

FINAL

TOTAL MAXIMUM DAILY LOAD (TMDL)

For

Fecal Coliform and Sediment (Biota impacted)

In

She Creek, Savannah River Basin

Rabun County, Georgia

Prepared by:

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In compliance with the provisions of the Federal Clean Water Act, 33 U.S.C §1251 et.seq., as amended by the Water Quality Act of 1987, P.L. 400-4, the U.S Environmental Protection Agency is hereby establishing Total Maximum Daily Loads (TMDLs) for fecal coliform and sediment for She Creek in the Savannah River Basin. Subsequent actions must be consistent with this TMDL.

James D. Giattina, Director
Water Management Division

Date

TMDL SUMMARY / SIGNATURE SHEET

FECAL COLIFORM AND SEDIMENT / She Creek Rabun County, Georgia HUC 03060102

In 1998, EPA Region 4 placed She Creek in the Savannah River Basin on the State of Georgia's Section 303(d) list as impaired due to fecal coliform and biota. A designation of "biota" reflects impacted biological community with sediment as a possible factor causing impairment. She Creek was originally placed on the 303(d) list in response to requirements of the settlement agreement of the Georgia "TMDL" lawsuit (Sierra Club v. EPA & Hankinson; No. 194-CV-2501-MHS, N.D.GA). The settlement agreement required a stream to be listed unless data expressly demonstrated the stream supported water quality standards.

Available fecal coliform data do not indicate violations of GAEPD's water quality standards for bacteria. EPA placed the stream on Georgia's 303(d) list based on violations of 305(b) listing guidance criteria as insufficient data were collected during the summer months to evaluate the geometric mean criteria. The She Creek fecal coliform TMDL is expressed in terms of concentration. The TMDL requires ambient fecal coliform levels not to exceed 200 per 100 ml based on the geometric mean of four or more samples collected in a 30-day period.

The She Creek biota TMDL is based on controlling sediment loads delivered to the stream. The hypothesis in the TMDL is if the impaired creek has a long-term annual sediment load similar to reference stream in the same ecoregion, then She Creek will remain stable and support healthy habitat. Watershed-scale loading of sediment in water was simulated using the Watershed Characterization System (EPA, 2001) for both the impaired and reference streams. The TMDL is expressed in terms of average annual loads as summarized in the TMDL Summary Table. Average annual watershed loads represent the long-term processes of accumulation of sediments in the stream habitat areas that are associated with the potential for habitat alteration and aquatic life effects.

The TMDLs assign wasteload allocations (WLA) to dischargers with NPDES permits. NPDES activities include municipal and industrial facilities, and stormwater discharge from MS4 and construction activities. There are no MS4 municipalities or NPDES facilities discharging sediment or fecal coliform in the She Creek watershed. NPDES construction activities are considered a significant source of sediment and are the only component of the WLA. Compliance with the State of Georgia's Storm Water General Permit should lead to sediment loadings from construction sites at or below applicable targets.

Nonpoint sources of sediment are considered the major sediment producing areas in the watershed. These sources include road crossings, agriculture, and bare ground (non-permitted construction type sites, etc.). Instream erosion processes (i.e., stream bank and streambed erosion) can be a significant source of sediment in the impaired creeks, but data were not available to confirm or quantify this.

TMDL SUMMARY FOR SHE CREEK

Parameter	Wasteload Allocation	Load Allocation	TMDL	Percent Reduction
Fecal Coliform	0 cfu/day	200 cfu/100 ml	200 cfu/100 ml	Not required
Sediment (Biota)	0 tons/yr (see note 1)	871 tons/yr	871 tons/yr	70%

Notes:

1. Wasteload allocation shown is for continuous discharge facilities; construction activities regulated under the NPDES program are required to comply with the conditions outlined in their permits.

Under the authority of Section 303(d) of the Clean Water Act, 33 U.S.C. 1251 et seq., as amended by the Water Quality Act of 1987, P.L. 100-4, the U.S. Environmental Protection Agency is hereby establishing TMDLs for fecal coliform and sediment in She Creek. The Total Maximum Daily Loads (TMDLs) established for She Creek require effluent from point sources, where applicable, and waters originating from nonpoint sources shall not exhibit fecal coliform concentrations and sediment loadings above the limits set herein.

