TOTAL MAXIMUM DAILY LOAD (TMDL)

For

Siltation & Habitat Alteration

In The

Harpeth River Watershed (HUC 05130204)

Cheatham, Davidson, Dickson, Hickman, Rutherford, & Williamson County, Tennessee

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ARS	Agricultural Research Station
BMP	Best Management Practices
CFR	Code of Federal Regulations
CFS	Cubic Feet per Second
CRC	Cumberland River Compact
DEM	Digital Elevation Model
DWPC	Division of Water Pollution Control
EPA	Environmental Protection Agency
HRWA	Harpeth River Watershed Association
HUC	Hydrologic Unit Code
LA	Load Allocation
MGD	Million Gallons per Day
MOS	Margin of Safety
MRLC	Multi-Resolution Land Characteristic
MS4	Municipal Separate Storm Sewer System
NED	National Elevation Dataset
NPS	Nonpoint Source
NPDES	National Pollutant Discharge Elimination System
NSL	National Sediment Laboratory
Rf3	Reach File v.3
RM	River Mile
SESD	Science and Ecosystem Support Division
STATSGO	State Soil and Geographic Database
SSURGO	Soil Survey Geographic Database
SWMP	Storm Water Management Plan
SWPPP	Storm Water Pollution Prevention Plan
TDEC	Tennessee Department of Environment & Conservation
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USLE	Universal Soil Loss Equation
WCS	Watershed Characterization System
WLA	Waste Load Allocation
WMD	Water Management Division
WWTF	Wastewater Treatment Facility

EXECUTIVE SUMMARY

Total Maximum Daily Load for Sediment in Waterbodies Listed on the State of Tennessee's 1998 Section 303(d) List Harpeth River Watershed (HUC 05130204)

The Tennessee Department of Environment and Conservation, Division of Water Pollution Control is proposing a Total Maximum Daily Load (TMDL) for sediment for waterbodies identified on the State's 1998 Section 303(d) list of impaired waters located within the Harpeth River Watershed in middle Tennessee. This TMDL proposes allocations for average annual sediment loading to activities and facilities discharging sediment to these waterbodies. This TMDL, when fully implemented, is expected to achieve the State's narrative water quality standard for protection of fish and aquatic life. The TMDL is expressed as pounds of average annual sediment load that can be discharged from each acre of the watershed during a year (lbs/acre/year) and still attain the applicable water quality standard.

Watershed Description

The Harpeth River watershed (HUC 05130204) is located in middle Tennessee and includes parts of Cheatham, Davidson, Dickson, Hickman, Rutherford, and Williamson Counties. The watershed lies within the Level III Interior Plateau (71) ecoregion and contains three Level IV sub-ecoregions. The Harpeth River watershed has approximately 1,364 miles of streams and drains a total area of 863 square miles. The mouth of the Harpeth River is at Cumberland River (Cheatham Lake) mile 152.9. The Harpeth River watershed has 23 waterbodies, representing nearly 323 miles, that are listed on the 1998 303(d) list for siltation and habitat alteration.

TMDL Approach

There are 23 facilities in the Harpeth River Watershed with National Pollutant Discharge Elimination System (NPDES) permits that require monitoring of Total Suspended Solids (TSS) or turbidity. The TMDL is providing these NPDES regulated Wastewater Treatment Facilities (WWTFs) their current NPDES permit limits as individual Waste Load Allocations (WLAs) for each facility. It is considered appropriate to provide these facilities their current discharge levels of TSS since these WWTF sources provide negligible loadings of sediment to the receiving waters compared to wet weather sources (e.g., NPDES regulated construction activities, Municipal Separate Storm Sewer Systems [MS4s], and nonpoint sources). Also, the TSS component of the WWTF discharges is generally composed more of organic material, and therefore, provides less direct impact on the biologic integrity of a stream (through settling and accumulation) than would stream sedimentation due to soil erosion during wet weather events.

This TMDL primarily addresses wet weather sources of sediment which are discharged to a receiving waterbody as a result of the storm events. These wet weather sources can be broadly defined, for the purposes of this TMDL, into two categories: wet weather sources regulated by the NPDES program, and wet weather sources *not* regulated by NPDES. Wet weather sources regulated by the NPDES program include industrial activities (which includes certain construction activities), and discharges from MS4s. The NPDES regulated sources are provided a Wasteload Allocation in this TMDL, and all other wet weather sources of sediment (those not regulated by NPDES) are provided a Load Allocation (LA).

