

TOTAL MAXIMUM DAILY LOAD (TMDL)

For

Total Mercury in Fish Tissue Residue

In

**Chattahoochee River
Including Listed Segment**

Soquee River to Lake Lanier



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 a Total Maximum Daily Load (TMDL) for Mercury for the Chattahoochee River from Lake Lanier to Soque River. Subsequent actions must be consistent with this TMDL.

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Date

Water Management Division

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TOTAL MAXIMUM DAILY LOAD (TMDL)
Total Mercury in Fish Tissue Residue
In the
In the Upper Chattahoochee 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 total mercury for the protection of public health associated with the consumption of fish taken from the following segment of the Upper Chattahoochee River in Georgia:

Soquee River to Lake Lanier

The calculated allowable load of mercury that may come into the identified segment of the Chattahoochee River without exceeding the applicable water quality standard is 2.3 kilograms per year. The applicable water quality standard is the State of Georgia's numeric interpretation of their narrative water quality standard for protection of human health from toxic substances. This interpretation provides that total mercury in the Chattahoochee shall not exceed the level that will result in more than 0.3 mg/kg mercury in fish tissue residue.

1. Introduction

The U.S. Environmental Protection Agency (EPA) Region 4 is proposing this Total Maximum Daily Load (TMDL) for total mercury for one listed segment of the Chattahoochee River, Georgia from the confluence of Soquee River to Lake Lanier. This segment is included on the State of Georgia's 2002 Section 303(d) list of impaired waters because mercury in fish tissue exceeds the numeric interpretation of the Georgia narrative water quality standard for mercury (GAEPD, 2001) of 0.3 mg/kg.

The State of Georgia provided EPA with a numeric interpretation of the Georgia narrative water quality standard for mercury (GAEPD, 2001). The numeric interpretation, which provides that mercury in fish tissue is not to exceed 0.3 mg/kg, is consistent with EPA's recently adopted guidance value for Methylmercury (USEPA, 2000). The State also provided EPA with a methodology for determining when a waterbody is impaired and is to be listed on the State's Section 303(d) lists, as well as a methodology for calculating the site-specific allowable water column concentration to protect the general population from the accumulation of mercury in fish tissue.

The State of Georgia has recently interpreted its narrative water quality standard for mercury in a manner that is consistent with EPA's recently adopted criterion document for residual mercury in fish tissue. Using the State's methodology and the data recently collected by Region 4, it appears that the listed segment of the Chattahoochee River is attaining the applicable water quality standard for mercury.

The Consent Decree in the case of *Sierra Club v. EPA*, 1:94-cv-2501-MHS (N.D. Ga.) requires the State or EPA to develop TMDLs for all waterbodies on the State of Georgia's current 303(d) list. Since the listed segment of the Chattahoochee River remains on the State's current 303(d) List, EPA is proposing this TMDL.

TMDLs are required for waters on a state's Section 303(d) list by Section 303(d) of the Clean Water Act (CWA) and the associated regulations at 40 CFR Part 130. A TMDL establishes the maximum amount of a pollutant a waterbody can assimilate without exceeding the applicable water quality standard. The TMDL allocates the total allowable pollutant load to wasteload allocations (WLAs) for point sources regulated by the National Pollutant Discharge Elimination System (NPDES) program and to load allocations (LAs) for all other sources. The WLAs and LAs in the TMDL provide a basis for states to limit the amount of pollution from both point and nonpoint sources to restore or protect the waterbody from exceeding the applicable water quality standard. This TMDL will provide the maximum annual average load of mercury that can enter the listed segment of the Chattahoochee River without exceeding the applicable water quality standard. An allocation of the maximum annual average load will be provided to both point sources and to nonpoint sources, primarily air deposition. Because of the significant uncertainties associated with the attainable reduction of the nonpoint source loading of mercury (i.e., atmospheric deposition) and the persistent bioaccumulative nature of mercury, this TMDL will establish that current NPDES permitted discharges be held at their current loading of mercury.

