# TOTAL MAXIMUM DAILY LOAD (TMDL)

# For
# Sediment

**In the Chattooga River Watershed**

**For Segments**

**Stekoa Creek Watershed**

**Stekoa Creek**

**Scott Creek**

**Pool Creek**

**Chechero Creek**

**Saddle Gap Creek**

**Warwoman Creek Watershed**

**Upper Warwoman Creek**

**Roach Mill Creek**

**West Fork Creek Watershed**

**Law Ground Creek**

EPA
United States
Environmental Protection
Agency

Region 4
serving the southeast

# TOTAL MAXIMUM DAILY LOAD (TMDL)

# Sediment

### In the Chattooga River Watershed

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 a TMDL for sediment for the protection of aquatic life in the following segments of the Chattooga River Watershed in Georgia:

Stekoa Creek

Scott Creek

Pool Creek

Chechero Creek

Saddle Gap Creek

Upper Warwoman Creek

Roach Mill Creek

Law Ground Creek

**The calculated allowable load of sediment that may come into the identified segments of the Chattooga River Watershed without exceeding the water quality target is a daily maximum of 11 tons/sq.mi./day; a low to mean flow instream sediment concentration range of 3 to 13 mg/l; and an annual loading of 90 tons/sq.mi./year.** EPA interpreted the State of Georgia's narrative water quality standard for fish and wildlife for the protection of aquatic life to determine the applicable water quality target. Based on a current estimated annual loading ranging from 150 to 500 tons/sq.mi./year, an estimated 20 to 80 percent reduction in sediment loading is needed for the identified sections of the Chattooga River Watershed to meet the applicable water quality target.

Original signed by ______ ______04/30/2001_

Beverly H. Banister, Director Date

Water Management Division

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# 1. Executive Summary

The U.S. Environmental Protection Agency (EPA) Region 4 is establishing this Total Maximum Daily Load (TMDL) for sediment in the Chattooga River Watershed. The 303(d) listed segments in Georgia are:

- Stekoa Creek
- Scott Creek
- Pool Creek
- Chechero Creek
- Saddle Gap Creek
- Upper Warwoman Creek
- Roach Mill Creek
- Law Ground Creek

Seven of these segments are listed on the State of Georgia's 2000 Section 303(d) list of impaired waters because of excessive sedimentation. The eighth segment, Roach Mill Creek, is impaired based on biological community and habitat impairment (due to excessive sedimentation). This TMDL identifies the allowable daily maximum, low to mean flow instream sediment concentration, and annual load of sediment for the Chattooga River Watershed that will result in attainment of the applicable narrative water quality standard.

This TMDL satisfies a consent decree obligation established in Sierra Club, et. al. v. EPA, Civil Action, 1: 94-CV-2501-MHS. The State of Georgia requested EPA to develop this TMDL for the impaired segments of the Chattooga River Watershed, and as such, EPA is establishing this TMDL for Georgia for the 8 listed segments of the Chattooga River Watershed. Although the midline of the Chattooga River Watershed serves as the east-west boundary between the states of Georgia and South Carolina and the north-south boundary between the states of Georgia and North Carolina, the TMDL does not provide wasteload allocations to South or North Carolina NPDES facilities. This TMDL reflects assumptions that sediment loads in the South and North Carolina portion of the Chattooga River Watershed will meet the applicable Georgia water quality standards at the South and North Carolina-Georgia border.

EPA originally proposed this TMDL for sediment for the Chattooga River Watershed on December 28, 2000. The public comment period for this proposal closed on January 28, 2001. By establishing this TMDL at this time, EPA is satisfying a court order to finalize this TMDL by April 30, 2001. This TMDL is being established in phases with this TMDL document representing the first phase of the process. If necessary, EPA expects to develop a revised TMDL for sediment for the Chattooga River Watershed in 2004. EPA believes that a phased approach is appropriate for this TMDL because information on the actual contributions of sediment to the Chattooga River Watershed from both point and nonpoint sources will be much better characterized in the future. In addition, information related to whether source reductions are being achieved can be reviewed to determine if any allocations of the load should be revisited.

In order for this TMDL to be developed, the applicable water quality target must be determined. The State of Georgia does not have a numeric water quality standard for the protection of aquatic life from excessive sedimentation. Based on site-specific field data from the Chattooga River Watershed, EPA has derived a numeric interpretation of the State of Georgia's narrative water quality standard for sediment to protect aquatic life due to excessive sedimentation. This interpretation of Georgia's water quality standard was based on site-specific data gathered for the Chattooga River Watershed in 1998 to 2000 specifically for the purpose of this TMDL. It does not apply to any other waters in the State of Georgia. In addition, in any future TMDLs for the Chattooga River Watershed, it is possible that EPA may revise this interpretation of the State's water quality standard based on new site-specific data collected at that time.

**The calculated allowable load of sediment that may come into the identified segments of**

**the Chattooga River Watershed without exceeding the water quality target is a daily maximum of 11 tons/sq.mi./day; a low to mean flow instream sediment concentration range of 3 to 13 mg/l (0.007 lbs/sq.mi./day to 0.12 lbs/sq.mi./day); and an annual loading of 90 tons/sq.mi./year**.

EPA interpreted the State of Georgia's narrative water quality standard for fish and wildlife for the protection of aquatic life to determine the applicable water quality target**. Based on a current estimated annual loading ranging from 150 to 500 tons/sq.mi./year, an estimated 20 to 80 percent reduction in sediment loading is needed for the identified sections of the Chattooga River Watershed to meet the applicable water quality target.** For determining appropriate control strategies and implementation plans for nonpoint sources, the percent reduction in sediment loading for annual average loads is needed.

## 2. Phased Approach to the TMDL

EPA recognizes that it may be appropriate to revise this TMDL based on information gathered and analyses performed after the TMDL is established. With such possible revisions in mind, this TMDL is characterized as a phased TMDL. In a phased TMDL, EPA or the state uses the best information available at the time to establish the TMDL at levels necessary to implement applicable water quality standards and to make the allocations to the pollution sources. However, the phased TMDL approach recognizes that additional data and information may be necessary to validate the assumptions of the TMDL and to provide greater certainty that the TMDL will achieve the applicable water quality standard. Thus, the Phase 1 TMDL identifies data and information to be collected after the first phase TMDL is established that would then be assessed and would form the basis for a Phase 2 TMDL. The Phase 2 TMDL may revise the needed load reductions or the allocation of the allowable load or both. EPA intends to gather new information and perform new analyses so as to produce a revised or Phase 2 TMDL for sediment for the identified segments of the Chattooga River Watershed, if necessary, in 2004. The phased approach is appropriate for this TMDL because information on the actual contributions of sediment to the Chattooga River Watershed from both point and nonpoint sources will be much better characterized in the future and additional reductions determined, if needed..

## 3. Problem Definition

The water segments in the Chattooga River Watershed for which this TMDL is being established are listed on the State of Georgia's 2000 Section 303(d) list. Seven of these segments are listed on the State of Georgia's 2000 Section 303(d) list of impaired waters because of excessive sedimentation. The eighth segment, Roach Mill Creek, is impaired based on biological community and habitat impairment (due to excessive sedimentation).

The purpose of this TMDL is to establish the acceptable loading of sediment from all sources, such that sediment levels in the Chattooga River Watershed will not exceed the applicable water quality standard as interpreted by EPA for protection aquatic life.

## 4. Applicable Water Quality Standard

TMDLs are established at levels necessary to attain and maintain the applicable narrative and numerical water quality standards. (See 40 CFR Section 130.7(c)(1).) The State of Georgia's Rules and Regulations for Water Quality Control do not include a numerical water quality standard for aquatic life protection due to sediment. The narrative standard is to maintain the biological integrity of the waters of the State – Georgia's Water Quality Standard is established in Georgia's Rules and Regulations for Water Quality Control, Chapter 391-3-6, Revised July, 2000 Georgia Regulation 391-3-6-.03(2)(a).

## 5. Background

The Chattooga River Watershed is located in northeastern Georgia. The location of the watershed, with the Stekoa Creek Watershed highlighted, is shown in Figure 1.

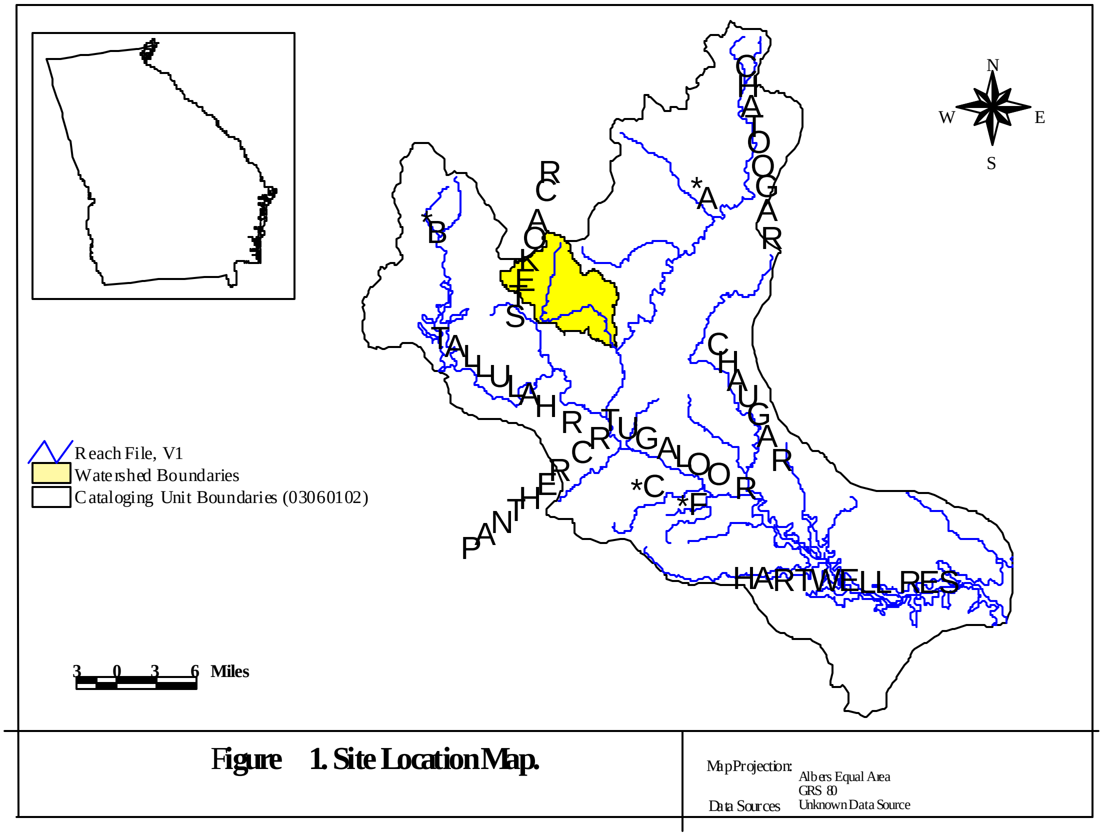


**Figure 1: Chattooga Watershed Location Map**

EPA developed TMDLs for each of the eight listed segments in the watershed. Figures 2 to 4 illustrate the drainage areas of the listed segments in the Stekoa Creek, Warwoman Creek and West Fork watersheds.

