΣQ_{Total} x 11.6 µg/L for all conditions and flows	-

Stream Segment	Criteria	Current Load	Hardness as mg/L $CaCO_3$	WLA	WLA_{SW}	LA	MOS	TMDL	Reduction
Tributary to Buffalo Creek GAR031501080604	Acute	ΣQ x 30.6µg/L for all conditions and flows	15	ΣQ_{WLA} x 2.3 µg/L for all conditions and flows	ΣQ_{WLAsw} x 2.3 µg/L for all conditions and flows	1.04X10^{-4} kg/day for 1Q10 ΣQ_{LA} x 2.3 µg/L for all conditions and flows	Implicit	1.04 X10^{-4} kg/day + WLA for 1Q10 ΣQ_{Total} x 2.3 µg/L for all conditions and flows	92.6%
			20	ΣQ_{WLA} x 3.0 µg/L for all conditions and flows	ΣQ_{WLAsw} x 3.0 µg/L for all conditions and flows	1.37 X10^{-4} kg/day for 1Q10 ΣQ_{LA} x 3.0 µg/L for all conditions and flows	Implicit	1.37 X10^{-4} kg/day + WLA for 1Q10 ΣQ_{Total} x 3.0 µg/L for all conditions and flows	90.4%
			25	ΣQ_{WL} x 3.6 µg/L for all conditions and flows	ΣQ_{WLAsw} x 3.6 µg/L for all conditions and flows	1.69 X10^{-4} kg/day for 1Q10 ΣQ_{LA} x 3.6 µg/L for all conditions and flows	Implicit	1.69 X10^{-4} kg/day + WLA for 1Q10 ΣQ_{Total} x 3.6 µg/L for all conditions and flows	88.1%
			30	ΣQ_{WLA} x 4.3 µg/L for all conditions and flows	ΣQ_{WLAsw} x 4.3 µg/L for all conditions and flows	2.00 X10^{-4} kg/day for 1Q10 ΣQ_{LA} x 4.3 µg/L for all conditions and flows	Implicit	2.00 X10^{-4} kg/day + WLA for 1Q10 ΣQ_{Total} x 4.3 µg/L for all conditions and flows	85.9%
			35	ΣQ_{WLA} x 5.0 µg/L for all conditions and flows	ΣQ_{WLAsw} x 5.0 µg/L for all conditions and flows	2.32 X10^{-4} kg/day for 1Q10 ΣQ_{LA} x 5.0 µg/L for all conditions and flows	Implicit	2.32 X10^{-4} kg/day + WLA for 1Q10 ΣQ_{Total} x 5.0 µg/L for all conditions and flows	83.7%

Stream Segment	Criteria	Current Load	Hardness as mg/L $CaCO_3$	WLA	WLA_{SW}	LA	MOS	TMDL	Reduction
Tributary to Buffalo Creek GAR031501080604	Chronic	ΣQ x 30.6µg/L for all conditions and flows	15	ΣQ_{WLA} x 1.8 µg/L for all conditions and flows	ΣQ_{WLAsw} x 1.8 µg/L for all conditions and flows	1.30 X10^{-4} kg/day for 7Q10 ΣQ_{LA} x 1.8 µg/L for all conditions and flows	Implicit	1.30 X10^{-4} kg/day + WLA for 7Q10 ΣQ_{Total} x 1.8 µg/L for all conditions and flows	94.2%
			20	ΣQ_{WLA} x 2.3 µg/L for all conditions and flows	ΣQ_{WLAsw} x 2.3 µg/L for all conditions and flows	1.66 X10^{-4} kg/day for 7Q10 ΣQ_{LA} x 2.3 µg/L for all conditions and flows	Implicit	1.66 X10^{-4} kg/day + WLA for 7Q10 ΣQ_{Total} x 2.3 µg/L for all conditions and flows	92.6%
			25	ΣQ_{WLA} x 2.7 µg/L for all conditions and flows	ΣQ_{WLAsw} x 2.7 µg/L for all conditions and flows	2.00 X10^{-4} kg/day for 7Q10 ΣQ_{LA} x 2.7 µg/L for all conditions and flows	Implicit	2.00 X10^{-4} kg/day + WLA for 7Q10 ΣQ_{Total} x 2.7 µg/L for all conditions and flows	91.0%
			30	ΣQ_{WLA} x 3.2 µg/L for all conditions and flows	ΣQ_{WLAsw} x 3.2 µg/L for all conditions and flows	2.34 X10^{-4} kg/day for 7Q10 ΣQ_{LA} x 3.2 µg/L for all conditions and flows	Implicit	2.34 X10^{-4} kg/day + WLA for 7Q10 ΣQ_{Total} x 3.2 µg/L for all conditions and flows	89.5%
			35	ΣQ_{WLA} x 3.7 µg/L for all conditions and flows	ΣQ_{WLAsw} x 3.7 µg/L for all conditions and flows	2.67 X10^{-4} kg/day for 7Q10 ΣQ_{LA} x 3.7 µg/L for all conditions and flows	Implicit	2.67 X10^{-4} kg/day + WLA for 7Q10 ΣQ_{Total} x 3.7 µg/L for all conditions and flows	88.1%