James D. Giattina, Director
Water Management Division

Date

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1. Introduction

TMDLs are required for impaired waters on a State's Section 303(d) list as required by the Federal Clean Water Act Section 303(d) and implementing regulation 40 CFR 130. A TMDL establishes the maximum amount of a pollutant a waterbody can assimilate without exceeding the applicable water quality standard. The TMDL then allocates the total allowable load to individual sources or categories of sources through wasteload allocations (WLAs) for point sources, and through load allocations (LAs) for non-point sources. In the TMDL, the WLAs and LAs provide a basis for states to reduce pollution from both point and non-point source activities that will lead to the attainment of water quality standards and protection of the designated use.

EPA placed She Creek on the Georgia's 303(d) list as impaired due to fecal coliform and biota. Sediment was identified as the probably source of impacted biota. She Creek, identified on the 303(d) list as GA-SV-She_Creek, is located in Rabun County, Georgia. Drainage from She Creek flows to Stekoa Creek, which discharges to the Chattooga River and eventually the Savannah River. The TMDL for She Creek satisfy the consent decree obligation established in *Sierra Club v. EPA*, Civil Action No: 94-CV-2501-MHS (N.D.GA). The Consent Decree requires TMDLs to be developed for all waters on Georgia's most current Section 303(d) list consistent with the schedule established by Georgia for its rotating basin management approach.

A multi-agency team, representing EPA, the U.S. Forest Service, GAEPD, and the GA Forestry Commission, evaluated water quality in the Chattooga River Basin. Results of this study were the basis for including She Creek on the 303(d) list. In 1994 and 1996, EPA Region 4 Science and Support Division (SESD) conducted habitat assessments in the Stekoa Creek watershed to support the She Creek biota listing and to identify reference streams in the watershed supporting healthy habitat. SESD scientist collected macroinvertebrate samples and qualitative assessment of stream habitat in accordance with rapid bioassessment protocols (Barbour et.al., 1999).

In 2001, EPA finalized sediment TMDLs for several streams in the Stekoa Creek watershed (EPA, 2001). The Stekoa Creek TMDL identified Cutting Bone Creek as a reference site supporting healthy habitat. The allowable loading in Cutting Bone Creek was estimated at 71 tons/square mile/year and was the basis of the TMDLs for the Stekoa Creek tributaries.

2. Watershed Characterization

She Creek is located in the Chattahoochee National Forest in Rabun County as shown in Figure 1. The She Creek watershed is within the Blue Ridge Mountain ecoregion (66d) characterized by forested slopes, high gradient, cool, clear streams and rugged terrain on a mix of igneous, metamorphic, and sedimentary rocks. She Creek is a tributary to the Chattooga River watershed. A description of the Chattooga watershed can be found in

the Clemson University report on Sedimentation in the Chattooga River Watershed (Van Lear, et. al., 1995).

The drainage area of the She Creek watershed is approximately 5.5 square miles. Land cover in the She Creek watershed is predominately forest. Landuse characteristics, based on National Land Cover Data (NLCD) of 1995, for the She Creek watershed and reference streams are shown in Table 1.

Table 1. Landuse Characteristics (acres)

Land Cover	She Creek
Cropland	11
Forest	3349
Commercial, Industrial, Transportation	3
Urban	26
Pasture	90
Barren, Transitional	17
Water	4
Total Area	3500