2. Problem Definition

The listed segment of the Chattahoochee River is on the State of Georgia's 2002 Section 303(d) list. This segment of the Chattahoochee River was listed because mercury in the tissue of Largemouth Bass, Redeye Bass, Snail Bullhead and Golden Redhorse exceeded the Fish Consumption Guidelines (FCG) established by the State of Georgia. (See Georgia Department of Natural Resources, 2000.) The Fish Consumption Guidelines establish limits on the amount of fish that should be consumed over a given time frame (a week or a month) in order to protect human health.

The Georgia Department of Natural Resources (DNR) uses a risk-based approach to determine how often contaminated fish may be consumed at different levels of fish tissue contamination assuming a consumption rate of approximately 32.5 grams per day. Table 1 provides the frequency of consumption for three different levels of fish tissue contaminated with mercury.

Table 1 Georgia Department of Natural Resources Fish Consumption Guideline

Mercury Fish Tissue Threshold (mg/kg)	Frequency of Consumption
0.23	Once a Week
0.70	Once a Month
2.3	Do Not Eat

If fish tissue contains 0.23 mg/kg (parts per million) or more of mercury, the State's FCG indicates that the fish should not be consumed more than once a week. If fish tissue contains 0.70 mg/kg (parts per million) or more of mercury, the State's FCG indicates the fish should not be consumed more than once a month, and if the fish tissue contains 2.30 mg/kg (parts per million) or greater of mercury, the State issues a "Do Not Eat" guideline. The following FCG are in place for the Chattahoochee River: Largemouth Bass, Redeye Bass, Snail Bullhead and Golden Redhorse – no more than one meal per week.

The methodology used by the State of Georgia in the development of the fish consumption guidelines targets specific species and size of fish, and uses a conservative risk-based approach in determining whether consumption guidance is warranted for a particular waterbody. EPA supports the State of Georgia's approach to establishing consumption guidelines as an appropriate way to inform the public of the potential risks in eating certain size and species of fish.

3. Applicable Water Quality Standard

TMDLs are established at levels necessary to attain and maintain the applicable narrative and numeric 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 numeric criterion for the protection of human health from methylmercury. The State's regulations provide a narrative water quality standard in which waters are to be free from

toxics. Since mercury may cause toxicity in humans, a numeric “interpretation” of the narrative water quality standard is necessary to assure that a TMDL will protect human health. EPA defers to the State water quality standard or criterion as the applicable water quality standard for development of the TMDL. States may establish (or interpret) their applicable water quality standards for protection of human health at a numeric concentration different from their fish consumption guidelines. The State of Georgia has made a numeric interpretation of their narrative water quality standard for toxic substances at a numeric concentration of no more than 0.3 mg/kg methylmercury in fish tissue. (See the July 2001 letter from the State to EPA.) This numeric interpretation protects the “general population” which is the population that consumes 17.5 grams per day or less of freshwater fish. This approach is consistent with EPA’s recently adopted guidance value for the protection of human health from methylmercury described in the document entitled, “Water Quality Criterion for the Protection of Human Health: Methylmercury”(EPA 2001). The waterbody is determined to be when the weighted fish consumption concentration is greater than 0.3 mg/kg. The methodology uses a “weighted consumption” approach that assumes that 10.2 grams per day (58.4%) of the total fish consumption is trophic level 3 fish (e.g., catfish and sunfish), and 7.3 grams per day (41.6%) are trophic level 4 fish (e.g., largemouth bass). See Equation 3-1 below.

Equation 3-1 Weighted Fish Tissue Calculation to Determine Impairment

*Weighted Fish Tissue Concentration = (Avg Trophic 4 Conc.*41.6%)+(Avg Trophic 3*58.4%)*
where:

Avg. Trophic 4 Concentration = 0.3 mg/kg

Avg. Trophic Level 3 Concentration = 0.1 mg/kg

EPA collected site-specific data from the listed segment of the Chattahoochee River on ambient mercury in fish tissue and in the water column in March/April 2001 at 2 locations in the Chattahoochee River. Using Equation 3-1, site-specific fish tissue concentration data collected in the Chattahoochee River yields a weighted fish tissue concentration of 0.2 mg/kg which is less than the State’s current, applicable water quality criterion of 0.3 mg/kg.