ΣQ_{WLA} is the sum of all current, potential and future NPDES regulated point source discharges to the watershed, including both continuous and storm water discharges.

6.0 RECOMMENDATIONS

The TMDL process consists of an evaluation of the sub-watersheds for each 303(d) listed stream segment to identify, as best as possible, the sources of copper causing the stream to exceed instream standards. The TMDL analysis was performed using the best available data to specify WLAs and LAs that will meet the copper water quality criteria so as to support the use classification specified for each listed segment.

This TMDL represents part of a long-term process to reduce loading of copper to meet water quality standards in the Tallapoosa River Basin. Implementation strategies will be reviewed and the TMDLs will be refined as necessary. The phased approach will support progress toward water quality standards attainment in the future. In accordance with USEPA TMDL guidance, these TMDLs may be revised based on the results of future monitoring and source characterization data efforts. The following recommendations emphasize further source identification and involve the collection of data to support the current allocations and subsequent source reductions.

6.1 Monitoring

Water quality monitoring is conducted at a number of locations across the State each year. Based on monitoring conducted by Southwire the Buffalo Creek segment downstream from Southwire can be delisted. It is recommended that sampling be continued to monitor instream copper concentrations, as well as hardness, TSS, pH and DOC. This should include both dry-weather and wet-weather sampling events. If exceedances of the copper criteria continue, then the sources should be determined and corrective actions may be needed. In the case where a watershed based plan has been developed for a listed stream segment, an appropriate water quality monitoring program will be outlined. The monitoring program will be developed to help identify the various copper sources. The monitoring program may be used to verify the 303(d) stream segment listings. This will be especially valuable for those segments where limited data resulted in the listing.

6.2 Reasonable Assurance

An allocation to a point source discharger does not automatically result in a permit limit or a monitoring requirement. Through its NPDES permitting process, GA EPD will determine whether the permitted dischargers to the listed watersheds have a reasonable potential of discharging copper levels equal to or greater than the allocated load. The results of this reasonable potential analysis will determine the specific type of requirements in an individual facility's NPDES permit. As part of its analysis, the GA EPD will use its EPA-approved 2001 NPDES Reasonable Potential Procedures to determine whether monitoring requirements or effluent limitations are necessary.

If effluent limitations are determined to be necessary for any or all of these facilities, they should be established in accordance with *Georgia Rules and Regulations for Water Quality Control*, Section 391-3-6-.06(4)(d)5.(ii)(b)(2). This regulation establishes that to protect against chronic effects, an effluent limitation should be imposed as a monthly average limit.

To protect against acute effects, an effluent limitation should be imposed as a daily maximum limit. Additionally, if effluent limitations or monitoring requirements are determined through a reasonable potential analysis to be necessary for any or all of these facilities, it is recommended that concentration limits or concentration monitoring requirements should be imposed in addition to any loading limits or monitoring requirements.

All industrial sites that have a storm water discharge associated with their primary industrial activity are required to submit a Notice of Intent under the NPDES General Industrial Permit for Storm Water that authorizes them to discharge storm water in accordance with the conditions and monitoring requirements established in the Industrial General Permit. Storm water from industrial sites that discharge within one linear mile of a 303(d) listed stream that might potentially contain the listed constituent must be monitored to determine that benchmarks levels are met.

EPD is working with local governments to foster the implementation of BMPs to address nonpoint sources. In addition, public education efforts will be targeted to individual stakeholders to provide information regarding the use of BMPs to protect water quality.