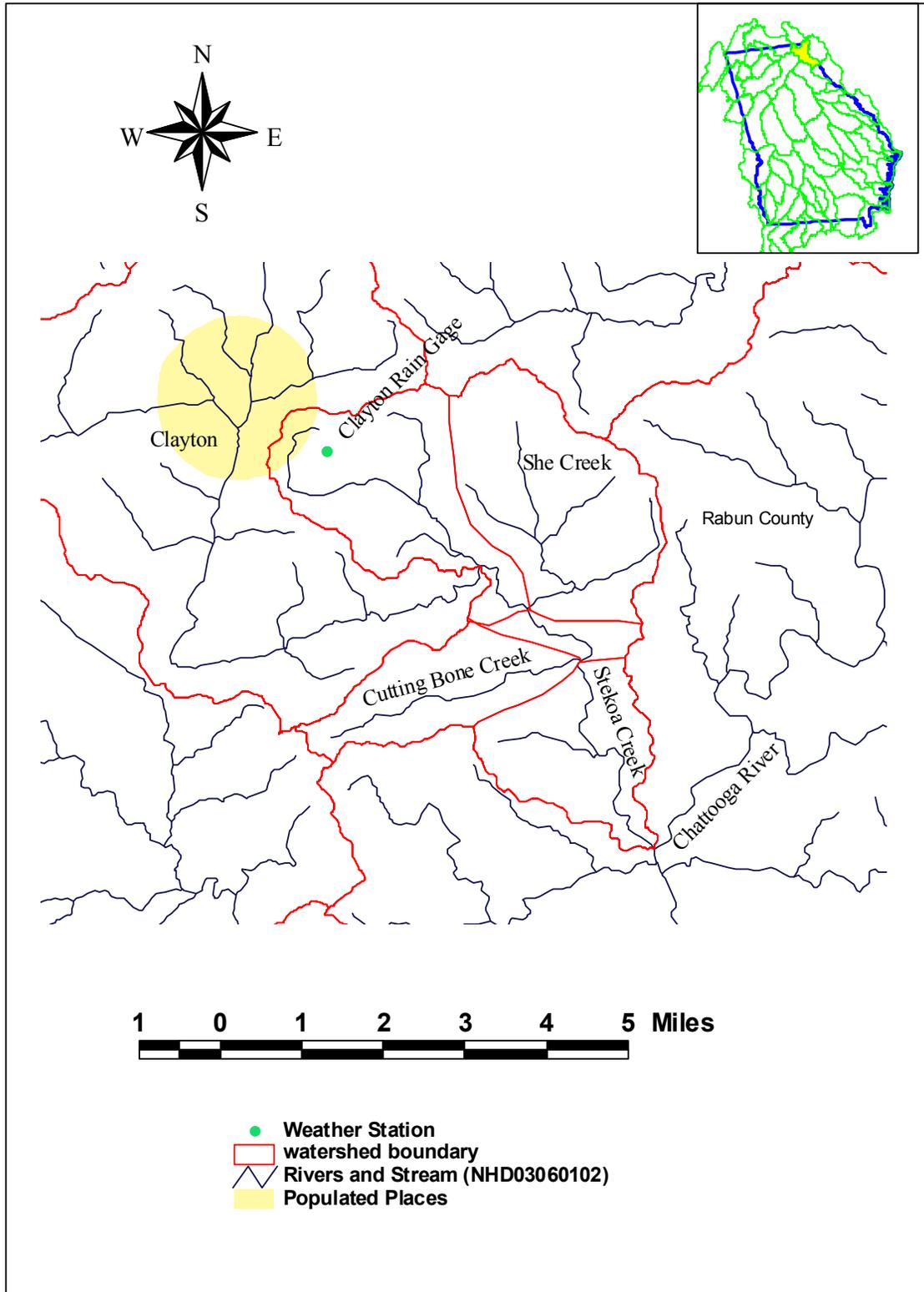


Figure 1. She Creek Location Map

3. Target Identification

The water use classification for the impaired waterbodies is fishing. The fishing classification, as stated in *Georgia's Rules and Regulations for Water Quality Control Chapter 391-3-6-.03(4)(c)* (GAEPD, 2004) applies to: Fishing, Propagation of Fish, Shellfish, Game and Other Aquatic Life.

3.1 Numerical Target for Fecal Coliform

An excerpt of the water quality standard for fecal coliform bacteria, as stated in the *State of Georgia's Rules and Regulations for Water Quality Control, Chapter 391-3-6-.03(iii)* (GAEPD, 2004) is:

For the months of May through October, when water contact recreation activities are expected to occur, fecal coliform not to exceed a geometric mean of 200 per 100ml based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours. For the months of November through April, fecal coliform not to exceed a geometric mean of 1000 per 100ml based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours and not to exceed a maximum of 4,000 per 100ml for any sample.

The above standard does not allow evaluation of data during the summer months (i.e., May through October) when less than four samples are collected in a 30-day period. EPA 305(b) listing guidance considers a stream impaired for fecal coliform bacteria if 10 percent of the samples exceed 400 per 100ml. EPA used this guidance to add She Creek to the Georgia 303(d) list.

3.2 Numerical Target for Sediment

GAEPD has established narrative criteria for sediment that applies to all waters of the State. The purpose of the narrative standard is to prevent objectionable conditions that interfere with legitimate water uses, as stated in *Georgia Regulation 391-3-6-.03(5)(c)* (GAEPD, 2004):

All waters shall be free from material related to municipal, industrial, or other discharges which produce turbidity, color, odor or other objectionable conditions which interfere with legitimate water uses.