For a TMDL to be established for the wet weather sources of sediment to the receiving waters, a numeric “target” protective of the uses of the waterbodies must be identified to serve as the basis for the TMDL. Where State regulation provides a numeric water quality criteria for the pollutant, the criteria is the basis for the TMDL. Where state regulation does not provide a numeric water quality criteria, as in the case of sediment, a numeric interpretation of the narrative water quality standard must be determined. The narrative water quality standard for protection of the fish and aquatic life designated use has been identified to serve as the basis for this sediment TMDL. All other designated uses for the waterbodies covered by this TMDL will be protected by attainment of the TMDL to protect fish and aquatic life.

For the purpose of this TMDL, the average annual sediment loading from a biologically healthy watershed located within the same Level IV ecoregion as the impaired watershed has been determined to be the appropriate numeric interpretation of the narrative water quality standard for protection of fish and aquatic life. The biologically healthy watershed was identified from the State’s ecoregion reference sites.

The Watershed Characterization System Sediment Tool was used to calculate the average annual sediment load for the biologically healthy (reference) subwatersheds in Level IV ecoregions 71f, 71h, and 71i. These were evaluated and the most appropriate reference load in each ecoregion selected as the target for TMDL analysis. Since the impairment of biological integrity due to sediment build-up is generally a long-term process, an average annual load is considered to be the appropriate measure for the TMDL. This average annual sediment load from the biologically healthy reference subwatershed is identified as the appropriate TMDL for the impaired subwatersheds located in the same Level IV ecoregion as the reference site.

The Watershed Characterization System Sediment Tool was also used to calculate the existing average annual sediment load for each impaired subwatershed in the Harpeth River watershed. Impaired subwatersheds are those in which one or more waterbodies on Tennessee's 1998 Section 303(d) list of impaired waters are located. The estimated existing average annual sediment loads for impaired subwatersheds are compared to the target average annual sediment loads for the biologically healthy subwatersheds to determine the percent reduction in average annual sediment loading required to fully attain the fish and aquatic life designated use.

The sediment TMDLs for waterbodies listed as impaired due to siltation/habitat alteration in the Harpeth River watershed are summarized in the table below.

TMDLs for 1998 303(d) Listed Waterbodies in the Harpeth River Watershed

Waterbody ID	1998 303(d) Listed Waterbody	TMDL [lbs/acre/year]
TN05130204001	Harpeth River - Dog Creek	220
TN05130204002	Jones Creek (Sulphur Fork to headwaters); Spicer Branch	220
TN05130204006	Turnbull Creek - Parker Creek; Barren Fork	220
TN05130204009A	Harpeth River Tributaries - Beech Ck.; Unnamed Tributary	660
TN05130204009B	Harpeth River Tributaries - Trace Ck.; Murray Branch; Newsome Creek	660
TN05130204010	South Harpeth River - Arkansas Creek; Bedford Creek	220
TN05130204013A	West Fork Harpeth River; Kennedy Ck.; Polk Ck. Cayce Branch	660
TN05130204013B	West Fork Harpeth Tributaries - Rattlesnake Branch	660
TN05130204016A	Harpeth River (West Fk. Harpeth River to I-65)	660
	Harpeth River (I-65 to headwaters)	220
TN05130204016B	Harpeth River Tributaries - Arrington Creek; Starnes Creek	220
	Harpeth River Tributaries - Spencer Creek; Watson Creek; Five Mile Creek; Lynnwood Creek	660
TN05130204016C	Harpeth River Tributaries - Kelly Ck.; Puckett Ck.; Concord Ck.; Cheatham Branch	220
TN05130204021	Little Harpeth River; Beech Creek; Otter Creek	660

Implementation of the TMDL

The WLAs provided to the NPDES Wastewater Treatment Facilities will be implemented through the State's NPDES permit program. The WLAs provided to the NPDES-regulated construction activities and municipal separate storm sewer systems (MS4s) will be implemented through Best Management Practices (BMPs) as specified in NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activit*y and Phase I & II MS4 permits. It is not technically feasible to incorporate numeric sediment limits into permits for these activities/facilities at this time. LAs for non-point sources will be achieved through the voluntary application of BMPs. Properly designed and well-maintained BMPs are expected to provide attainment of the wet weather WLAs and LAs.