4. TMDL Target

In order to establish the TMDL, the maximum allowable concentration of total mercury in the ambient water must be determined that will prevent accumulation of methylmercury in fish tissue above the applicable water quality standard of 0.3 mg/kg level. To determine this allowable ambient water concentration, EPA referred to the “Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health” (EPA 2000). The methodology is expressed below (Equation 4-1):

Equation 4-1 Water Quality Standard Calculation

$$WQS = \frac{((ReferenceDose - RSC) * BodyWeight * UnitsConversion)}{(ConsumptionRate * Weighted BAF * FractionMeHg)}$$

where:

WQS = 1.0 ng/l

Reference Dose = 0.0001 mg/kg/day MeHg

RSC = 0.000027mg/kg/day MeHg (Relative Source Contribution from Saltwater Species)

Body Weight = 70 kg

Units Conversion = 1.0E6

Consumption Rate = 0.0175 kg/day Fish

Weighted Bioaccumulation Factor = 4,034,057

Fraction of the Total Mercury as Methylmercury = 0.07 as measured

In the determination of the allowable ambient water concentration, EPA used the recommended national values from the Human Health Methodology, including the reference dose of 0.0001-mg/k/day methylmercury; a standard average adult body weight of 70 kg; and the consumption rate for the general population of 17.5 grams per day. (Note that a recent report by the National Academy of Sciences confirms that methylmercury is a potent toxin, and concludes that EPA's reference dose of 0.0001 mg/kg/day is appropriate. (See NAS, Toxicological Effects of Methylmercury, July 2000)). For the other factors in the calculation, bioaccumulation and fraction methylmercury, EPA used site-specific data from the listed segment of the Chattahoochee River collected in March/April of 2002. (See Section 5.2.) From this site-specific data, EPA determined a representative "weighted" bioaccumulation factor (BAF). This BAF was calculated by taking the average calculated BAF from each of the two trophic levels to determine a "weighted" BAF based upon the different consumption rates for trophic levels, and a measured fraction methylmercury of 0.07. Using this approach, an allowable concentration of total mercury in the ambient water of the listed segment of the Chattahoochee River for the protection of human health is 1.0 nanograms per liter (parts per trillion). This concentration or less in the ambient water will prevent the bioaccumulation of mercury in fish tissue above 0.3 mg/kg. The site-specific data for total mercury in the water column collected in March/April 2002 was 0.3 to 1.5 ng/l.

5. Background

The Chattahoochee River is located in north/central Georgia (USGS Hydrologic Unit Code (HUC) 3070101). The Chattahoochee River basin is presented in Figure 1.