3.3 Target Selection

The target for the fecal coliform TMDL is the ambient concentration of 200 per 100ml as stated in the Georgia Rules and Regulations. The sediment TMDL target is based on the hypothesis that if the long-term annual sediment load in She Creek is similar to a biologically unimpacted, healthy stream in the same ecoregion, then the impacted waterbody will remain stable and not be biologically impaired due to sediment. The target load in the Stekoa Creek TMDL was the loading transported in Cutting Bone

Creek, estimated at 71 tons/sq.mile/yr (USEPA, 2001a). She Creek and Cutting Bone Creek are both tributaries to Stekoa Creek. It is appropriate to use the target load established in the Stekoa Creek TMDL to develop the sediment TMDL for She Creek.

4. Water Quality and Habitat Assessment

4.1 Fecal Coliform Data

She Creek was placed on the Georgia 303(d) list as not supporting the Fishing designated use classification based on data collected during an assessment of pollutant sources in the Stekoa Creek watershed (Maas, 1993). Fecal coliform data collected during this study is shown in Table 2 and illustrated graphically in Figure 2. Rainfall measurements collected at the NOAA station in Clayton, Georgia is included on Figure 2 to identify trends between elevated coliform levels and rainfall. Based on the available data, elevated coliform levels occur in response to rainfall events. The solid line on this plot is the one-day maximum water quality criteria. This criterion is valid during the months November through April. In other months, the State of Georgia does not have a one-day maximum criteria for fecal coliform.

Table 2. Fecal Coliform Concentration in She Creek (Maas, 1995)

Date	Fecal Coliform (cfu/100ml)
8/6/93	420
8/25/93	3,100
9/23/93	200
10/6/94	144
11/9/94	273
1/5/95	135

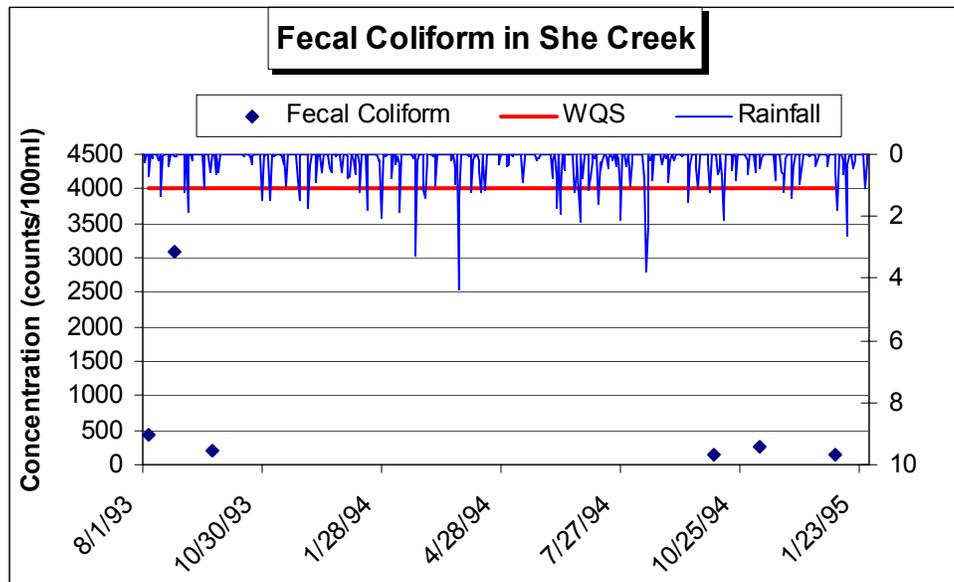


Figure 2. Fecal Coliform Measurements in She Creek

Insufficient fecal coliform data were collected on She Creek to evaluate the geometric mean criteria. With the limited data collected during the months of November through April, there were no violations of the one-day maximum criteria. EPA added She Creek to the Georgia 303(d) list based on 305(b) listing guidance for streams with limited data, which considers a stream impaired for fecal coliform if 10 percent of the samples exceed 400 cfu per 100 ml. Based on available data, two of the six samples, or 33%, exceeded 400 cfu/100ml.