6.3 Public Participation

A thirty-day public notice was provided for these TMDLs. During this time, the availability of these TMDLs was public noticed, a copy of the TMDLs was provided as requested, and the public was invited to provide comments on the TMDLs.

7.0 INITIAL TMDL IMPLEMENTATION PLAN

This plan identifies applicable state-wide programs and activities that may be employed to manage point and nonpoint sources of copper loads for the impaired stream segments in the Tallapoosa River Basin. Local watershed planning and management initiatives will be fostered, supported, or developed through a variety of mechanisms. Implementation may be addressed by watershed improvement projects, assessments for Section 319 (h) grants, the local development of watershed protection plans, or “Targeted Outreach” initiated by EPD. These initiatives will supplement or possibly replace this initial implementation plan. Implementation actions should also be guided by the recommended management practices and actions contained within each applicable Regional Water Plan developed as part of Georgia’s Comprehensive State-wide Water Management Plan implementation (Georgia Water Council, 2008).

7.1 Impaired Segments

This initial plan is applicable to the copper impaired stream segments in the Tallapoosa River Basin, which were added to Georgia’s 303(d) list available on EPD’s website (www.gaepd.org). The following table summarizes the descriptive information provided in the 303(d) list.

Water Bodies Listed on the 2002 303(d) for Copper in the Tallapoosa River Basin

Water body	Reach ID	Status	Water Use	Segment	Criterion Violated	Miles
Buffalo Creek	GAR031501080602	Not Supporting	Fishing	Downstream Southwire Corp. (Carroll Co.)	Cu	3
Buffalo Creek	GAR031501080601	Not Supporting	Fishing	Upstream Little Tallapoosa River (Carroll Co.)	FC, Cu	6
Tributary to Buffalo Creek	GAR031501080604	Not Supporting	Fishing	Carrollton (Carroll County)	Cu	1

The current water quality standard [*State of Georgia’s Rules and Regulations for Water Quality Control*, Chapter 391-3-6-.03(6)(c)(iii) (EPD, 2015) states that instream concentrations shall not exceed the acute criteria under 1-day, 10-year minimum flow (1Q10) or higher stream flow conditions, and shall not exceed the chronic criteria under 7-day, 10-year minimum flow (7Q10) or higher stream flow conditions. The acute and chronic copper criteria are determined using the following equations:

$$\text{acute criteria for dissolved copper} = (e^{(0.9422[\ln(\text{hardness})] - 1.700)})(0.96)\ \mu g/L$$

$$\text{chronic criteria for dissolved copper} = (e^{(0.8545[\ln(\text{hardness})] - 1.702)})(0.96)\ \mu g/L$$

The hardness used in the above equations is expressed in mg/L as $CaCO_3$.

The State adopted and EPA approved a site specific copper criteria for Buffalo Creek, from Richards Lake Dam to confluence with Little Tallapoosa River, using the Biotic Ligand Model (BLM) under Chapter 391-3-6-.03(5)(e)(ii) of Georgia's Rules and Regulations, Revised August 2016. The site specific acute and chronic criteria are given below:

$$\text{acute criteria for dissolved copper} = 4.9X10^{8}\ e^{\left(-0.5\left(\left(\frac{(\ln(pH)-2.316)}{-0.1816}\right)^{2}+\left(\frac{(\ln(DOC)-32.18)}{-5.453}\right)^{2}\right)\right)}$$

$$\text{chronic criteria for dissolved criteria} = 3.043X10^{8}\ e^{\left(-0.5\left(\left(\frac{(\ln(pH)-2.316)}{-0.1816}\right)^{2}+\left(\frac{(\ln(DOC)-32.18)}{-5.453}\right)^{2}\right)\right)}$$

This regulation cited above requires instream concentrations of dissolved copper shall not exceed the acute criteria at 1Q10 or higher stream flow conditions, and shall not exceed the chronic criteria at 7Q10 or higher stream flow conditions.

These criteria are expressed in terms of the dissolved fraction in the water column and are a function of either total hardness or pH and an assume DOC of 4.5 mg/L. Exceedances of these criteria are violations of the water quality standards for these metals, and are the basis for adding a stream segment to the 303(d) listing.