As the science and available data for wet weather discharges of sediment continues to grow, more advanced approaches to sediment TMDLs are expected to be developed. These new approaches will be applied, as appropriate, through the adaptive management process to enhance the effectiveness of TMDLs for providing a sound basis for water quality management decisions. A discussion of U.S. Environmental Protection Agency's (EPA's) proposed future approach to sediment TMDLs is provided in the Appendix C.

Evaluation of the Effectiveness of the TMDL

The effectiveness of the TMDL will be assessed within the context of the State's rotating watershed management approach. Watershed monitoring and assessment activities will provide information by which the effectiveness of sediment loading reduction measures can be evaluated. This monitoring will be guided by the results of a Harpeth River watershed sediment study, conducted by the Harpeth River Watershed Association and the Cumberland River Compact. Monitoring data, ground-truthing, and source identification actions will also enable implementation of particular types of BMPs to be directed to specific areas in the subwatersheds. These TMDLs will be revaluated during subsequent watershed cycles and revised as required to assure attainment of applicable water quality standards.

PROPOSED SEDIMENT TOTAL MAXIMUM DAILY LOAD (TMDL) HARPETH RIVER WATERSHED (HUC 05130204)

1.0 INTRODUCTION

Section 303(d) of the Clean Water Act requires each state to list those waters within its boundaries for which technology based effluent limitations are not stringent enough to protect any water quality standard applicable to such waters. Listed waters are prioritized with respect to designated use classifications and the severity of pollution. In accordance with this prioritization, states are required to develop Total Maximum Daily Loads (TMDLs) for those water bodies that are not attaining water quality standards. State water quality standards consist of designated use(s) for individual waterbodies, appropriate numeric and narrative water quality criteria protective of the designated uses, and an antidegradation statement. The TMDL process establishes the maximum allowable loadings of pollutants for a waterbody that will allow the waterbody to maintain water quality standards. The TMDL may then be used to develop controls for reducing pollution from both point and nonpoint sources in order to restore and maintain the quality of water resources (USEPA, 1991).

2.0 WATERSHED DESCRIPTION

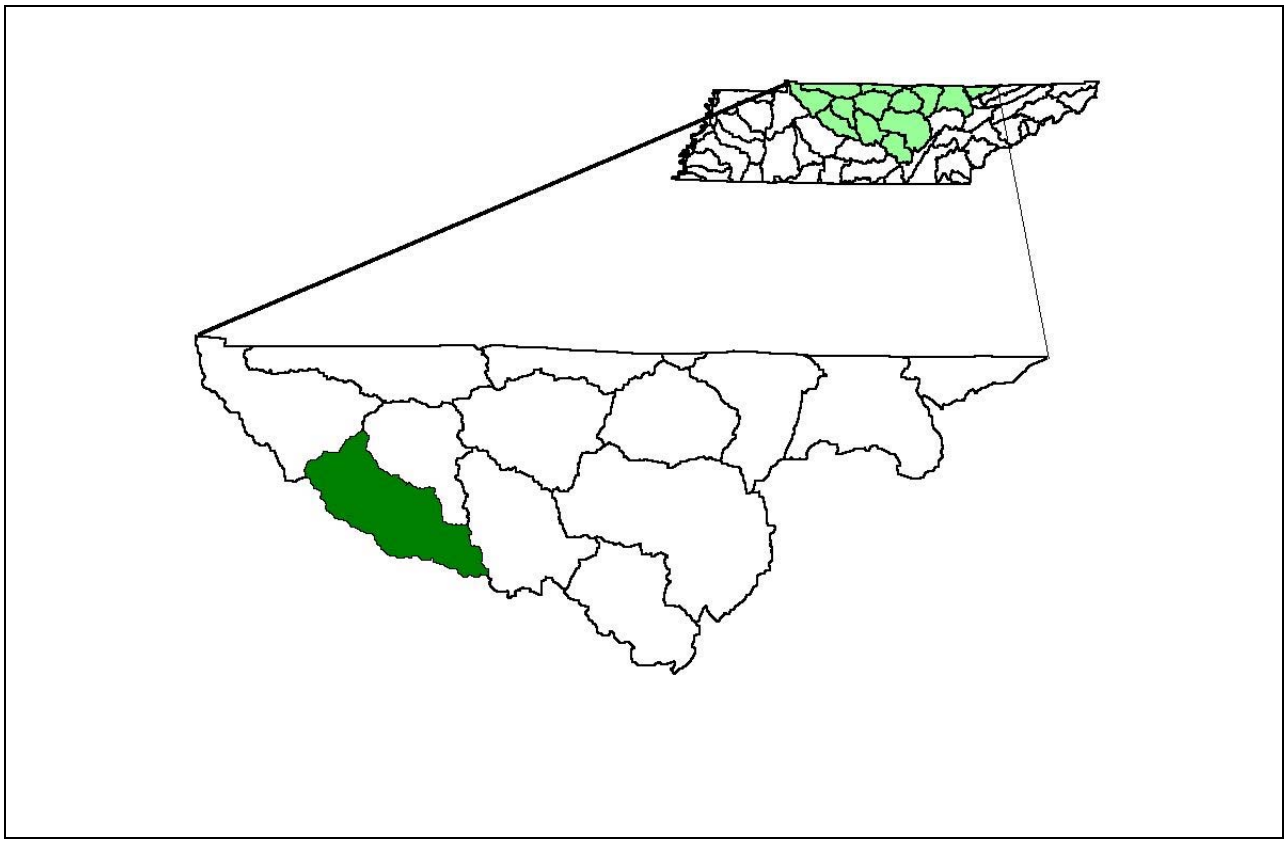
The Harpeth River watershed (HUC 05130204) is located in Middle Tennessee (Figure 1) and includes parts of Cheatham, Davidson, Dickson, Hickman, Rutherford, and Williamson Counties. The watershed lies within the Level III Interior Plateau (71) ecoregion and contains three Level IV ecoregions as shown in Figure 2 (USEPA, 1997):