4.2 Habitat Assessment

Criteria SESD used in selecting the reference sites included: 1) level of human disturbance; 2) accessibility; 3) representativeness; and 4) health of the stream. Other considerations included lack of permitted discharges, landuse classification, and good riparian conditions. SESD collected macroinvertebrate samples to provide additional information on water quality conditions. Detail information on habitat assessment criteria can be found in the assessments conducted as part of the Stekoa Creek TMDL (USEPA 1999a).

Habitat assessments were completed in She Creek in 1995. The habitat assessment evaluates the stream's physical parameters and is broken in three levels: 1) instream characteristics affecting biological communities (e.g., instream cover, epifaunal substrate, embeddedness, and riffle frequency); 2) channel morphology, and 3) riparian zone surrounding the stream. Results of the habitat assessment are shown in Table 3. A summary of biologic indices observed in She Creek is shown in Table 4. In this table, a low value for the percent dominate taxa is desirable as this indicates a balance in the species present in the water.

Table 3. Habitat Scores for She Creek (1995)

Habitat Index	Habitat Score
Instream Cover (Fish)	17
Epifaunal Substrate	11
Embeddedness	2
Riffle Frequency	16
Channel Alteration	19
Sediment Deposition	3
Channel Flow Status	15
Bank Vegetation (left)	7
Bank Vegetation (right)	5
Bank Stability (left)	9
Bank Stability (right)	5
Riparian Zone (left)	10
Riparian Zone (right)	7
Habitat Total	117

Table 4. Summary of Biological Community Index in She Creek

Biological Index	Score
EPT Index	7
Taxa Richness	16
% Dominate Taxon	36.2%

5. Source Assessment

A TMDL evaluation examines the known potential sources of the pollutant in the watershed, including point sources, nonpoint sources, and background levels. For the purpose of these TMDLs, facilities under the National Pollutant Discharge Elimination System (NPDES) Program are considered point sources.

5.1 Point Sources

Discharge from municipal and industrial facilities may contribute fecal coliform as well as biologically active and inert solids to receiving waters as TSS and/or turbidity. There are no NPDES discharges in She Creek watershed.

Soil erosion from construction sites is a major source of sediment in Georgia's streams. The State of Georgia requires construction sites over one acre to have a General Storm Water NPDES permit. The permit authorize the discharge of storm water associated with construction activity in accordance with the limitations, monitoring requirements, and other conditions set forth in the permit. All construction sites are required to have an Erosion and Sediment Control Plan; to implement, inspect, and maintain BMPs; and to monitor storm water for turbidity. The permit can be considered a water quality-based permit, in that the numerical limits in the permit, if met and enforced, will not cause a water quality problem in an unimpaired stream or contribute to an existing problem in an impaired stream.

5.2 Nonpoint Sources

Wildlife, septic systems, agricultural, and human activities associated with hiking and camping are identified as possible nonpoint sources contributing to the coliform levels in the Stekoa Creek watershed (Maas, 1993 and Hansen et al, 1995). Based on the landuse distribution, agricultural activities are not prevalent in the watershed and not likely a major contributor to elevated coliforms in the stream.

Roads, bare ground (i.e., non-permitted construction type sites, etc.), and development are sited as the major nonpoint source of sediment in the She Creek watershed (Van Lear, et al, 1995). A detailed road survey was conducted as part of the Clemson University study of sedimentation in the Chattooga River watershed and found gravel and unsurfaced roads as the greatest frequency of sediment sources. The noted causes of sedimentation from roads were: 1) poor location and design; 2) rutting, gullyng, and sheet erosion of road surfaces; 3) road bank slumping; 4) erosion of road side ditches; 5) stream and drainage crossings; 6) poor placement of ditch turnouts or outlets; 7)

inadequate frequency or maintenance of surface drainage features; and 8) improperly located or functioning culverts. Many of the unpaved, open roads surveyed in the study were within the National Forest.

6. Sediment Modeling Approach

EPA and Tetra Tech developed the Arcview-based Watershed Characterization System (WCS) to provide tools for characterizing various watersheds (USEPA, 2001b). WCS was used to display and analyze geographic information system (GIS) data including landuse, soil type, ground slope, road networks, NPDES discharges, and watershed characteristics. An extension of WCS is the Sediment Tool, which provides a mechanistic, simplistic simulation of precipitation-driven runoff and sediment delivery based on the Universal Soil Loss Equation (USLE).