Upper Chattahoochee River

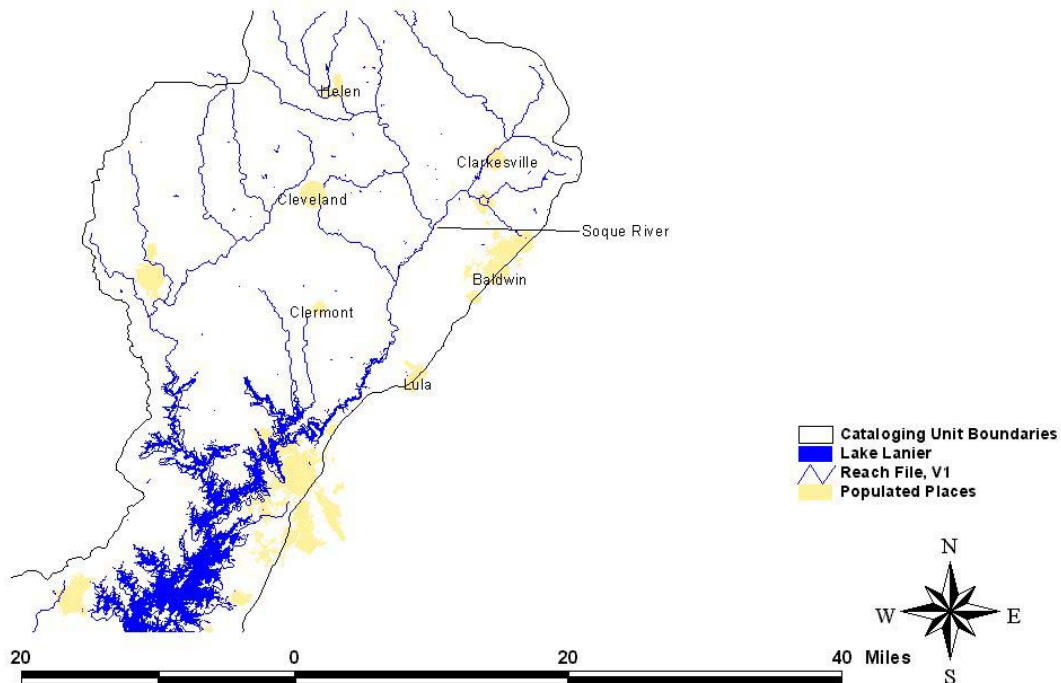


Figure 1 Map of Chattahoochee River

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. There are 3 NPDES permitted facilities (Table 2) that discharge to the listed segment of the Chattahoochee River.

Table 2 Permitted Facilities

Facility	Permit #	Flow (MGD)
Scovill Fastners	GA0001112	3
Clarkesville WPCP	GA0032514	0.75
Demorest WPCP	GA0032506	0.4

5.2. Available Monitoring Data

EPA Region 4 sampled the listed segment of the Chattahoochee River in March/April of 2002. Since even low concentrations of mercury in water can lead to significant accumulation of mercury in fish tissue, EPA sampled the Chattahoochee River using the most sensitive sampling and analytical techniques. The samples were collected using the

“clean hands” method (EPA, November 2000), and analyzed using the ultra-trace level analytical technique, EPA Method 1630/1631 (USEPA, 1999). EPA adopted this method in June of 1999 for mercury in water for data gathering and compliance monitoring under the Clean Water Act and Safe Drinking Water Act. This method can reliably measure mercury to 0.5 ng/l (parts per trillion).

The purpose of this data collection effort was to collect data needed for the development of this mercury TMDL. The sample locations for the water column are illustrated in Figure 2. Water column, sediment and soil samples (taken adjacent to the water column samples outside the flood plain) were taken from 2 locations in the listed segment of the Chattahoochee River. The sample locations noted as DB (Duncan Bridge Road) and BB (Belton Bridge Road) were used for this TMDL.

Sampling Station Locations

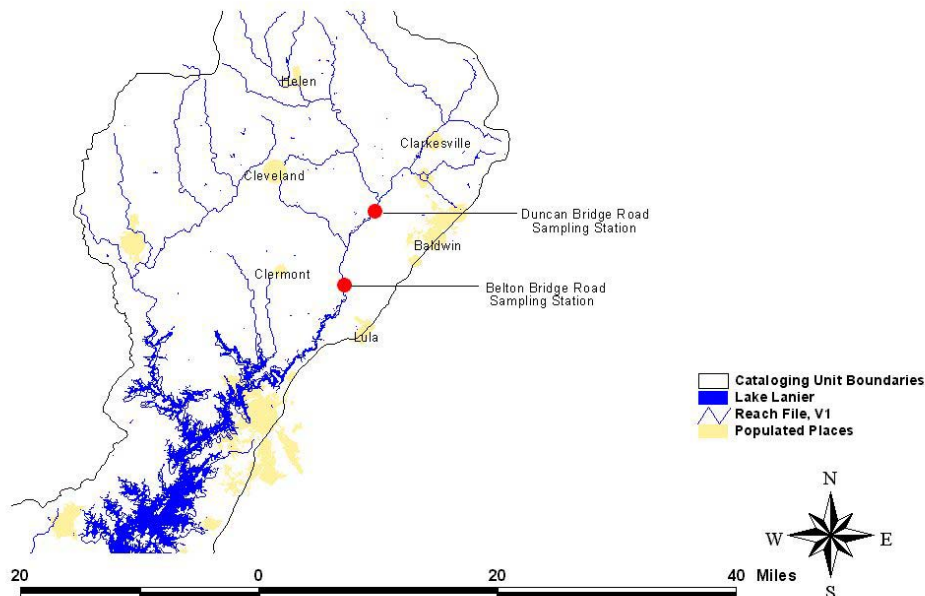


Figure 2 Chattahoochee River Sampling Station Locations

Sample locations for the fish collection are illustrated in Figure 2. The fish collection consisted of approximately 10 fish per sampling location, 5 - trophic level 3 fish (sunfish, catfish, etc.) and 5 - trophic level 4 (largemouth bass).