- Western Highland Rim (71f) is characterized by dissected, rolling terrain of open hills, with elevations of 400 to 1000 feet. The geologic base of Mississippian-age limestone, chert, and shale is covered by soils that tend to be cherty, acidic and low to moderate in fertility. Streams are characterized by coarse chert gravel and sand substrates with areas of bedrock, moderate gradients, and relatively clear water. The oak-hickory natural vegetation was mostly deforested in the mid to late 1800's, in conjunction with the iron ore related mining and smelting of the mineral limonite, but now the region is again heavily forested. Some agriculture occurs on the flatter areas between streams and in the stream and river valleys: mostly hay, pasture, and cattle, with some cultivation of corn and tobacco.

- Outer Nashville Basin (71h) is a more heterogeneous region than the Inner Nashville Basin, with more rolling and hilly topography and slightly higher elevations. The region encompasses most all of the outer areas of the generally non-cherty Ordovician limestone bedrock. The higher hills and knobs are capped by the more cherty Mississippian-age formations, and some Devonian-age Chattanooga shale, remnants of the Highland Rim. The region's limestone rocks and soils are high in phosphorus, and commercial phosphate is mined. Deciduous forests with pasture and cropland are the dominant land covers. Streams are low to moderate gradient, with productive nutrient-rich waters, resulting in algae, rooted vegetation, and occasionally high densities of fish. The Nashville Basin as a whole has a distinctive fish fauna, notable for fish that avoid the region, as well as those that are present.

- Inner Nashville Basin (71i) is less hilly and lower than the Outer Nashville Basin. Outcrops of the Ordovician-age limestone are common, and the generally shallow soils are redder and lower in phosphorus than those of the Outer Basin. Streams are lower gradient than surrounding regions, often flowing over large expanses of limestone bedrock. The most characteristic hardwoods within the Inner Basin are a maple-oak-hickory-ash association. The limestone cedar glades of Tennessee, a unique mixed grassland/forest/cedar glades vegetation type with many endemic species, are located primarily on the limestone of the Inner Nashville Basin. The more xeric, open characteristics and shallow soils of the cedar glades also result in a distinct distribution of amphibian and reptile species.

Figure 1 Location of Harpeth River Watershed



The Harpeth River watershed has approximately 1,364 miles of streams (Rf3) and drains a total area of 863 square miles. The mouth of the Harpeth River is at Cumberland River (Cheatham Lake) mile 152.9. Watershed land use distribution is based on the Multi-Resolution Land Characteristic (MRLC) databases derived from Landsat Thematic Mapper digital images from the period 1990-1993. Land use for the Harpeth River watershed is summarized in Table 1 and shown in Figure 3.