# Stekoa Creek Tributary Watersheds

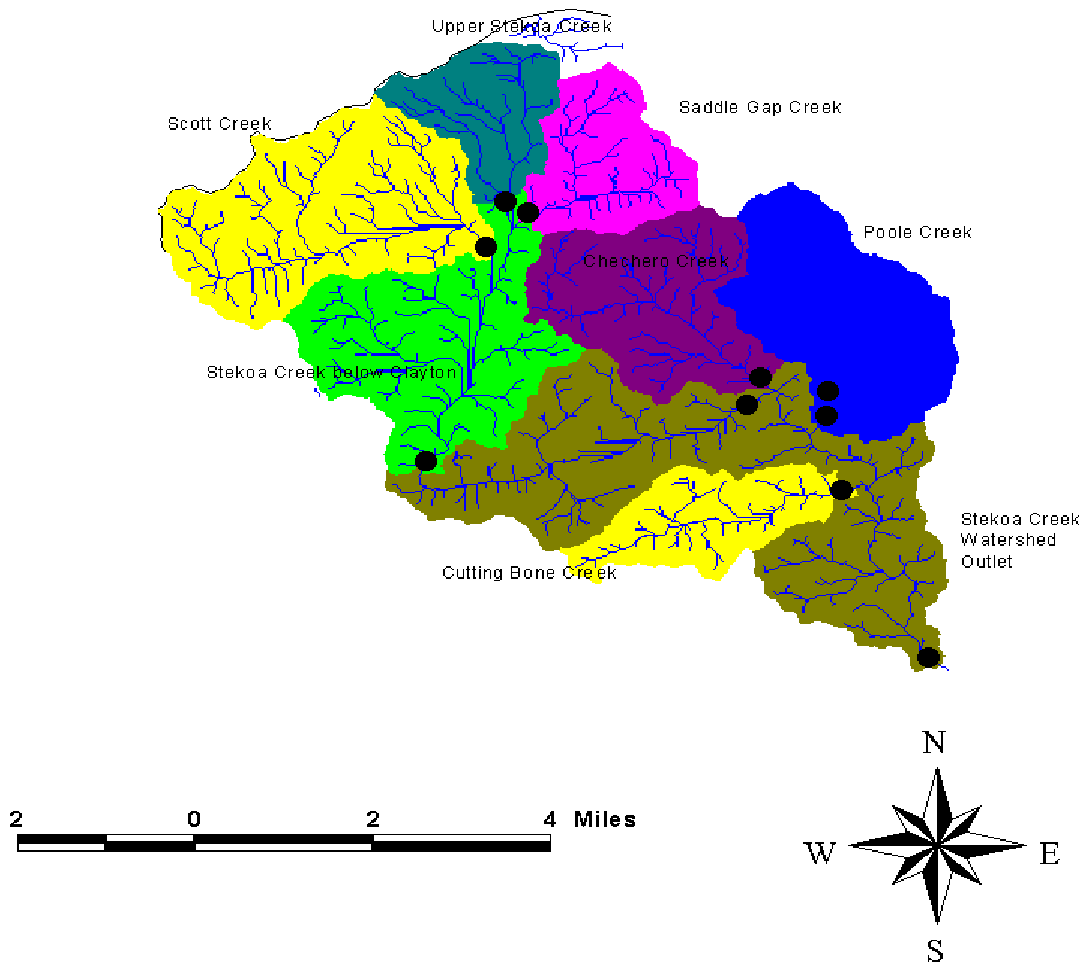


**Figure 2: Stekoa Creek Tributary Watersheds**

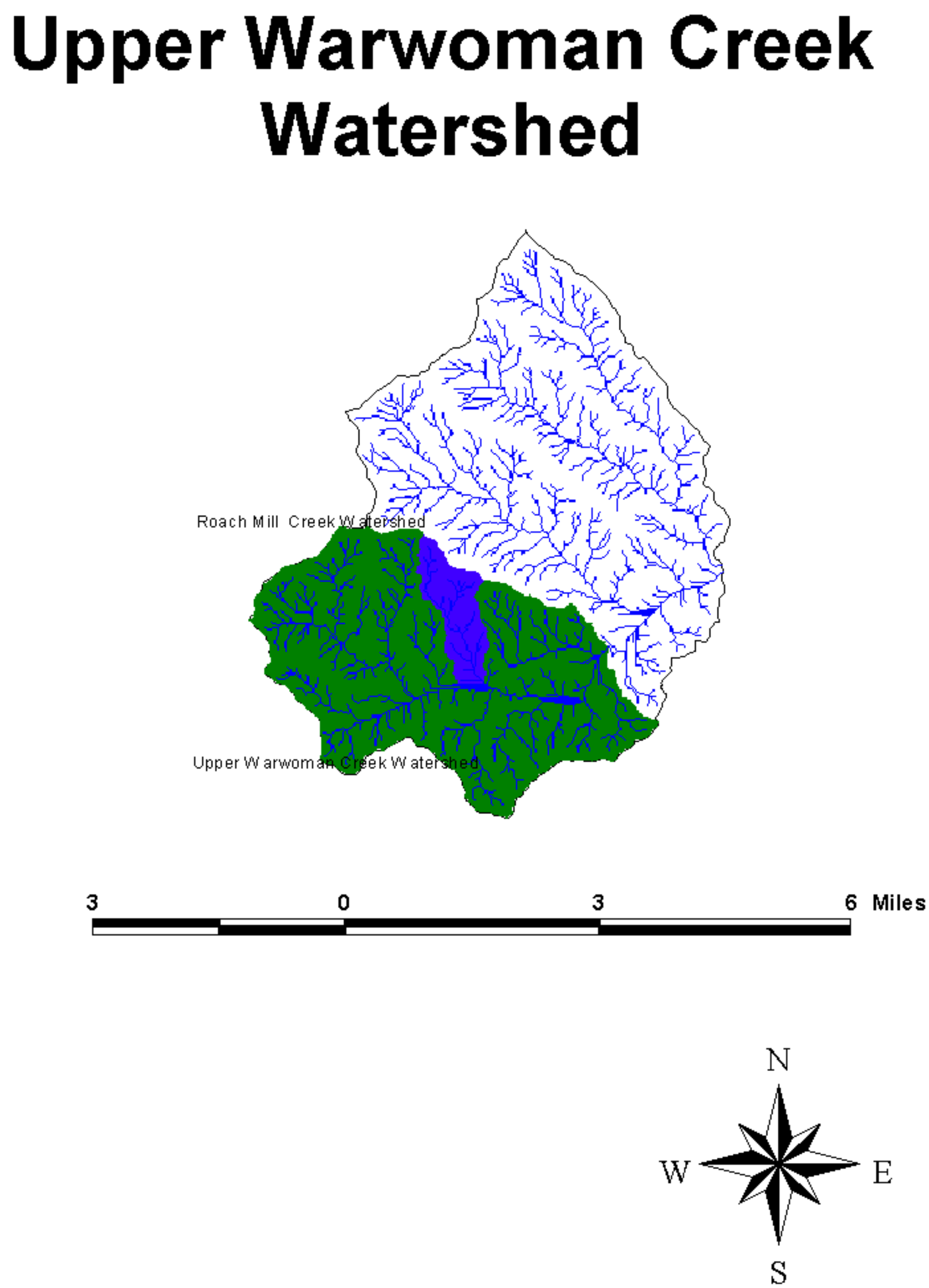


**Figure 3: Upper Warwoman Tributary Watersheds**

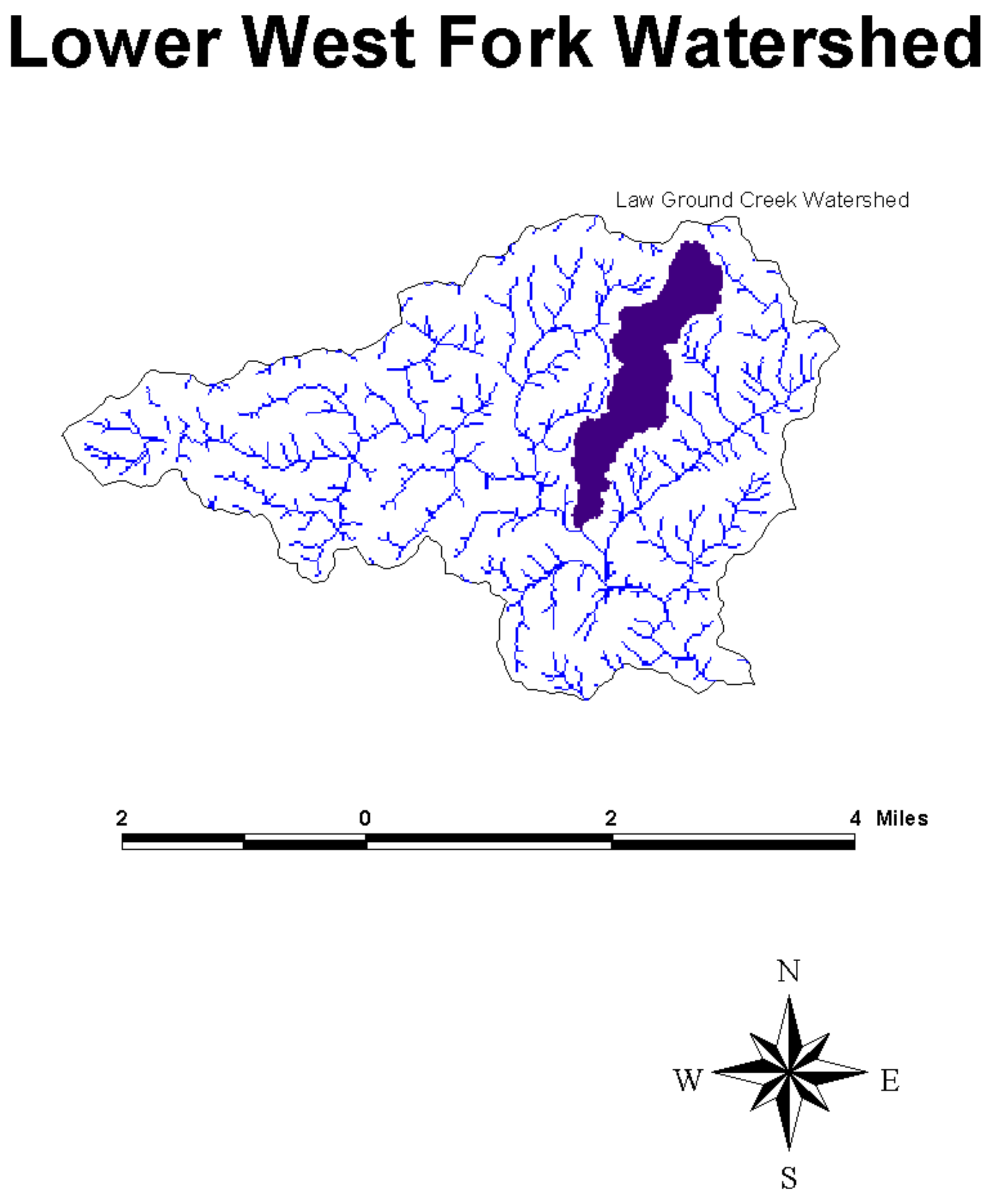


**Figure 4: Lower West Fork Tributary Watersheds**

Each watershed contains several different types of land uses. Different land uses collect and distribute sediment at different rates as a function of runoff and erosion. Figure 5 illustrates the landuses in the Chattooga Watershed.