The following sections provide the results of the field sampling for mercury.

5.2.1. *Water Column Data*

Water column samples were taken to determine the ambient concentration of mercury in the water column using Method 1631, an ultra-trace level clean sampling and analytical

technique with a quantification level of 0.5 ng/l. The water column samples were analyzed for both total mercury and methylmercury. Because methylmercury is the primary form of mercury taken up in the food chain, it was important to quantify the fraction of the total mercury in the methyl form. Table 3 provides the measured mercury concentrations in the water column of the listed segment of the Chattahoochee River.

Table 3 Water Column Mercury Concentrations

Station	Waterbody	Mercury, Total (THg, ng/L)	Mercury, Methyl (MeHg, ng/L)	Fraction MeHg
DB	Chattahoochee River	1.5	0.06	0.04
BB	Chattahoochee River	0.3	0.03	0.11

5.2.2. *Sediment/Soil Data*

Samples of river sediments were gathered at the same locations as the water samples to determine the amount of mercury associated with the sediments and pore water. This data provides important information that can be used to parameterize the water quality model by providing evidence of the effects of mercury in the sediments on the total mercury water column concentration. Soil samples were collected from the surrounding watershed where the other samples were taken. EPA collected the soil samples to be used in the calibration of the watershed model. Table 4 provides the mercury concentrations associated with soils collected during the March/April 2002.

Table 4 Sediment/Soil Mercury Concentrations

Station	Waterbody	Total Mercury		Methylmercury	
		Sediment ug/kg	Surface Soil ug/kg	Sediment ug/kg	Surface Soil ug/kg
DB	Chattahoochee River	44	37	0.93	0.18
BB	Chattahoochee River	37	52	0.98	0.81

5.2.3. *Fish Tissue Data*

Samples of fish were taken from the listed segment of the Chattahoochee River within the same area as the water column and sediment samples. Trophic level three (sunfish, catfish) and trophic level four fish (largemouth bass) were targeted in the collection because they represent the fish that are caught and kept by anglers and consumed as a source of food. The fish filets obtained during EPA's sampling effort were analyzed for total mercury. Table 5 provides the individual fish data.

Table 5 Fish Tissue Mercury Data

Station	Waterbody	Trophic Level	Species	Total Length (mm)	Whole Wt (gm)	Filet Wt (gm)	THg, (mg/kg) Wet Weight
DB	Upper Chattahoochee	4	Largemouth Bass	447	1082	391	0.41
DB	Upper Chattahoochee	4	Spotted Bass	310	357	131	0.25
DB	Upper Chattahoochee	4	Redeye Bass	386	742	272	0.41
DB	Upper Chattahoochee	4	Redeye Bass	316	406	153	0.16
DB	Upper Chattahoochee	4	Redeye Bass	258	197	75	0.20
BB	Upper Chattahoochee	4	Spotted Bass	304	342	139	0.51
BB	Upper Chattahoochee	4	Largemouth Bass	470	1310	486	0.19
BB	Upper Chattahoochee	4	Walleye	480	868	400	0.59
BB	Upper Chattahoochee	4	Walleye	606	1925	831	0.95
BB	Upper Chattahoochee	4	Striped bass	670	3695	1365	0.18
DB	Upper Chattahoochee	3	Channel catfish	509	1158	335	0.28
DB	Upper Chattahoochee	3	Redhorse sp.	451	1029	402	0.08
DB	Upper Chattahoochee	3	Redbreast Sunfish	215	201	67	0.07
DB	Upper Chattahoochee	3	Shadow Bass	180	110	39	0.11
DB	Upper Chattahoochee	3	Spotted Bullhead	277	234	62	0.05
BB	Upper Chattahoochee	3	Snail Bullhead	225	NA	36	0.13
BB	Upper Chattahoochee	3	Sluegill Sunfish	183	83	29	0.09
BB	Upper Chattahoochee	3	Longear Sunfish	185	97	34	0.08
BB	Upper Chattahoochee	3	Black Crappie	170	44	19	0.01
BB	Upper Chattahoochee	3	Redear Sunfish	164	52	18	0.10

Table 6 shows the calculated weighted fish tissue concentration using the data during March/April 2002 and applying Equation 3-1. A weighted fish tissue concentration exceeding 0.3 mg/kg would indicate impairment.