7.2 Potential Sources

An important part of the TMDL analysis is the identification of potential source categories. A source assessment characterizes the known and suspected sources for copper in the watershed. Sources are broadly classified as either point or nonpoint sources. A point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Point sources of copper may include discharges from wastewater treatment facilities and storm water discharges through permitted storm water systems. Nonpoint sources of these metals are diffuse and cannot be identified as entering the water body at a single location. These sources generally involve land use activities that contribute the metals to streams during rainfall events. However, other potential nonpoint sources exist such as direct deposition of particulates from air emissions, and seepage of contaminated groundwater.

Three industrial facilities have been identified as potential point sources for copper loads to Buffalo Creek. One industrial facility operates under an NPDES discharge permit that includes a limit for copper. The other facilities are covered under the Industrial General Storm Water Permit. Based on their SIC codes, these industrial facilities may be involved in the manufacture of products or use of compounds containing copper.

Water quality sampling conducted by the EPD and Southwire indicate that nonpoint sources may be the most significant cause for exceedances of copper criteria in Buffalo Creek and the Tributary to Buffalo Creek. Potential nonpoint sources for copper include: non-permitted storm runoff from industrial sites, runoff from parking lots and streets can contain elevated levels from brake dust left by motor vehicles, runoff from improper disposal of waste materials, illicit discharges into storm sewer systems, leachate from operating and closed landfills, overflows from sanitary sewer lines, and leaking septic systems.

7.3 Management Practices and Activities

The NPDES permit program provides a basis for municipal, industrial, and storm water permits, monitoring and compliance with limitations, and appropriate enforcement actions for violations. In accordance with EPD rules and regulations, all discharges from point source facilities are required to be in compliance with the conditions of their NPDES permit at all times.

EPD is responsible for administering and enforcing laws to protect the waters of the state and is the lead agency for implementing the state's Nonpoint Source Management Program. Georgia is working with federal, county, and local governments, and other state and county agencies to foster implementation of BMPs that address nonpoint source pollution. The following management practices are recommended to reduce copper loads to the impaired stream segments:

- Sustain compliance with NPDES wastewater permit requirements;
- Uphold requirements that all new and replacement sanitary sewage systems be designed to minimize discharges into storm sewer systems;
- Sustain compliance with NPDES MS4 permit requirements, where applicable;
- Further develop and streamline mechanisms for reporting and correcting illicit discharges, breaks, surcharges, and general sanitary sewer system problems;
- Sustain compliance with NPDES Industrial General Permit requirements, including where applicable, achieving benchmark levels for monitored constituents;
- Ensure storm water management plans are in place and being implemented by the local governments, and by the industrial facilities located in the watershed;
- Adoption of local ordinances (i.e. septic tanks, storm water, etc.) that address local water quality;
- Continue efforts to increase public awareness and education towards the impact of human activities in urban settings on water quality, ranging from the consequences of industrial and municipal discharges to the activities of individuals in residential neighborhoods.
- Implement Erosion and Sedimentation Control Plans for land disturbing activities; and application of the *Manual for Erosion and Sediment Control in Georgia* (GSWCC, 2014);
- Continue working with federal, state, and local agencies and owners of sites where further cleanup measures are necessary, and in developing control measures to prevent future releases of copper and copper compounds.

- Implementation of recommended Water Quality management practices in the *Middle Chattahoochee Regional Water Plan* (2011);

7.4 Monitoring

EPD encourages local governments and municipalities to develop instream water quality monitoring programs. These programs can help pinpoint various pollutant sources, as well as verify the 303(d) stream segment listings. EPD recommends that monitoring of copper, total hardness, pH, DOC, and TSS be continued for Buffalo Creek and the Tributary to Buffalo Creek to determine if implementation of BMPs results in the improvement of water quality over time. EPD is available to assist in completing a monitoring plan, preparing a Sampling Quality Assurance Plan (SQAP), and/or providing necessary training as needed.

7.5 Future Action

This Initial TMDL Implementation Plan includes a general approach to pollutant source identification, as well as management practices to address pollutants. In the future, EPD will continue to determine and assess the appropriate point and non-point source management measures needed to achieve the TMDLs and also to protect and restore water quality in impaired water bodies.

For point sources, any future wasteload allocations for wastewater treatment plant facilities will be implemented in the form of water-quality based effluent limitations in NPDES permits. Any wasteload allocations for regulated storm water will be implemented in the form of BMPs in the NPDES permits. Contributions of copper from regulated communities may also be managed using permit requirements such as watershed assessments, watershed protection plans, and long term monitoring. These measures will be directed through current point source management programs.