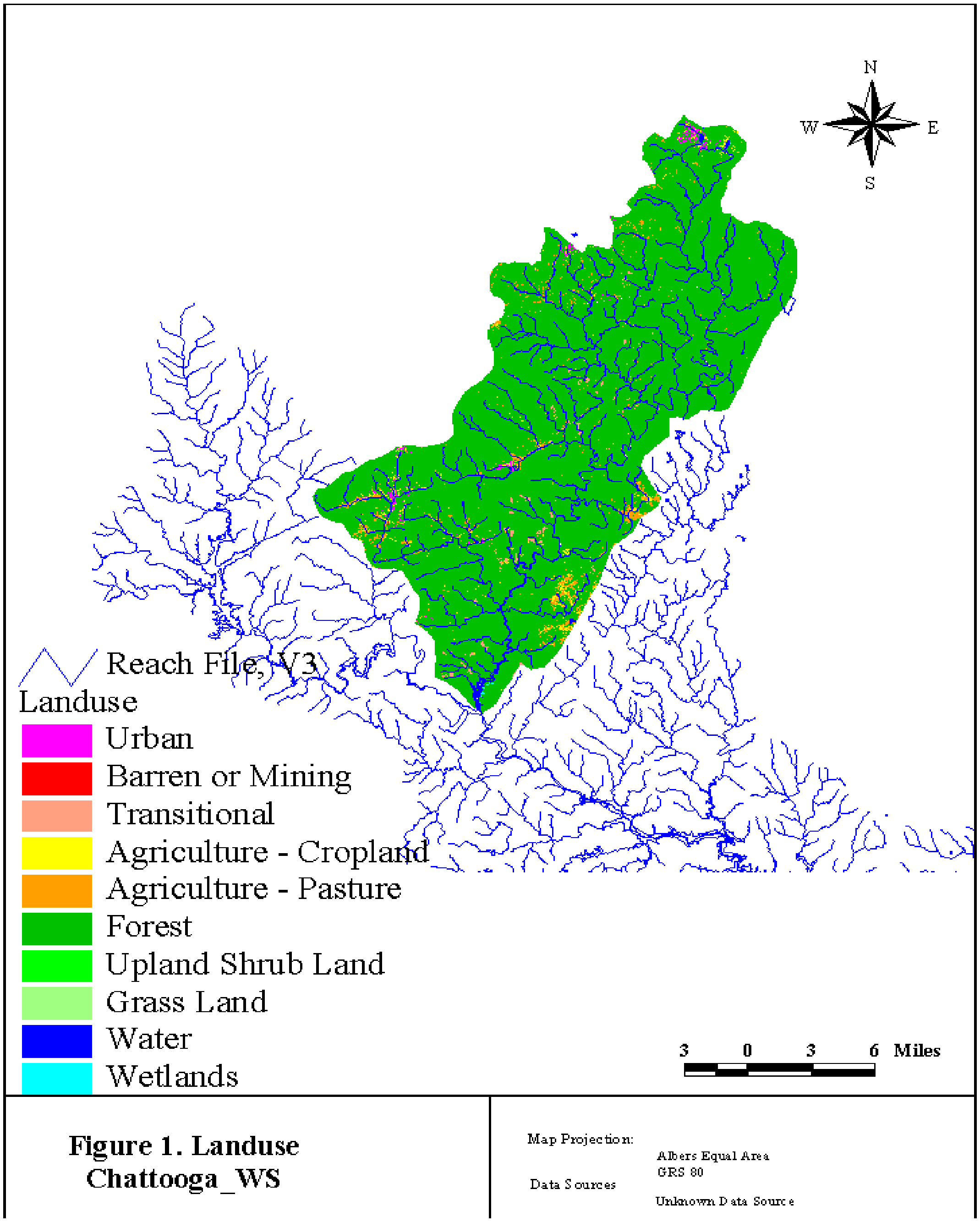


Figure 5: Chattooga Watershed Landuses

## 5.1. 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 this TMDL, facilities permitted under the National Pollutant Discharge Elimination System (NPDES) Program are considered point sources.

### *5.1.1. Point Sources:*

One wastewater treatment facility point source is located in the Georgia portion of the 303(d) listed streams. The Clayton Wastewater Treatment Facility (Permit # GA0021806) discharges directly to Stekoa Creek below Clayton. With a design discharge flow of 0.5 million gallons per day; the total maximum daily sediment permitted load is 0.06 tons/day of Total Suspended Solids (TSS) or 0.04% of the average yearly load. This point source sediment load does not represent a significant impact on the stream's sediment budget. The wastewater treatment facility point source load is a minor component and the organic "sediment" being measured by the TSS monitoring does not necessarily cause a habitat problem.

Other potential point sources discharges in the Georgia portion of the listed streams are storm water discharges associated with construction activity. The State of Georgia Department of Natural Resources, Environmental Protection Division has developed a general storm water permit. All existing and new storm water point sources within the State of Georgia, that are required to have a permit, are authorized to discharge storm water associated with construction activity to the waters of the State of Georgia in accordance with the limitations, monitoring requirements and other conditions set forth in Parts I through VII of the Georgia Storm Water General Permit. The permit limitations are established to assure that the storm water runoff from these point source sites does not cause or contribute to the existing sediment impairment. A Comprehensive Monitoring Plan with turbidity monitoring requirements is required to assure any storm water discharge from the site does not cause or contribute to the existing sediment problem.

The Georgia General Storm Water Permit for Construction Activities (Storm Water Permit) was developed to reduce the input of sediment from construction activities. In the Upper Stekoa Creek Watershed, based on the available mid 1990s landuse information, it was estimated that, absent the limitations established by the Storm Water Permit, construction would contribute 450 tons/square-mile/year to the stream sediment load. Implementation of the Storm Water Permit in the Upper Stekoa Creek Watershed, which has the highest contribution from construction activities, should reduce the sediment contributed by these construction activities to 55 tons/square-mile/year (0.45 lbs/day/acre), which is below the target of 90 tons/square-mile/year. This reduced load would be less than 1% of the total sediment allowable load for the Upper Stekoa Creek Watershed.

The Georgia General Storm Water Permit can be considered to be a water quality-based permit, in that the numeric limits in the permit, if met and enforced, will not cause a water quality problem in a unimpaired stream or contribute to an existing problem in an impaired stream. It is recommended that for impaired watersheds, the cold water (trout stream) turbidity table be used.

### *5.1.2. Existing Nonpoint Watershed Sediment Loads:*

The long–term sediment watershed load was calculated using the Universal Soil Loss Equation (USLE) (see Section 7) and broken down by land use sediment sources and road erosion sediment sources. The current estimated long–term area weighted watershed sediment loads for the listed streams in the Chattooga River Watershed are shown in Table 1.

**Table 1: Watershed Sediment Loads**

| **Listed Streams - Georgia** | Watershed | Watershed (Tons/Year) | Road (Tons/Year) | Area (Sq.Mi.) | Total (Tons/Yr) | Area Weighted (Tons/Year/Sq.Mi.) |
|---|---|---|---|---|---|---|
| Scott Creek | Stekoa | 205 | 873 | 6.1 | 1078 | 177 |
| Stekoa Creek above Clayton | Stekoa | 319 | 467 | 1.7 | 786 | 461 |
| Saddle Gap Creek | Stekoa | 205 | 873 | 2.7 | 1078 | 392 |
| Chechero Creek | Stekoa | 342 | 395 | 4.2 | 737 | 175 |
| Pool / She Creek | Stekoa | 257 | 247 | 4.8 | 504 | 106 |
| Cutting Bone Creek | Stekoa | 56 | 93 | 2.1 | 149 | 71 |

| | | | | | | |
|---|---|---|---|---|---|---|
| (unimpacted segment) | | | | | | |
| Stekoa @ Boggs Mt Rd. | Stekoa | 3030 | 4425 | 21.3 | 7455 | 351 |
| Upper Warwoman Creek | Upper Warwoman | 1031 | 1230 | 9.0 | 2251 | 250 |
| Roach Mill Creek | Upper Warwoman | 40 | 78 | 0.7 | 118 | 162 |
| Law Ground Creek | Lower West Fork | 25 | 226 | 0.9 | 251 | 269 |

The Georgia listed streams in the Chattooga River Watershed are in four 12-digit hydrologic unit code (HUC) watershed delineations. For each of these 12 digit HUCs, detailed information on sediment load by individual land coverage is provided below:

### *5.1.3. Upper Stekoa Creek Watershed – HUC 0306002001*

The listed segments in the Upper Stekoa Watershed are:

- Stekoa Creek
- Scott Creek
- Saddle Gap Creek

The Upper Stekoa Creek Watershed mid 1990s landuse information was used to develop the existing sediment loads. Table 2 provides the listing of the various landuses and the estimated annual contribution of sediment from each landuse category.

**Table 2: Upper Stekoa Watershed Landuse and Related Sediment Loads**

| Land use | Acres | Tons/Sq.Mi./Year |
|---|---|---|
| Open Water | 6 | 0 |
| Low Intensity Residential | 89 | 1453 |
| High Intensity Residential | 32 | 154 |

| | | |
|---|---|---|
| High Intensity Commercial | 157 | 122 |
| Bare Rock/Sand/Clay | 1 | 0 |
| Construction (Prior to the discharge limitations in the Storm Water Permit) | 6 | 47955 |
| Deciduous Forest | 7294 | 26 |
| Evergreen Forest | 1750 | 13 |
| Mixed Forest | 4077 | 13 |
| Pasture/Hay | 723 | 134 |
| Row Crops | 204 | 5939 |
| Other Grasses | 257 | 166 |
| Woody Wetlands | 2 | 1536 |
| Emergent Herbaceous Wetlands | 0 | 934 |
| Total Watershed Load without Roads | | 3030 tons/year |
| Roads | | 4425 tons/year |

### *5.1.4. Lower Stekoa Creek Watershed – HUC 0306002002*

The listed segments in the Lower Stekoa Creek Watershed are:

- Chechero Creek
- Pool Creek

The Lower Stekoa Creek Watershed mid 1990s landuse information was used to develop the existing sediment loads. Table 3 provides the listing of the various landuses and the estimated annual contribution of sediment from each landuse category.

**Table 3: Lower Stekoa Creek Watershed Landuse and Related Sediment Loads**

| Land use | Acres | Tons/Sq.Mi./Year |
|---|---|---|
| Open Water | 4 | 0 |
| Low Intensity Residential | 37 | 1818 |
| High Intensity Residential | 1 | 38 |
| High Intensity Commercial | 6 | 205 |
| Construction (Prior to the discharge limitations in the Storm Water Permit) | 26 | 109 |
| Deciduous Forest | 4100 | 26 |
| Evergreen Forest | 2211 | 13 |
| Mixed Forest | 3846 | 19 |
| Pasture/Hay | 196 | 160 |
| Row Crops | 40 | 7533 |
| Other Grasses | 83 | 179 |
| Woody Wetlands | 1 | 755 |
| Emergent Herbaceous Wetlands | 0 | 58 |
| Total Watershed Load without Roads in Listed Segments | | 599 tons/year |
| Roads in Listed Segments | | 642 tons/year |

### *5.1.5. Upper Warwoman Creek Watershed – HUC 0306002002*

The listed segments in the Upper Warwoman Creek Watershed are:

- Upper Warwoman Creek
- Roach Mill Creek

The Upper Warwoman Creek Watershed mid 1990s landuse information was used to develop the existing sediment loads. Table 4 provides the listing of the various landuses and the estimated annual contribution of sediment from each landuse category.