Figure 2 Level IV Ecoregions in the Harpeth River Watershed

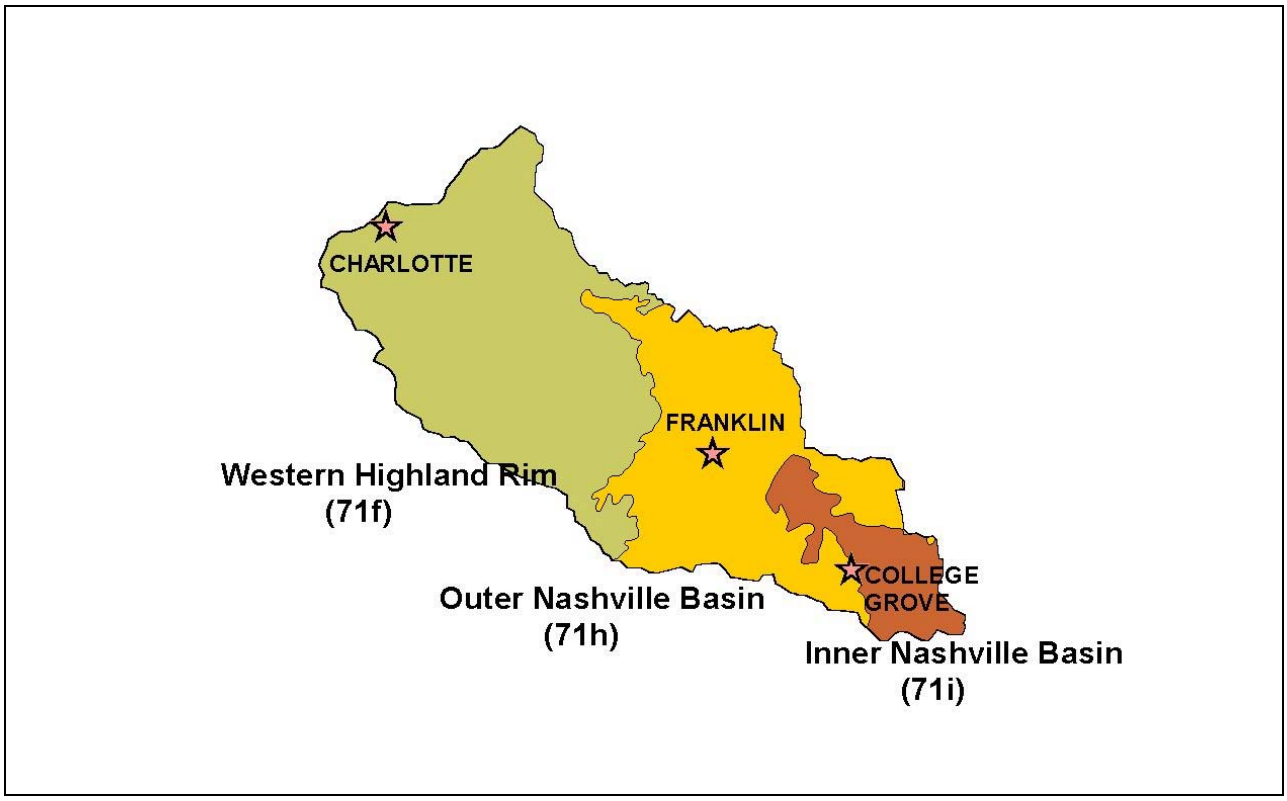


Figure 3 MRLC Land Use Distribution in the Harpeth River Watershed

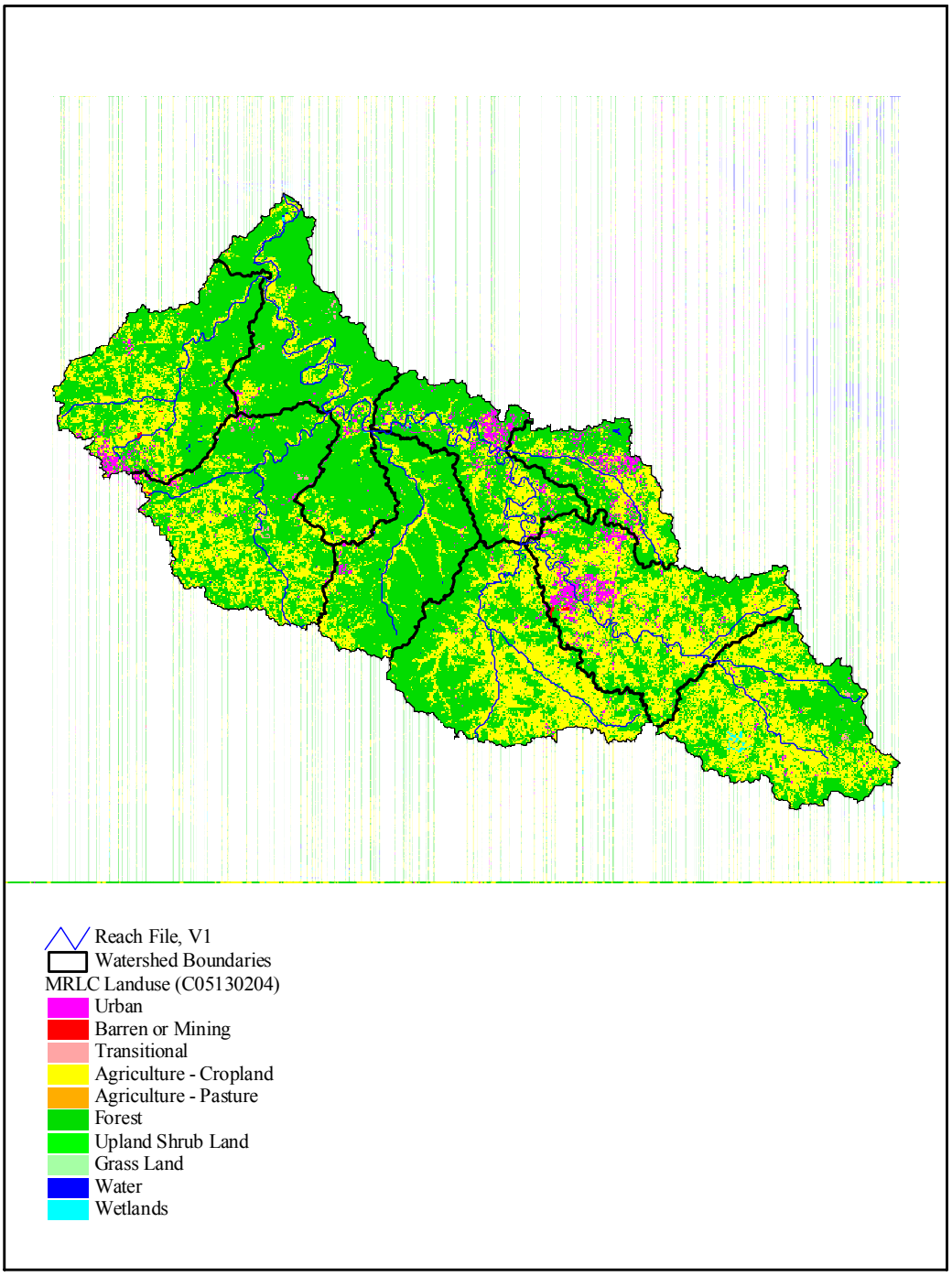


Table 1 Land Use Distribution - Harpeth River Watershed

LAND COVER/LAND USE	AREA [sq. mi.]	AREA [%]
Open Water	3.2	0.4
Low Intensity Residential	15.9	1.9
High Intensity Residential	1.9	0.2
High Intensity Commercial /Industrial/Transportation	7.5	0.9
Bare Rock/Sand/Clay	0	0
Transitional	1.6	0.2
Deciduous Forest	429.3	50.2
Evergreen Forest	21.6	2.5
Mixed Forest	84.6	9.9
Pasture/Hay	200.0	23.4
Row Crops	75.1	8.8
Other Grasses (Urban/Recreational)	12.5	1.4
Woody Wetlands	1.1	0.1
Emergent Herbaceous Wetlands	0	0
Quarries/Strip Mines/Gravel Pits	0.5	0.1
Total	**854.8**	**100.0**

3.0 PROBLEM DEFINITION

Siltation effects impact over 4,000 miles of streams in Tennessee and is by far the most frequently cited pollutant for surface waters. Pollution due to siltation has a significant economic impact due to increased water treatment costs, loss of storage capacity in reservoirs, direct impacts to navigation, and the increased possibility of flooding (TDEC 2000a).