The USLE equation is designed as a method to predict average annual soil loss caused by sheet and rill erosion. While it can estimate long-term annual soil loss and guide on proper cropping, management, and conservation practices, it cannot be applied to a specific year or storm event. A summary of USLE input parameters used to estimate the watershed loadings in She Creek is provided in Appendix A. Details of the WCS Sediment Tool are documented in the TMDL developed for sediment in Headstall Creek in the Savannah River Basin (GAEPD, 2004).

The WCS Sediment Tool assumes all the sediment in the stream originates from the watershed. For streams characterized by extremely unstable banks the Sediment Tool may underestimate the load, as sediment originating from streambank sloughing may be a major source of sediment as compared to the loadings from the watershed. Therefore, the WCS Sediment Tool provides an estimate of the chronic, or long-term, impact of sediment discharging from the watershed and represent average conditions during all seasons.

The Sediment Tool divides the watershed into a grid network based on elevation data (30 by 30 meter data). For each grid cell within the watershed, the Sediment Tool calculates the potential erosion using the USLE and each cell's specific characteristics. The model routes the sediment through each grid cell until it reaches the stream. The stream grid network incorporates flow and has the capability of accumulating flow. Sediment loadings in She Creek based on results of the WCS Sediment Tool analysis are shown in Table 5.

Table 5. Estimated Sediment Loadings for Existing (chronic) Conditions

Waterbody	Drainage Area (mi²)	Yield (tons/mi²/yr)	Total Load (tons/yr)
She Creek	5.48	231	871

7. Total Maximum Daily Load (TMDL)

A TMDL establishes the total pollutant load a waterbody can assimilate and still achieve water quality standards. The components of a TMDL include a wasteload allocation (WLA) for point sources, a load allocation (LA) for nonpoint sources (including natural background), and a margin of safety (MOS), either implicitly or explicitly, to account for uncertainty in the analysis. Conceptually, a TMDL is defined by the equation:

$$\text{TMDL} = \Sigma \text{WLA} + \Sigma \text{LA} + \text{MOS}$$

The fecal coliform TMDL for the She Creek is expressed in terms of concentration, as flow data are not available to calculate loads. The sediment TMDL is expressed in terms of sediment yield, in units of tons/mi²/yr, based on average annual area-weighted loads calculated using the WCS Sediment Tool. It is acceptable for TMDLs to be expressed through other appropriate measures (e.g., concentration and sediment yield) other than mass loads per time (40 CFR 130.2). TMDL components are shown in Table 6. A summary of the TMDL is provided in Appendix B.

Table 6. TMDL Components

Parameter	Wasteload Allocation	Load Allocation	TMDL	Percent Reduction
Fecal Coliform	0 cfu/day	200 cfu/100ml	200 cfu/100ml	Not Required
Sediment (Biota)	0 tons/yr (see note 1)	871 tons/yr	871 tons/yr	70%

Notes:

1. Wasteload allocation shown is for continuous discharge facilities; construction activities regulated under the NPDES program are required to comply with the conditions outlined in their permits.
2. Load Allocation based on an area weighted sediment load of 159 tons/mi²/yr estimated for stable streams in the ecoregion

7.1 Wasteload Allocation (WLA)

Wasteload allocations are provided to point source discharge from industrial and municipal facilities as well as permitted stormwater discharges. There are no industrial or municipal NPDES facilities continuously discharging fecal coliform or sediment in the She Creek watershed.

Compliance with the Georgia Storm Water Permit will ensure construction sites meet the TMDL area weighted loadings. EPA assumes that construction activities in the watershed will be conducted in compliance with Georgia's Storm Water Permit including

monitoring and discharge limitations. Compliance with these permits should lead to sediment loadings from construction sites at or below applicable targets.

7.2 Load Allocation (LA)

Nonpoint sources are considered to be the primary cause of sediment impairment and elevated fecal coliform concentrations in She Creek. Wildlife, septic systems, and human activity associated with hiking and camping contribute fecal coliform to She Creek. Previous studies have indicated the elevated fecal coliform problems in the Stekoa Creek watershed are avoidable and reasonable management options and practices exist to help alleviate problems (Hansen, et al 1995).