**Table 4: Upper Warwoman Watershed Landuse and Related Sediment Loads**

| **Land use** | **Acres** | **Tons/Sq.Mi./Year** |
|---|---|---|
| Open Water | 1 | 0 |
| Low Intensity Residential | 82 | 2726 |
| High Intensity Commercial | 5 | 224 |
| Construction (Prior to the discharge limitations in the Storm Water Permit) | 1 | 0 |
| Deciduous Forest | 4470 | 32 |
| Evergreen Forest | 4230 | 26 |
| Mixed Forest | 5470 | 26 |
| Pasture/Hay | 270 | 224 |
| Row Crops | 60 | 9549 |
| Other Grasses | 38 | 134 |
| Woody Wetlands | 1 | 1408 |
| Total Watershed Load without Roads | | 1031 tons/year |
| Roads | | 1230 tons/year |

### *5.1.6. Lower West Fork Creek Watershed – HUC 0306002002*

The listed segment in the Lower West Fork Creek Watershed is:

- Law Ground Branch

The Lower West Fork Creek Watershed mid 1990s landuse information was used to develop the existing sediment loads. Table 5 provides the listing of the various landuses and the estimated annual contribution of sediment from each landuse category.

**Table 5: Lower West Fork Watershed Landuse and Related Sediment Loads**

| **Land use** | **Acres** | **Tons/Sq.Mi./Year** |
|---|---|---|
| Open Water | 0.5 | 0 |
| Transitional | 104 | 454 |
| Deciduous Forest | 1480 | 26 |
| Evergreen Forest | 3400 | 26 |
| Mixed Forest | 3340 | 26 |
| Pasture/Hay | 74 | 710 |
| Row Crops | 6 | 23066 |
| Total Watershed Load without Roads in Listed Segment | | 25 tons/year |
| Roads for Listed Segment | | 226 tons/year |

# 6. EPA Region 4 Biological/Habitat Data and Information

Biological and habitat data were collected in 1998 to 2000 and reported in the "Assessment of Water Quality Conditions Chattooga River Watershed" (USEPA Region 4, 1999). Excerpts from that report are included below:

> The results of the analyses on Stekoa Creek at stations SC01 and SC02 indicate that the designated uses of this stream are partially supported. The biological ranking was fair at both SC01 and SC02 indicating some impairment of the community. The biological communities at both locations are impacted and community structures reflect the poor conditions of the stream. The results of the analyses indicate that the cause of the

impairment is likely due to the increase in sediment, which are primarily sands. The habitat rankings of both the EPA Rapid Biological Procedures (RBP) and Pfankuch indicated impacted habitat conditions at SC01. Some improvement in habitat was noted at SC02; however, the ranking was still in the fair range for the Pfankuch rating. The bottom substrate characteristics indicated that sand size and smaller particles were very prominent in this stream. Due to the impacted condition of the aquatic macroinvertebrate community, this stream should also be listed as partially meeting designated uses due to impairment of the biological community with the likely pollutant of concern listed as sediment.

Five streams that are tributaries to Stekoa Creek were also sampled. Three of these streams showed adverse impacts to the biological community. Pool Creek and Saddle Gap Creek had fair ratings for the macroinvertebrate community and Chechero Creek rated poor at the sample station location. Scott Creek, Saddle Gap, and Chechero Creeks had fair RBP habitat ratings while Pool Creek had poor habitat conditions. Analysis of the sediments of the stream indicated that these streams also had substrates dominated by fine sediments and sand sized particles. The biological condition of Scott Creek was good; however, due to habitat degradation, primarily related to the large amount of sand in the substrate, the designated use support is threatened. Based on the results of the analyses Stekoa Creek and the tributaries of Chechero Creek, Saddle Gap Creek, and Pool Creek are not fully supporting designated uses. Therefore, these streams should also be included on Georgia EPD’s 303(d) list with sediment listed as the pollutant of concern. Cutting Bone Creek was also sampled and the biological community was rated as good and the habitat was rated as good. However, observations of field personnel and sediment measures indicated that the stream substrate showed areas of increasing sediment deposits. The stream is recommended to be listed as fully supporting designated uses but placed on a watch list to provide increased attention to controlling sources of sediment inflow to the stream.

# 7. Model Development

The link between the habitat alteration due to sediment loads and the identified sources of sediment is the basis for the development of the TMDL. The linkage is defined as the cause and effect relationship between the selected indicators and identified sources. This provides the basis for estimating the total assimilative capacity of the river and any needed load reductions.

## 7.1. Watershed Sediment Loading Model

An analysis of watershed loading could be conducted at various levels of complexity, ranging from a simplistic gross estimate to a dynamic model that captures the detailed runoff from the watershed to the receiving waterbody. The limited amount of data available for the Chattooga River Watershed prevented EPA from using a detailed dynamic watershed runoff model, which needs a great deal of data for calibration. Instead, EPA determined the sediment contributions to the Chattooga River Watershed from the surrounding watershed based on an annual mass balance of sediment in water and sediment loading from the watershed.

Watershed-scale loading of sediment in water and sediment was simulated using the Watershed Characterization System (WCS) (USEPA, 2001). The complexity of this loading function model falls between that of a detailed simulation model, which attempts a mechanistic, time-dependent representation of pollutant load generation and transport, and simple export coefficient models, which do not represent temporal variability. The WCS provides a mechanistic, simplified simulation of precipitation-driven runoff and sediment delivery, yet is intended to be applicable without calibration. Solids load from runoff can then be used to estimate pollutant delivery to the receiving waterbody from the watershed. This estimate is based on sediment concentrations in wet and dry deposition, which is processed by soils in the watershed and ultimately delivered to the receiving waterbody by runoff, erosion and direct deposition.

### *7.1.1. Universal Soil Loss Equation*

The Universal Soil Loss Equation (USLE), developed by Agriculture Research Station (ARS) scientists W. Wischmeier and D. Smith, has been the most widely accepted and utilized soil loss equation for over 30 years. Designed as a method to predict average annual soil loss caused by sheet and rill erosion, the USLE is often criticized for its lack of applications. While it can estimate long-term annual soil loss and guide conservationists on proper cropping, management, and conservation practices, it cannot be applied to a specific year or a specific storm. The USLE is mature technology and enhancements to it are limited by the simple equation structure. However based on its long history of use and wide acceptance by the forestry and agriculture communities, it was selected as an adequate tool for estimating long-term annual soil erosion, for evaluating the impacts of land use changes and evaluating the benefits of various Best Management Practices (BMPs).

The Sediment Tool, which incorporates the USLE equation, is an extension of the Watershed Characterization System (WCS). For more detailed information on WCS, refer to the WCS User's Manual. The Sediment Tool can be used to perform the following tasks:

- Estimate extent and distribution of potential soil erosion in the watershed.
- Estimate potential sediment delivery to receiving waterbodies.
- Evaluate effects of land use, BMPs, and road network on erosion and sediment delivery.

Soil loss from sheet and rill erosion is mainly due to detachment of soil particles during rainfall. It is the major soil loss from crop production and grazing areas, construction sites, mine sites, logging areas, and unpaved roads. The magnitude of soil erosion is normally estimated through the use of the Universal Soil Loss Equation (USLE). The USLE equation is a multiplicative function of crop and site specific factors that represent rainfall erosivity ($R$), soil erodibility ($K$), soil slope ($S$), slope length ($L$), cropping or conservation management practices ($C$), and erosion control practices ($P$). The R factor describes the kinetic energy generated by the frequency and intensity of rainfall. The $K$ factor represents the susceptibility of soil to erosion (i.e. soil detachment). The $L$ and $S$ factors represent the effect of slope length and slope steepness on erosion, respectively. The $C$ factor represents the effect of plants, soil cover, soil biomass and soil disturbing activities on erosion including crop rotations, tillage and residue practices. Finally, the $P$ factor represents the effects of conservation practices such as contour farming, strip cropping and terraces.

The USLE equation for estimating average annual soil erosion is:

$$A = RKLSCP$$

- **A** = average annual soil loss in t/a (tons per acre)
- **R** = rainfall erosivity index
- **K** = soil erodibility factor
- **LS** = topographic factor - L is for slope length & S is for slope
- **C** = cropping factor
- **P** = conservation practice factor

Evaluating the factors in USLE:

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R - the rainfall erosivity index

Most appropriately called the erosivity index, it is a statistic calculated from the annual summation of rainfall energy in every storm (correlates with raindrop size) times its maximum 30 - minute intensity. As expected, it varies geographically.

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K - the soil erodibility factor

This factor quantifies the cohesive or bonding character of a soil type and its resistance to dislodging and transport due to raindrop impact and overland flow.

LS - the topographic factor

Steeper slopes produce higher overland flow velocities. Longer slopes accumulate runoff from larger areas and also result in higher flow velocities. Thus, both result in increased erosion potential, but in a non - linear manner. For convenience L and S are frequently lumped into a single term.

C - the crop management factor

This factor is the ratio of soil loss from land cropped under specified conditions to corresponding loss under tilled, continuous fallow conditions. The most computationally complicated of USLE factors, it incorporates effects of: tillage management (dates and types), crops, seasonal erosivity index distribution, cropping history (rotation), and crop yield level (organic matter production potential).

P - the conservation practice factor

Practices included in this term are contouring, strip cropping (alternate crops on a given slope established on the contour), and terracing.

Appropriate values for the USLE parameters should be provided for each of the management activities. Literature values are available, but site-specific values should be used when available. Estimates of the USLE parameters and thus the soil erosion as computed from the USLE equation are provided by the Natural Resources Conservation Service's National Resources Inventory (NRI) 1994. The NRI database contains information of the status, condition and trend of soil, water and related resources collected from approximately 800,000 sampling points across the country.

Soil loss from gully erosion occurs in sloping areas mainly as a result of natural processes. Farming practices such as livestock grazing exacerbates it. The deepening of rill erosion causes gullies. The amount of sediment yield from gully erosion is generally less than that caused by sheet and rill erosion. There are no exact methods or equations to quantify gully erosion, but Dunne and Leopold (1978) provide percent sediment yield estimates for various regions of the country. In a small grazed catchment near Santa Fe, New Mexico, gully erosion was found to contribute only 1.4 percent of the total sediment load as compared to sheet erosion and rain splash, which contributed 97.8 percent of the sediment load. Dunne and Leopold report that in most cases (nationally and internationally) gully erosion contributes less than 30 percent of the total sediment load, although the percentages have ranged from 0 percent to 89 percent contribution (Dunne and Leopold, 1978).

The soil losses from the erosion processes described above are localized losses and not the total amount of sediment that reaches the stream. The fraction of the soil losses in the field that is eventually delivered to the stream depends on several factors, which include the distance of the source area from the stream, the size of the drainage area, and the intensity and frequency of rainfall. Soil losses along the riparian areas are expected to be delivered into the stream with runoff-producing rainfall.