EPD will work to support watershed improvement projects that address non-point source pollution. This is a process whereby EPD and/or Regional Commissions or other agencies or local governments, under a contract with EPD, will develop a Watershed Management Plan intended to address water quality at the small watershed level (HUC 10 or smaller). These plans will be developed as resources and willing partners become available. The development of these plans may be funded via several grant sources, including but not limited to, Clean Water Act Section 319(h), Section 604(b), and/or Section 106 grant funds. These plans are intended for implementation upon completion.

Any Watershed Management Plan that specifically address water bodies contained within this TMDL will supersede the Initial TMDL Implementation Plan once EPD accepts the plan. Future Watershed Management Plans intended to address this TMDL and other water quality concerns, written by EPD and for which EPD and/or the EPD Contractor are responsible, will contain at a minimum the USEPA’s 9 Elements of Watershed Planning:

1) An identification of the sources or groups of similar sources contributing to nonpoint source pollution to be controlled to implement load allocations or achieve water quality standards. Sources should be identified at the subcategory level with estimates of the extent to which they are present in the watershed

(e.g., X numbers industrial sites needing upgrading, Y acres of contaminated soils needing remediation, or Z linear miles of eroded stream bank needing restoration);

2) An estimate of the load reductions expected for the management measures;

3) A description of the NPS management measures that will need to be implemented to achieve the load reductions established in the TMDL or to achieve water quality standards;

4) An estimate of the sources of funding needed, and/or authorities that will be relied upon, to implement the plan;

5) An information/education component that will be used to enhance public understanding of and participation in implementing the plan;

6) A schedule for implementing the management measures that is reasonably expeditious;

7) A description of interim, measurable milestones (e.g., amount of load reductions, improvement in biological or habitat parameters) for determining whether management measures or other control actions are being implemented;

8) A set of criteria that can be used to determine whether substantial progress is being made towards attaining water quality standards and, if not, the criteria for determining whether the plan needs to be revised; and;

9) A monitoring component to evaluate the effectiveness of the implementation efforts, measured against the criteria established under item 8.

The public will be provided an opportunity to participate in the development of Watershed Management Plans that address impaired waters and to comment on them before they are finalized.

EPD will continue to offer technical and financial assistance (when and where available) to complete Watershed Management Plans that address the impaired water bodies listed in this and other TMDL documents. Assistance may include but will not be limited to:

- Assessments of pollutant sources within watersheds;
- Determinations of appropriate management practices to address impairments;
- Identification of potential stakeholders and other partners;
- Developing a plan for outreach to the general public and other groups;
- Assessing the resources needed to implement the plan upon completion; and
- Other needs determined by the lead organization responsible for plan development.

EPD will also make this same assistance available, if needed, to proactively address water quality concerns. This assistance may be in the way of financial, technical, or other aid and may be requested and provided outside of the TMDL process or schedule.

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Appendix A

Estimation of 1Q10 and 7Q10 Flows for Buffalo and Little Buffalo Creeks

Calculation of Average 1Q10 and 7Q10 Estimates for Streams in the Tallapoosa River Basin

Source: Anthony J. Gotvald, 2016, Provisional Draft Selected Low-Flow Frequency Statistics for Continuous- Record Stream Gages in Georgia, 2013, Scientific Investigations Report 2016-####, U.S. Geological Survey, Reston, Virginia

Stream	Gage No	Drainage Area (sq miles)	1Q10 (cfs)	Productivity Factor (cfs/sq miles)	7Q10 (cfs)	Productivity Factor (cfs/sq miles)
Little Tallapoosa River at US 27, at Carrollton, Ga	02413000	95.1	2.28	0.024	3.6	0.038
Buffalo Creek, Downstream Southwire	-	13.32	0.319	-	0.504	-
Buffalo Creek, Upstream Little Tallapoosa River	-	18.01	0.432	-	0.682	-
Tributary to Buffalo Creek	-	0.79	0.019	-	0.030	-

(1) Using the reported 1Q10 and 7Q10 Little Tallapoosa River gage to calculate the 1Q10 and 7Q10 of the 303(d) listed segments of Buffalo Creek and the tributary to Buffalo Creek using productivity factors.