Sediment from roads and construction activities are the primary source of sediment impairment in Shed Creek. Restoration of riparian buffer zones is recommended. Further ongoing monitoring needs to be completed to monitor progress and to assure further degradation does not occur.

For those land disturbing activities related to silviculture that may occur on public lands, it is recommended that practices as outlined for landowners, foresters, timber buyers, loggers, site preparation and reforestation contractors, and others involved with silvicultural operations follow the practices to minimize nonpoint source pollution as outlined in "Georgia's Best Management Practices for Forestry (GAEPD 1999).

7.3 Margin of Safety

A Margin of Safety (MOS) is a required component of a TMDL that accounts for the uncertainty in the relationship between the pollutant loads and the quality of the receiving waterbody. The MOS is typically incorporated into the conservative assumptions used to develop the TMDL. A MOS is incorporated into these TMDLs by selecting the average sediment loading numerical target rather than the greatest allowable sediment loading value for streams that have been identified as having good habitat and biology.

7.4 Critical Conditions

The average annual watershed load represents the long-term processes of sediment accumulation of sediments in the stream habitat areas that are associated with the potential for habitat alteration and aquatic life effects.

7.5 Seasonal Variation

Seasonal variation is incorporated in these TMDLs through the use of average annual loads.

8. Recommendations

EPA and EPD have developed Implementation Plans for sediment TMDLs in other impaired waterbodies in the state. Details of this plan can be found in “*Total Maximum Daily Load Evaluation for Headstall Creek in the Savannah River Basin for Sediment (Biota impacted)*” (GAEPD, 2004). In summary, the Implementation Plan includes a list of best management practices (BMPs) and provides for an initial implementation of demonstration projects to address one or more of the major sources of pollutants identified in the TMDL.

Unpaved roads (and their use) are considered the major contributors of sediment to the Chattooga River and its tributaries (Van Lear et al, 1995). Recommendations made in studies of sediment in the Chattooga River for She Creek include vegetate stream banks, install silt fence prior to development, stabilize mineral soil away from stream banks and use suitable stream crossing structures. For road sections that run parallel to the creek and slump into the creek, establishing sediment barricades between road and creek, relocating road sections or paving unpaved roads may reduce sediment from entering the creek.

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APPENDIX A
WCS SEDIMENT PARAMETERS

Table A- 1. USLE Parameters used in She Creek Sediment Model

Parameter	She Creek	
	Min	Max
LS Factor	0.076	37.719
K Factor	0.23	0.25
P Factor	1	1
C Factor	0	0.12
R Factor	300	300
Weighted R Factor	300	300
Composite Erosion	0	33.769
Composite Sediment	0	26.581

APPENDIX B
TMDL SUMMARY

TMDL Summary Components

1. 303(d) Listed Waterbody Information

State: Georgia
Location: Rabun County
Major River Basin: Savannah
8-digit HUC: 03060102
Watershed Area: 5.48 square miles
Tributary To: Stekoa Creek
Ecoregion: Blue Ridge Mountains Southern Igneous Ridges and Mountains (66d)
Constituent(s) of Concern: Fecal Coliform and Biota
Designated Use: Fishing

Applicable Water Quality Standard:

Fecal Coliform:

For the months of May through October, fecal coliform not to exceed a geometric mean of 200 per 100ml. For the months of November through April, fecal coliform not to exceed a geometric mean of 1000 per 100ml and not to exceed a maximum of 4,000 per 100ml for any sample. Geometric means based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours.

Sediment:

All waters shall be free from material related to municipal, industrial, or other discharges which produce turbidity, color, odor, or other objectionable conditions which interfere with legitimate water uses.

2. TMDL Development

Fecal Coliform: Ambient concentration-based limits

Sediment:

Watershed-scale loadings of sediment were simulated using the Watershed Characterization System Sediment Tool. The Sediment Tool is based on the Universal Soil Loss Equation (USLE).

3. TMDL Allocations

Parameter	Wasteload Allocation	Load Allocation	TMDL	Percent Reduction
Fecal Coliform	0 cfu/day	200 cfu/100ml	200 cfu/100ml	Not Required
Sediment (Biota)	0 tons/yr (see note 1)	871 tons/yr	871 tons/yr	70%

Notes:

1. Wasteload allocation shown is for continuous discharge facilities; construction activities regulated under the NPDES program are required to comply with the conditions outlined in their permits.

Margin of Safety (MOS): Implicit