### *7.1.2. Sediment Analysis*

The watershed sediment loads for selected watersheds are determined using the USLE and available GIS coverage. The sediment analysis produces the following outputs:

- Source Erosion and Sediment
- Stream Grid
- Sediment Delivery on Stream

The sediment analysis is also able to evaluate default scenarios by, for example, changing land uses and BMPs. The following are some of the parameters that may be altered:

- C and P Lookup values
- Land Use Change Layer
- BMP Layers
- Add/Delete Roads
- Create Road Control Structure Layer

The sediment analysis can be run for a single watershed or multiple watersheds. For TMDL development purposes the basic sediment analysis was used for developing relative impacts. Other applications used in developing the TMDL include the evaluation of the effectiveness of BMPs and development of implementation plans.

### *7.1.3. Sediment Modeling Methodology*

The watersheds of interest are first delineated. The stream grid for each delineated watershed, based on the Digital Elevation Maps (DEM) data, is created so that the stream matches the elevation (i.e., the stream corresponds to the lower elevations in the watershed). The system uses this threshold to determine whether a particular grid cell corresponds to a stream. Grid cells having flow accumulation values higher than the threshold will be considered as part of the stream network. The RF3 stream network is used as a reference or basis of comparison to obtain the desired stream density. A stream grid corresponding to the stream network that has fifty 30 by 30 meter headwater cells is the default.

For each 30 by 30 meter grid cell the potential erosion based on USLE and potential sediment delivery to the stream network is estimated. The potential erosion from each cell is calculated using the USLE and the sediment delivery to the stream network can be calculated using one of four available sediment delivery equations.

(1) Distance-based equation 1 (Sun and McNulty 1988)

$$Md = M * (1 - 0.97 * D / L),$$

$$L = 5.1 + 1.79 * M,$$

Where Md is the mass moved from each cell to the closest stream network (US tons/acre/yr);

D (feet) is the least cost distance from a cell to the nearest stream network; and

L (feet) is the maximum distance that sediment with mass M (US ton) may travel.

(2) Distance-based equation 2 (Yagow et al. 1998)

$$DR = \exp(-0.4233 * L * Sf),$$

$$Sf = \exp(-16.1 * (r / L + 0.057)) - 0.6,$$

Where DR is the sediment delivery ration;

L is the distance to stream in meters and

r is the relief to stream in meters.

(3) Area-based equation (converted from a curve from National Engineering Handbook by Soil Conservation Service 1983

$$DR = 0.417762 * A \wedge (-0.134958) - 0.127097,$$

$$DR <= 1.0,$$

Where DR is the sediment delivery ratio and

A is area in square miles;

(4) WEPP-based regression equation (L.W.Swift, Jr.,2000)

$$Z=0.9004-0.1341*X-0.0465*X^2+0.00749*X^3-0.0399*Y+0.0144*Y^2+0.00308*Y^3,$$

$X>0, Y>0,$

Where Z is percent of source sediment passing to next grid cell,

X is cumulative distance downslope,

Y is percent slope in grid cell.

The sediment analysis provides the calculations for six new parameters.

- Source Erosion – estimated erosion from each grid cell due to the land cover
- Road Erosion – estimated erosion from each grid cell representing a road
- Composite Erosion – composite of the source and road erosion layers
- Source Sediment – estimated fraction of the soil erosion from each grid cell that reaches the stream (sediment delivery)
- Road Sediment – estimated fraction of the road erosion from each grid cell that reaches the stream
- Composite Sediment – composite of the source and erosion sediment layers

The sediment delivery can be calculated based on the composite sediment, road sediment, or source sediment layer. The sources of sediment by each land use type is determined showing the types of land use, the acres of each type of land use, and the tons of sediment estimated to be generated from each land use. The information and estimates developed using this methodology were summarized in Tables 1 through 5 in Section 5.

### *7.1.4. Sediment Analysis Inputs*

Before conducting a sediment analysis, a number of data layers must be available. These include the following:

- DEM (grid) – The DEM layers that come with the WCS distribution system are shape files and are of coarse resolution (300 m x 300 m). The user needs to import a DEM grid layer. A higher resolution DEM grid layer (30m x 30 m) was downloaded from USGS web site or from a state's GIS data clearinghouse

- Road – The road layer is needed as a shape file and requires additional attributes such as C (road type), P (road practice) and ditch (value of either 3 or 4, indicating presence or absence of side ditch, respectively). If these attributes are not provided, the Sediment Tool automatically assigns default values of road type 2 (secondary paved roads) ditch 3 (with ditch) and road practice 1 (no practices).

- Soil – The SSURGO (1:24k) soil data may be imported into the WCS project if higher-resolution soil data is required for the estimation of potential erosion. If the SSURGO soil database not available, the system uses the STATSGO Soil data (1:250k) by default.

- The Multi-Resolution Land use Classification (MRLC) data are also used.

- Rainfall erosivity index is either provides based on a rainfall index of the USA or can be calculated based on precipitation data.

The Universal Soil Loss Equation (USLE) R, K, LS, C, and P factors are calculated from the above data as follows:

$A = RKLSCP$

- **A** = average annual soil loss in t/a (tons per acre) is calculated.
- **R** = rainfall erosivity index is provide based on a rainfall index of the USA.
- **K** = soil erodibility factor calculated based on soil types.

- **LS** = topographic factor - L is for slope length set at 30 meters and S is for slope calculated based on the 30 meter DEM data. Presently a watershed average LS term is used.

- **C** = cropping factor or land use factor.

- **P** = conservation practice factor or BMP implementation.

### *7.1.5. Sediment Load Development Methodology*

For each watershed of interest, the "existing" long–term sediment loading is estimated via the USLE sediment analysis, using default parameters and estimated C and P values. The USLE 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 a specific storm.

The resultant sediment load calculation for each watershed is therefore expressed as a long-term annual soil loss expressed in tons per year calculated for the R - the rainfall erosivity index, a statistic calculated from the annual summation of rainfall energy in every storm (correlates with raindrop size) times its maximum 30 - minute intensity.

The watershed sediment load target is based on the long - term annual soil loss expressed in tons per year calculated for relatively unimpacted watershed with demonstrated healthy biology and habitat. For the initial sediment load development consistent default parameters and inputs are used for each watershed. These include the MRLC land use data, the USGS DEM data, STASTGO soil information and watershed average C and P values for each land use type.

## *7.2. Instream Sediment Impacts*

The instream flows and sediment concentrations were estimated based on daily flows proportioned from the Chattooga River USGS gage #02177000, the USLE predicted annual loadings and the following sediment flow relationship:

TSS (mg/l) = coefficient * (Flow / Mean Flow) ^ 1.37

This relationship was developed for the Chattooga Watershed based on sediment and flow data collected in 1998 and 1999 and based on historic flow and sediment data available from the USGS. The information and data is reported in the Chattooga River Watershed Hydrologic / Sedimentation Study (USEPA Region 4. 1999)

This relationship of sediment to flow for a relatively unimpacted stream is shown in Figure 6.

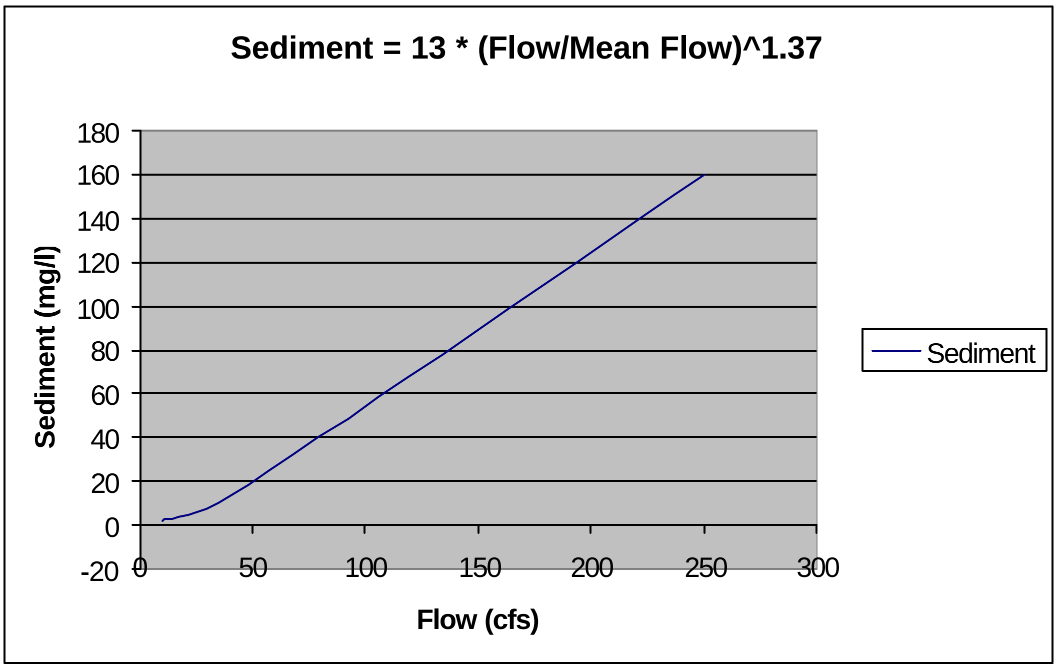


**Figure 6: Sediment and Flow Relationship**

Figure 7 illustrates the estimated 1992 flow and sediment concentrations for Upper Stekoa Creek watershed, which has a calculated long-term annual sediment load of 371 tons/sq.mi./year, an area of 21.3 sq.mi and a predicted mean flow sediment concentration of 50 mg/l.

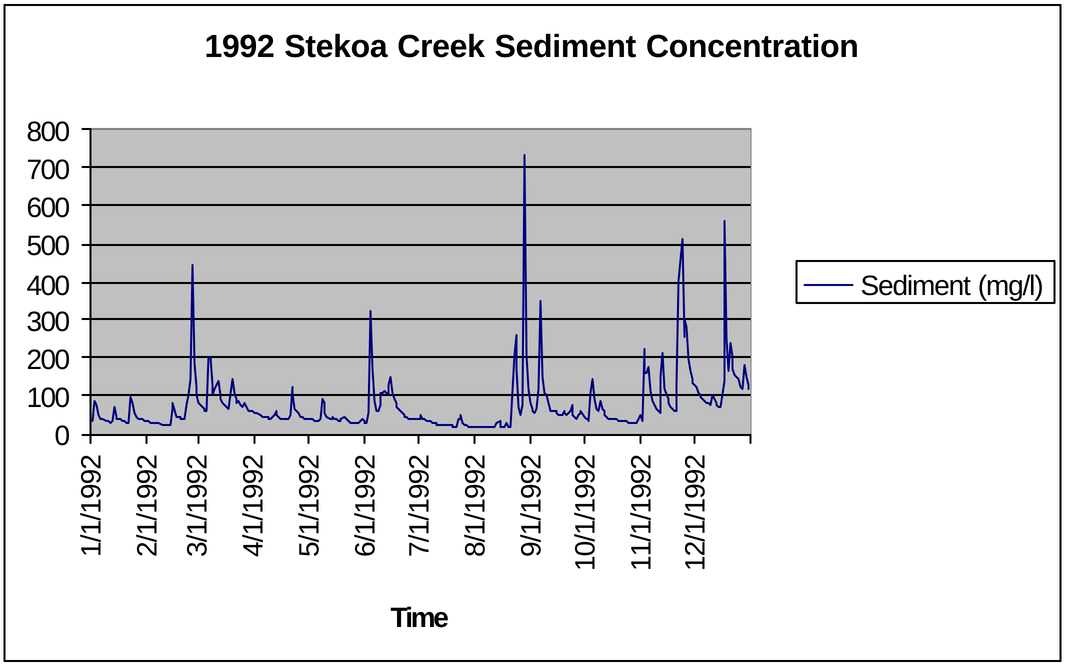


**Figure 7: 1992 Stekoa Creek Estimated Sediment Concentrations**

Figure 8 illustrates the estimated 1992 flow and sediment concentrations for the relatively unimpacted Cuttingbone Creek watershed, which has a calculated long-term annual sediment load of 71 tons/sq.mi./year.