Table 6 Weighted Average Fish Tissue Concentration

Trophic Level	Avg. Conc. Total Hg mg/kg	Max. Conc. Total Hg mg/kg	Min. Conc. Total Hg mg/kg	Count	Length	Total Hg mg/kg Geomean
4	0.4	1.0	0.2	11	424.7	0.3
3	0.1	0.3	0.0	10	255.9	0.1

Applying Equation 3-1 to the trophic level geometric mean concentrations yields a weighted average fish tissue concentration of 0.2 mg/kg.

6. 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 (as calculated in Section 3), for the listed segment of the Chattahoochee River is 2.3 kg/year to protect the accumulation of mercury in fish tissue. This TMDL determines the maximum load of total mercury that can enter the Chattahoochee River within a year without exceeding 0.3 mg/kg in fish tissue residue as calculated in Section 3.

6.1. Critical Condition Determination

The average annual flow and average annual loading represents the critical conditions for this TMDL. Average annual flow and average annual loading are appropriate for several reasons. First, EPA's human health methodology, which has been used to derive an appropriate numeric interpretation of Georgia's narrative water quality standard for toxic substances for this TMDL, assumes that health effects due to mercury occur as a result of long-term exposure to mercury in fish tissue through consumption of contaminated fish. The bioaccumulation of methylmercury in fish tissue is a long-term, multi-year, process. The State applies their human health criteria at a flow equivalent to the annual average flow (Georgia Rules and Regulations for Water Quality Control, Chapter 391-3-6-.03(5)(e)(iv) which requires the application of average annual load in the TMDL.

6.2. Seasonal Variation

Mercury is expected to fluctuate based on the amount and distribution of rainfall, and variable emissions from local and distant atmospheric sources. Since wet deposition is greatest in the spring and winter seasons, loadings of mercury are highest during these seasons. However, these seasonal impacts or other short-term variability in loadings are damped out by the biotic response of bioaccumulation, which as discussed above, is a long-term process. Therefore, seasonal variations are not important in this TMDL, which is expressed as an average annual load.

6.3. 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 may be expressed in conservative assumptions used to develop the TMDL. A MOS is incorporated into this TMDL in that the maximum load is based upon a conservative representation of mercury entering the Chattahoochee River and the TMDL calculation does not take into account reduction/volatilization. In addition, that increment of mercury loading between the current annual loading and the total amount of mercury the River can receive without exceeding the water quality standard is reserved as an additional MOS. This MOS reflects EPA's recognition that mercury is a bioaccumulative, persistent pollutant that appears on EPA's list of priority toxic pollutants.

6.4. TMDL Determination

To determine the total maximum load of total mercury to the Chattahoochee River, a conservative mass balance calculation is used. The annual average flow and the water quality standard as calculated in Equation 4-1 will be used to determine the maximum load of mercury to the waterbody as not to exceed a water column concentration of 1.0 ng/l. (See Equation 6-1.)

Equation 6-1 TMDL Determination

$$TMDL = \frac{WQS (ng / l) * Annual Average Flow * Number of Seconds / Year * 1000}{Number of ng / g}$$

where:

Water Quality Standard= 1.0 ng/l

Annual Average Flow in Waterbody = 74.26 cubic meters/second

Number of Seconds/Year = 31536000

Number of ng per gram = 1E9

The TMDL Load is calculated as 2.3 kg/year total mercury.

7. Allocation of Loads

In a TMDL assessment, the total allowable load is divided and allocated to the various pollutant sources. This allocation is provided as a Load Allocation (LA) to the nonpoint sources and as a Wasteload Allocation (WLA) to the point-source facilities in Georgia with an NPDES permit.

The calculated allowable load of mercury that can come into the Chattahoochee River without exceeding the applicable water quality standard of 1.0 ng/l is 2.3 kilograms/year. Because this assessment indicates that the allowable load can be maintained without reducing the current loads received by the River, both point and nonpoint sources will be assigned allocations equal to current loads. The remainder of the loading capacity is assigned to the MOS.

8. References

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