Silt alters the physical properties of waters by:

- Restricting or preventing light penetration
- Altering temperature patterns
- Decreasing the depth of pools or lakes
- Changing flow patterns

Silt alters the chemical properties of waters by:

- Interfering with photosynthesis
- Causing an increase in sediment oxygen demand due to decomposition of organic material
- Increasing nutrient levels which can accelerate eutrophication
- Transporting organic chemicals and metals into the water column (especially if the original disturbed site was contaminated)

Silt alters the biological properties of waters by:

- Smothering eggs and nests of fish
- Piggybacking other pollutants in possibly toxic amounts or providing a reservoir of substances that may bioconcentrate in the food chain
- Clogging the gills of fish and other forms of aquatic life
- Interfering with the feeding of fish species that find food by sight
- Covering substrate that provides habitat for benthic organisms that provide food for fish
- Reducing biological integrity by altering habitats to favor burrowing species
- Accelerating the growth of submerged aquatic plants

The State of Tennessee's final 1998 303(d) list (TDEC, 1998) was approved by the U.S. Environmental Protection Agency (EPA), Region IV on September 17, 1998. The list identified a number of waterbodies in the Harpeth River watershed as not fully supporting designated use classifications due to siltation and/or habitat alteration (see Table 2). The designated use classifications for the Harpeth River and its tributaries include fish and aquatic life, irrigation, livestock watering & wildlife, and recreation. Some waterbodies in the watershed are also classified for industrial water supply and/or domestic water supply. This TMDL is established to attain the fish and aquatic life designated use since all other uses will be protected by this approach.

Waterbodies in the Harpeth River watershed were reassessed by the State in 2000 using more recent data and a revised waterbody identification system (see Table 3). The waterbody listings in Table 3 represent smaller watersheds than those listed in the 1998 303(d) list (Table 2.) All waters listed on the 2000 reassessment (Table 3) fall within one of the larger watersheds on the1998 303(d) list (Table 2). The last column in Table 3 provides the link between the 2000 assessment and the 1998 303(d) list. Since this Harpeth River sediment TMDL addresses all subwatersheds in the Harpeth River watershed, all waterbodies listed on both the 1998 303(d) list and the 2000 assessment are provided a TMDL for sediment loading.

Table 2 1998 303(d) List For Siltation/Habitat Alteration– Harpeth River Watershed

Waterbody ID	Impacted Waterbody	RM Partially Supporting	RM Not Supporting	CAUSE (Pollutant)
TN05130204001	HARPETH RIVER - Dog Ck is not supporting.		3.8	Siltation Habitat Alteration
TN05130204002	JONES CREEK - Jones Cr from Sulphur Fk to headwaters is partially. Spicer Branch is not supporting.	23.5	5.9	Siltation
TN05130204006	TURNBULL CREEK - Barren Fork and Parker Creeks are partial.	24.7		Siltation Habitat Alterations
TN05130204009A	HARPETH RIVER TRIBUTARIES - Beech and unnamed tributary to Harpeth are not supporting.		5.7	Siltation Habitat Alterations
TN05130204009B	HARPETH RIVER TRIBUTARIES - Newsome Cr, Trace Cr, and Murray Branch are partially supporting.	10.4		Siltation Habitat Alterations
TN05130204010	SOUTH HARPETH R - A portion of Arkansas Creek is not supporting. Bedford Cr. is partially.	5.8	5.7	Siltation Habitat Alterations
TN05130204013A	WEST FORK HARPETH RIVER - A portion of West Harpeth, plus Cayce Branch, Polk, and Kennedy Creek, are partially supporting.	62.1		Siltation Habitat Alterations
TN05130204013B	WEST FORK HARPETH RIVER TRIBUTARIES - Rattlesnake Branch is not supporting		6.5	Siltation Habitat Alterations
TN05130204016A	HARPETH RIVER-From W FK Harpeth to headwaters is partially supporting.	37.3		Habitat Alterations Siltation
TN05130204016B	HARPETH RIVER TRIBUTARIES Arrington Cr, Spencer Cr, Watson Br, 5-mile Cr, Lynnwood Cr, and Starnes Cr are partially supporting.	79		Habitat Alterations Siltation
TN05130204016C	HARPETH RIVER TRIBUTARIES Concord Cr, Puckett, Cheatham, Kelly, portion of Harpeth headwaters, are not supporting.		35.7	Habitat Alterations Siltation
TN05130204021	LITTLE HARPETH RIVER - Portions of Little Harpeth, Beech, and Otter Creeks are partially supporting.	16.2		Habitat Alterations Siltation