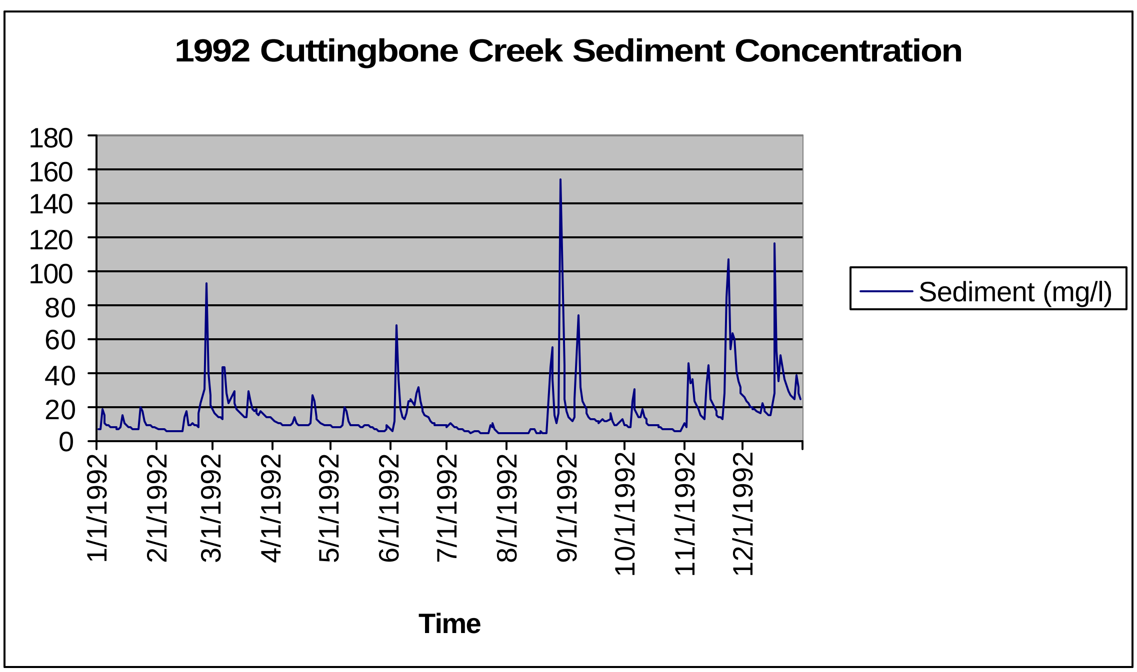

**Figure 8: 1992 Unimpacted Cuttingbone Creek Sediment Concentrations**

# 8. Numeric Sediment Target Determination

## *8.1. Numeric Target*

The working hypothesis for the sediment watershed load is that if the Chattooga River Watershed has a long–term annual sediment load similar to a relatively biologically unimpacted healthy stream, then the Chattooga River Watershed will remain stable and not be biologically impaired due to sediment. Conversely, if the Chattooga River Watershed sediment concentrations exceed the unimpacted stream's long–term annual sediment load then the stream will be unstable and biologically impaired. Biologically unimpacted streams in the West Fork Watershed of the Chattooga River Basin and Cuttingbone Creek in the Stekoa Creek Watershed were used to develop a target sediment watershed load. A biologically unimpacted stream's watershed sediment loading rate per area average of around 100- tons/year/square mile was developed as an acceptable loading rate. A sediment-loading rate per area of 90-tons/year/square mile was used as the target; this includes a 10 percent margin of safety. A percent reduction TMDL was developed by comparing the impacted watersheds' sediment-loading rate to the biologically unimpacted watersheds' sediment loading rate.

Sediment loads in the Stekoa Watershed and the Warwoman Watershed (adjoining similar watersheds) were compared to the Use Support Evaluation performed by Region 4 during the 1998-2000 watershed assessment (USEPA Region 4, 1999). An average projected sediment watershed load of 100 tons/year/sq.mi. was concluded to relate to a relatively unimpacted watershed. The Use Support Evaluation is based on the EPA Rapid Biological Procedures (RPB) for determining wadeable stream biological and habitat conditions where a rating of 1 is poor, 2 is fair, 3 is good and 4 is very good. Table 6 shows the results of these use support determinations. The streams with Use Support, Biological and Habitat ratings of 3 or 4 were determined to be unimpacted streams and watersheds. Figure 9 shows the relationship between these unimpacted and impacted streams' use support ratings and projected sediment yield.

**Table 6: Stekoa and Warwoman Use Support Ratings**

| **Stekoa Watershed** | Station ID | Ton/Year/Sq.Mi. | Use Support Rating | Biological Rating | RPB Habitat Rating |
|---|---|---|---|---|---|
| Stekoa above Clayton | SC-01 | 461 | 2 | 2 | 2 |
| Stekoa @ Boggs Mt Rd. | SC-02 | 351 | 2 | 2 | 3 |
| Cutting Bone Creek | SC-03 | 71 | 4 | 2 | 2 |
| Scott Creek | SC-04 | 177 | 3 | 3 | 2 |
| Pool / She Creek | SC-05 | 106 | 2 | 2 | 1 |
| Chechero Creek | SC-06 | 175 | 1 | 1 | 2 |
| Saddle Gap Creek | SC-07 | 392 | 2 | 2 | 2 |
| **Warwoman Watershed** | | | | | |
| WarWoman Creek @ Black Diamond Rd | WW-01 | 125 | 2 | 2 | 1 |
| Warwoman Creek @ Warwoman Ford | WW-02 | 104 | 4 | 3 | 3 |
| Martin / Finney Creek | WW-03 | 92 | 4 | 3 | 3 |
| Roach Mill Creek | WW-04 | 162 | 2 | 2 | 2 |
| Tuckaluge Creek | WW-05 | 103 | 4 | 3 | 3 |
| Hoods Creek | WW-06 | 108 | 4 | 4 | 3 |
| Walnut Fork | WW-07 | 65 | 4 | 4 | 4 |
| Sarah's Creek | WW-08 | 51 | 4 | 3 | 3 |
| Morsingills Creek | WW-09 | 110 | 3 | 3 | 1 |
| Goldmine Branch | WW-10 | 100 | 3 | 3 | 1 |

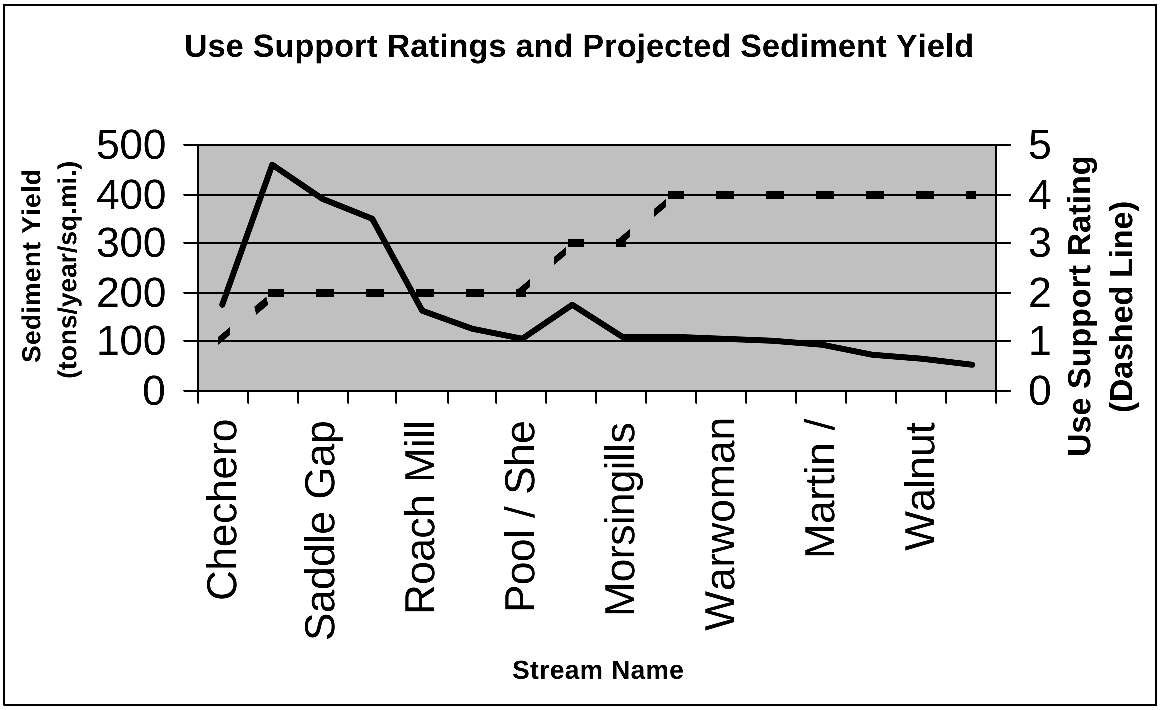


**Figure 9: Use Support Ratings and Sediment Yields**

## 9. Total Maximum Daily Load (TMDL)

The TMDL is the total amount of a pollutant that can be assimilated by the receiving waterbody without exceeding the applicable water quality standard, in this case, a numeric interpretation of the State of Georgia's narrative water quality standard for aquatic life This TMDL determines the maximum load of sediment that can enter the Chattooga River Watershed.

### *9.1. Critical Condition Determination*

The 1980 through 1998 flow period was used to evaluate the instream sediment conditions. The average annual flow period of 1992 was selected as a period that represents the critical conditions for determining the daily maximum allowable sediment load and concentrations. The daily maximum load or concentration can be viewed as being the "acute" concentration the stream can handle. The flow period of 1980 through 1998 will be used to calculate the mean flow sediment concentrations and the low flow sediment concentrations. The instream sediment concentrations related to the mean and low flows can be informational in indicating the relative health and status of the stream.

The annual average load is also reported since this loading is more appropriate than a daily load for representing 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.

## 9.2. Seasonal Variation

The use of flow to determine the allowable loads under this TMDL accounts for seasonal variations relevant to this TMDL. Sediment is expected to fluctuate based on the amount and distribution of rainfall and is taken into consideration by examining the flow years of 1980 through 1998. Since flow is greatest in the spring and winter seasons, loadings of sediment are highest during these seasons. However, these seasonal impacts or other short-term variability in loadings are evened out by the response of habitat alteration, which as discussed above, is a long-term process. Therefore, the average annual load was also calculated.

## 9.3. Margin of Safety

A Margin of Safety (MOS) is a required component of a TMDL that accounts for the uncertainty about 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 this TMDL in a variety of ways. These include a MOS implicitly assigned by selection of average USLE factors and by an explicit 10 percent reduction in the sediment loading numeric target.

## 9.4. TMDL Development

The maximum daily loads for each listed segment in the Chattooga Watershed were estimated using daily flows proportioned from the Chattooga River USGS gage #02177000, the USLE predicted annual loadings and the following sediment flow relationship where:

TSS (mg/l) = coefficient * (Flow / Mean Flow) ^ 1.37

Daily loads for the low to mean flow instream sediment concentrations and average annual loadings were also determined. Figure 10 illustrates the yearly variation in the associated sediment loads for a relatively unimpacted watershed.

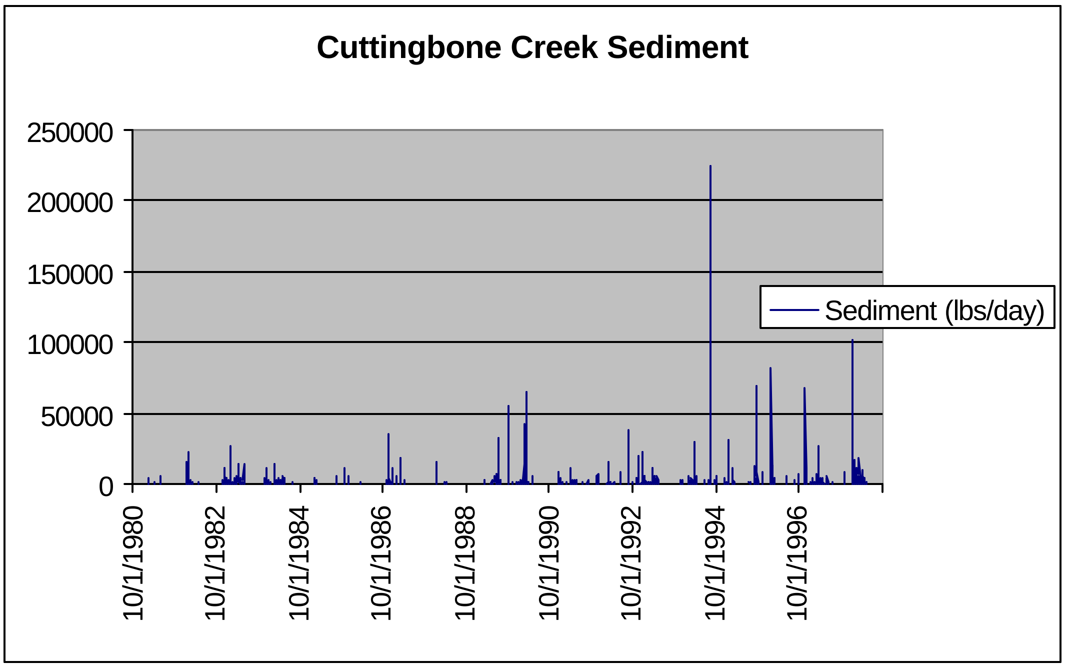


**Figure 10: Cuttingbone Creek Sediment 1980-1998**

### 9.5. TMDL Determination

The Chattooga River Watershed existing loads are presented in Table 7.

**Table 7: Existing Watershed Loads**

| Watershed | Existing Sediment Daily Loads per Square Mile | | | Existing Annual Sediment Loads |
|---|---|---|---|---|
| **Stream Name** | **Daily Maximum** | **Average Flow** | **Steady State Low Flow** | **(tons/year/sq.mi.)** |
| Stekoa | 930 tons/day or 734 mg/l | 10 tons/day or 50 mg/l | 0.6 tons/day or 10 mg/l | 351 |
| Scott Creek | 770 tons/day or 990 mg/l | 1.4 tons/day or 25 mg/l | 0.1 tons/day or 5 mg/l | 177 |
| Pool Creek | 380 tons/day or 630 mg/l | 0.2 tons/day or 15 mg/l | 0.04 tons/day or 3 mg/l | 106 |
| Chechero Creek | 530 tons/day or 990 mg/l | 1 tons/day or 25 mg/l | 0.06 tons/day or 5 mg/l | 175 |
| Saddle Gap Creek | 820 tons/day or 2400 mg/l | 1.5 tons/day or 60 mg/l | 0.09 tons/day or 12 mg/l | 392 |
| Upper Warwoman Creek | 1700 tons/day or 1520 mg/l | 3.2 tons/day or 37 mg/l | 0.2 tons/day or 6 mg/l | 250 |
| Roach Mill Creek | 53 tons/day or 680 mg/l | 0.1 tons/day or 15 mg/l | 0.01 tons/day or 3 mg/l | 162 |
| Law Ground Creek | 180 tons/day or 1620 mg/l | 0.3 tons/day or 40 mg/l | 0.02 tons/day or 8 mg/l | 269 |

The impaired segments' watershed TMDLs, using the previously defined target of 90 tons/sq.mi./year and the 1992 average flow year are presented in Table 8.

**Table 8: Chattooga Impaired Segments' Watershed TMDLs**

| **Watershed** | **Sediment Daily Loads and Concentrations per Watershed** | | | **Annual Sediment Loads** |
|---|---|---|---|---|
| **Stream Name** | **Daily Maximum** | **Average Flow** | **Steady State Low Flow** | **(tons/year/sq.mi.)** |
| Stekoa Creek | 240 tons/day or 190 mg/l | 2.6 tons/day or 13 mg/l | 0.15 tons/day or 3 mg/l | 90 |
| Scott Creek | 70 tons/day or 190 mg/l | 0.75 tons/day or 13 mg/l | 0.045 tons/day or 3 mg/l | 90 |
| Pool Creek | 54 tons/day or 190 mg/l | 0.6 tons/day or 13 mg/l | 0.035 tons/day or 3 mg/l | 90 |
| Chechero Creek | 90 tons/day or 190 mg/l | 1.0 tons/day or 13 mg/l | 0.06 tons/day or 3 mg/l | 90 |
| Saddle Gap Creek | 30 tons/day or 190 mg/l | 0.33 tons/day or 13 mg/l | 0.02 tons/day or 3 mg/l | 90 |
| Upper Warwoman Creek | 100 tons/day or 190 mg/l | 1.1 tons/day or 13 mg/l | 0.07 tons/day or 3 mg/l | 90 |
| Roach Mill Creek | 8 tons/day or 190 mg/l | 0.09 tons/day or 13 mg/l | 0.005 tons/day or 3 mg/l | 90 |
| Law Ground Creek | 10 tons/day or 190 mg/l | 0.1 tons/day or 13 mg/l | 0.006 tons/day or 3 mg/l | 90 |

# 10. Allocation of Loads

In a TMDL assessment, the total allowable load is divided and allocated to the various pollutant sources – both point sources and nonpoint sources. Allocations provided to point sources are wasteload allocations (WLAs). The Clayton Wastewater Treatment Facility (Permit #

GA0021806) discharges directly to Stekoa Creek below Clayton. With a design discharge flow of 0.5 million gallons per day; the WLA from continuous point source discharge for sediment is 0.06 tons/day or 0.04% of the watershed's allowable annual year load. Based on the numeric limits of the storm water permit the area loading will be 55 tons/square-mile/year or 0.45 lbs/day/acre, which is below the target of 90 tons/square-mile/year.

Allocations to nonpoint sources are load allocations (LAs). Roads, agriculture and bare ground (construction sites, etc.) sediment sources are the major sediment producing areas in the watershed. If best management practices (BMPs), as recommended in Georgia's Best management Practices, for these practices and other sediment producing activities are implemented at the sites that are near the stream's drainage network and the stream's riparian zone or buffer zones are maintained or restored, then the TMDL targets can be met.

**The calculated allowable load of sediment that can come into the Chattooga River Watershed without exceeding the applicable narrative water quality standard, as interpreted by EPA, is 90 tons/square mile/year.** For example, in the Upper Stekoa Creek Watershed, this assessment indicates that over 99% of the loading of sediment is from nonpoint sources and construction activity prior to issuance of Georgia's Storm Water Permit. Implementation of the Storm Water Permit will reduce construction sediment runoff. Additional sediment reduction activities should target nonpoint sources, including the unpaved roads, to gain the greatest water quality benefit.

## *10.1. TMDL Formula:*

TMDL = WLA + LA + MOS, where:

- TMDL = 100 tons/sq.mi./year
- WLA from the continuous permitted discharge for Upper Stekoa Creek Watershed = 23 tons/year;
- WLA from wet weather discharges subject to the General Storm Water Permit =

55 tons/sq.mi./year; and

- LA from nonpoint source runoff and roads = 90 tons/sq.mi./year

- MOS = 10 tons/sq.mi./year

### 10.2. TMDL Assumptions:

The allocations in this TMDL reflect the following assumptions regarding ongoing watershed restoration and/or pollution control activities in the Chattooga watershed:

The United States Forest Service manages about 70% of the Chattooga watershed. EPA assumptions regarding activities on Forest Service lands include:

- Restoration activities, including but not limited to maintenance and rehabilitation of roads and trails, will continue under the Chattooga Watershed Large-Scale Watershed Restoration Project, funded by the U.S. Forest Service.

- Private contractors will continue to be required to use Georgia's Best Management Practices for forestry activities (including road building and/or maintenance) undertaken on U.S. Forest Service lands in the watershed.

- If these BMPs land managed by the U.S. Forest Service, we believe that loadings from 70% of the Chat W will be at levels at or below applicable water quality target.

- Forest Service research activities to evaluate the effectiveness of the Georgia BMPs will continue and will provide information that can be considered in Phase 2 of the TMDL.

EPA also assumes that construction activities in the watershed will be conducted in compliance with Georgia's Storm Water General Permit for construction activities, including discharge limitations and monitoring requirements contained in the General Storm Water Permit. Compliance with these permits will lead to sediment loadings from construction sites at are at levels at or below applicable targets.

With respect to all land disturbance activities, including road building and maintenance, if these BMPs are implemented, then EPA believes that water quality targets for sediment will be achieved throughout the Chattooga Watershed.

The wasteload allocation component of this TMDL reflects the following additional assumptions:

- No NPDES point source will be authorized to increase its mass loadings of sediment above levels reflected in current water quality-based effluent limitations or allowed in the State's General Storm Water Permit.

- The permitting authority will establish the shortest reasonable period of time for compliance with permit limitations and conditions based on this TMDL.

These assumptions provide reasonable assurance that the allocation of loads in this TMDL, described in more detail below, are appropriate. During Phase 1 of this TMDL, EPA and Georgia will gather data and information to determine whether continued reliance on these assumptions is reasonable. The Phase 2 TMDL may revise the allocation of the allowable load, as necessary, should EPA or Georgia be required to change the assumptions underlying that allocation.

## *10.3. Allocation to Nonpoint Sources*

It is recommended that the Chattooga watershed be considered a high priority for riparian buffer zone restoration and any sediment reduction BMPs, especially for the road crossings, agricultural activities, and construction activities. 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).

#### *10.3.1. Stekoa Creek Watershed - Upper Stekoa Creek Watershed – HUC 0306002001*

A 75 percent sediment load reduction in the annual sediment load for Upper Stekoa Creek Watershed is needed to meet the estimated watershed sediment loading reduction target. The main contributors to the Stekoa Creek watershed sediment load are: 1) watershed loadings (primarily construction runoff prior to the limitations established by the General Storm Water Permit) causing forty percent of the loading and 2) unpaved or poorly maintained roads causing sixty percent of the loading. To meet the proposed target, the General Storm Water Permit should be implemented and specific BMPs should be implemented for forestry and agriculture, construction not subject to the General Storm Water Permit and roads that reduce each of their respective sediment contributions.

#### *10.3.2. Scott Creek Watershed - Upper Stekoa Creek Watershed – HUC 0306002001*

A 50 percent sediment load reduction for Scott Creek Watershed is needed to meet the estimated watershed sediment loading reduction target. The main contributors to the Scott Creek watershed sediment load are: 1) watershed loadings (primarily construction runoff prior to the limitations established by the General Storm Water Permit) causing twenty percent of the loading and 2) unpaved or poorly maintained roads causing eighty percent of the loading. To meet the proposed target, the General Storm Water Permit should be implemented and specific BMPs should be implemented for forestry and agriculture, construction not subject to the General Storm Water Permit and roads that reduce each of their respective sediment contributions.

#### *10.3.3. Saddle Gap Creek Watershed - Upper Stekoa Creek Watershed – HUC 0306002001*

A 77 percent sediment load reduction for Saddle Gap Creek Watershed is needed to meet the estimated watershed sediment loading reduction target. The main contributors to the Saddle Gap Creek watershed sediment load are: 1) watershed loadings (primarily construction runoff prior to the limitations established by the General Storm Water Permit) causing twenty percent of the loading and 2) unpaved or poorly maintained roads causing eighty percent of the loading. To meet the proposed target, the General Storm Water Permit should be implemented and specific BMPs should be implemented for forestry and agriculture, construction not subject to the General Storm Water Permit and roads that reduce each of their respective sediment contributions

### *10.3.4. Chechero Creek Watershed - Lower Stekoa Creek Watershed – HUC 0306002002*

A 50 percent sediment load reduction for Chechero Creek Watershed is needed to meet the estimated watershed sediment loading reduction target. The main contributors to the Chechero Creek watershed sediment load are: 1) watershed loadings (primarily construction runoff prior to the limitations established by the General Storm Water Permit) causing forty five percent of the loading and 2) unpaved or poorly maintained roads causing fifty five percent of the loading. To meet the proposed target, the General Storm Water Permit should be implemented and specific BMPs should be implemented for forestry and agriculture, construction not subject to the General Storm Water Permit and roads that reduce each of their respective sediment contributions

### *10.3.5. Pool Creek Watershed - Lower Stekoa Creek Watershed – HUC 0306002002*

A 15 percent sediment load reduction for Pool Creek Watershed is needed to meet the estimated watershed sediment loading reduction target. The main contributors to the Pool Creek watershed sediment load are: 1) watershed loadings (primarily construction runoff prior to the limitations established by the General Storm Water Permit) causing fifty percent of the loading and 2) unpaved or poorly maintained roads causing fifty percent of the loading. To meet the proposed target, the General Storm Water Permit should be implemented and specific BMPs should be implemented for forestry and agriculture, construction not subject to the General Storm Water Permit and roads that reduce each of their respective sediment contributions

### *10.3.6. Law Ground Branch Watershed – Warwoman Watershed HUC 030601020602*

A 67 percent sediment load reduction for Law Ground Branch Watershed is needed to meet the estimated watershed sediment loading reduction target. The main contributors to the Law Ground Branch watershed sediment load are: 1) watershed loadings (primarily construction runoff prior to the limitations established by the General Storm Water Permit) causing ten percent of the loading and 2) unpaved or poorly maintained roads causing ninety percent of the loading. To meet the proposed target, the General Storm Water Permit should be implemented and specific BMPs should be implemented for forestry and agriculture, construction not subject to the General Storm Water Permit and roads that reduce each of their respective sediment contributions. Since roads are a major contributor, this should be a major BMP implementation area.

### *10.3.7. Upper Warwoman Creek Watershed – Warwoman Watershed HUC 030601020602*

A 64 percent sediment load reduction for Upper Warwoman Creek Watershed is needed to meet the estimated watershed sediment loading reduction target. The main contributors to the Upper Warwoman Creek watershed sediment load are: 1) watershed loadings (primarily construction runoff prior to the limitations established by the General Storm Water Permit) causing forty five percent of the loading and 2) unpaved or poorly maintained roads causing fifty five percent of the loading. To meet the proposed target, the General Storm Water Permit should be implemented and specific BMPs should be implemented for forestry and agriculture, construction not subject to the General Storm Water Permit and roads that reduce each of their respective sediment contributions.

### *10.3.8. Roach Mill Creek Watershed – West Fork Watershed HUC 030601020102*

A 44 percent sediment load reduction for Roach Mill Creek Watershed is needed to meet the estimated watershed sediment loading reduction target. The main contributors to the Roach Mill

Creek watershed sediment load are: 1) watershed loadings (primarily construction runoff prior to the limitations established by the General Storm Water Permit) causing thirty five percent of the loading and 2) unpaved or poorly maintained roads causing sixty five percent of the loading. To meet the proposed target, the General Storm Water Permit should be implemented and specific BMPs should be implemented for forestry and agriculture, construction not subject to the General Storm Water Permit and roads that reduce each of their respective sediment contributions.

## 10.4. Allocation to NPDES Point Sources

This TMDL estimates that less than 1% of the current loadings of sediment to the Chattooga River Watershed are from continuous and storm water NPDES point sources.

### 10.4.1. NPDES Wastewater Treatment Facilities

One wastewater treatment facility point source is located in the Georgia portion of the listed watersheds. The Clayton Wastewater Treatment Facility (Permit # GA0021806) discharges directly to Stekoa Creek below Clayton. With a design discharge flow of 0.5 million gallons per day; the WLA from continouous point source discharge for sediment is 0.06 lbs/day of Total Suspended Solids (TSS) or 0.04% of the watershed's allowable flow year load. This point source sediment load does not represent a significant impact on the stream's sediment budget. (EPA 2000a). The wastewater treatment facility point source load is a minor component and the organic "sediment" being measured by the TSS monitoring does not necessarily cause a habitat problem. This TMDL assigns this source a WLA consistent with its current NPDES permit.

### 10.4.2. Storm Water Point Sources

Other potential point sources discharges in the Georgia portion of the listed streams are storm water discharges associated with construction activity. The State of Georgia Department of Natural Resources, Environmental Protection Division has developed a general storm water permit. All existing and new storm water point sources within the State of Georgia, that are required to have a permit, are authorized to discharge storm water associated with construction activity to the waters of the State of Georgia in accordance with the limitations, monitoring requirements and other conditions set forth in Parts I through VII of the Georgia Storm Water General Permit. The permit limitations are established to assure that the storm water runoff from these point source sites does not cause or contribute to the existing sediment impairment. A Comprehensive Monitoring Plan with turbidity monitoring requirements is required to assure any storm water discharge from the site does not cause or contribute to the existing sediment problem.

The Georgia General Storm Water Permit for Construction Activities (Storm Water Permit) was developed to reduce the input of sediment from construction activities. In the Upper Stekoa Creek Watershed, based on the available mid 1990s landuse information, it was estimated that, absent the limitations established by the Storm Water Permit, construction would contribute 450 tons/square-mile/year to the stream sediment load. Implementation of the Storm Water Permit in the Upper Stekoa Creek Watershed, which has the highest contribution from construction activities, should reduce the sediment contributed by these construction activities to 55 tons/square-mile/year (0.45 lbs/day/acre), which is below the target of 90 tons/square-mile/year. This reduced load would be less than 1% of the total sediment allowable load for the Upper Stekoa Creek Watershed.

The Georgia General Storm Water Permit can be considered to be a water quality-based permit, in that the numeric limits in the permit, if met and enforced, will not cause a water quality problem in a unimpaired stream or contribute to an existing problem in an impaired stream. It is recommended that for impaired watersheds, the cold water (trout stream) turbidity table be used. A Comprehensive Monitoring Plan with turbidity monitoring requirements is required to assure any storm water discharge from the site does not cause or contribute to the existing sediment problem. Since the point source storm water component is addressed and controlled through the implementation and enforcement Georgia Storm Water Permits. It is recommended that for streams in the impaired watersheds the cold water (trout stream) turbidity table be used. Based on the numeric limits of the storm water permit the area loading will be 55 tons/square-mile/year or 0.15 lbs/day/sq.mi., which is below the target of 90 tons/square-mile/year. This will ensure that permitted point source sediment loads in the watersheds will contribute less than 1% of the total sediment.

The Georgia General Storm Water Permit can be considered to be a water quality-based permit, in that the numeric limits in the permit, if met and enforced, will not cause a water quality problem in a unimpaired stream or contribute to an existing problem in an impaired stream.

This TMDL accords the permitting authority a certain amount of discretion in incorporating these wasteload allocations into NPDES permits. The permitting authority can determine the appropriate frequency, duration and location of monitoring associated with the sediment characterization component of the wasteload allocation. The permitting authority also has the discretion to determine the level of oversight in connection with the development of sediment minimization plans and the discharger's choice of appropriate, cost-effective measures to implement such plans. EPA believes that each of these decisions is heavily fact-dependent and that the permitting authority is the appropriate decision maker in this regard.

## *10.5. Informational TMDLs:*

For informational purposes, watershed loadings were developed for the Full Support-Threatened waters in Georgia and for the partial and non support waters in North and South Carolina.

The specific Georgia 303(d) tributaries identified as full support-threatened in the Chattooga River Watershed are:

| **Stream** | **Area (Sq.Mile)** | **Roads /Watershed (Tons/Year)** | **Total (Tons/Year/Sq.Mi.)** | **Percent Reduction** |
|---|---|---|---|---|
| Morsingills Creek | 3.6 | 614 / 181 | 221 | 59 |
| Goldmine Branch | 1.4 | 204 / 77 | 201 | 55 |
| Laurel Creek | 2.1 | 128 / 77 | 98 | 8 |

| | | | | |
|---|---|---|---|---|
| Reed Mill Creek | 1.7 | 272 / 189 | 272 | 67 |
| Big Creek | 9.2 | 1590 / 1454 | 332 | 73 |

# 11. State and Federal Responsibility

EPA intends to undertake the following responsibilities under this TMDL:

1. Review "major" NPDES permits and other identified "minor" NPDES permits for facilities located in the watershed of the segments of the Chattooga River Watershed that are covered by this Phase TMDL;

2. Take the lead on revising the TMDL, if needed.

EPA expects Georgia to undertake the following responsibilities for the Chattooga River Watershed:

1. Identify the "major" NPDES facilities affected by this TMDL;

2. Implement the Georgia General Storm Water Permit.

3. Maintain the Notices of Intent that include the location and duration period of the General Storm Water Permits issued in the Chattooga Watershed and review the monitoring data, submitted to Georgia pursuant to monitoring requirements of the General Storm Water Permit.

# 12. References

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