Table 3 2000 Assessment – Stream Impairment Due to Siltation/Habitat Alteration in the Harpeth River Watershed

Waterbody ID	Segment Name	Size [mi.]	Use Support	CAUSE (Pollutant)	Reference to 1998 303(d) List Waterbody ID
TN05130204001 – 0500	Dog Creek	3.8	Not	Siltation Other Habitat Alterations	TN05130204001
TN05130204002 – 0300	Spicer Branch	4.6	Not	Siltation Other Habitat Alterations	TN05130204002
TN05130204002 – 0400	Unnamed Tributary To Jones Creek	0.5	Not	Siltation Other Habitat Alteration	TN05130204002
TN05130204002 – 2000	Jones Creek	15.1	Partial	Siltation	TN05130204002
TN05130204006 – 0300	Tidwell Branch	1.1	Partial	Siltation	
TN05130204006 – 0500	Barren Fork	10.6	Partial	Siltation	TN05130204006
TN05130204006 – 0510	Rials Branch	1.9	Partial	Siltation	TN05130204006
TN05130204006 – 0600	Parker Creek	4.1	Partial	Siltation Other Habitat Alteration	TN05130204006
TN05130204006 – 0700	Goslin Branch	4.3	Partial	Siltation	TN05130204006
TN05130204006 – 0800	Nails Creek	7.6	Partial	Siltation	TN05130204006
TN05130204006 – 0920	Jordan Hollow Creek	2.4	Partial	Siltation	TN05130204006
TN05130204006 – 0930	Gum Branch	2.7	Partial	Siltation	TN05130204006
TN05130204009 – 0200	Newsom Branch	1.7	Partial	Siltation	TN05130204009B
TN05130204009 – 0600	Murray Branch	3.6	Partial	Siltation	TN05130204009B
TN05130204009 – 0800	Unnamed Trib. to Harpeth River	2.1	Not	Siltation	TN05130204009A
TN05130204009 – 0900	Trace Creek	4.9	Partial	Other Habitat Alterations	TN05130204009B
TN05130204009 – 1100	Beech Creek	3.6	Not	Other Habitat Alterations	TN05130204009A
TN05130204010 – 0500	Bedford Creek	5.0	Partial	Siltation Other Habitat Alterations	TN05130204010
TN05130204010 – 0600	Arkansas Creek	5.7	Partial	Siltation	TN05130204010
TN05130204013 – 0100	Polk Creek	8.8	Partial	Siltation Other Habitat Alterations	TN05130204013A
TN05130204013 – 0200	Kennedy Creek	4.8	Partial	Other Habitat Alterations	TN05130204013A
TN05130204013 – 0310	Rattlesnake Branch	6.5	Not	Other Habitat Alterations	TN05130204013B

Table 3 2000 Assessment – Stream Impairment Due to Siltation/Habitat Alteration in the Harpeth River Watershed (Continued)

Waterbody ID	Segment Name	Size [mi.]	Use Support	CAUSE (Pollutant)	Reference to 1998 303(d) List Waterbody ID
TN05130204013 – 0320	Cayce Branch	5.9	Partial	Siltation Other Habitat Alterations	TN05130204013A
TN05130204013 – 1000	West Harpeth River	13.4	Partial	Siltation	TN05130204013A
TN05130204016 – 0100	Lynwood Creek	5.4	Partial	Other Habitat Alterations Siltation	TN05130204016B
TN05130204016 – 0200	Spencer Creek	19.9	Partial	Siltation	TN05130204016B
TN05130204016 – 0300	Watson Branch	6.8	Partial	Siltation	TN05130204016B
TN05130204016 – 0500	Arrington Creek	24.6	Partial	Siltation	TN05130204016B
TN05130204016 – 0700	Starnes Creek	10.0	Partial	Other Habitat Alterations Siltation	TN05130204016B
TN05130204016 – 0900	Fivemile Creek	14.4	Partial	Siltation	TN05130204016B
TN05130204016 – 1100	Donelson Creek	3.4	Not	Siltation	
TN05130204016 – 2000	Harpeth River	9.0	Partial	Siltation	TN05130204016A
TN05130204016 – 3000	Harpeth River	7.5	Partial	Siltation	TN05130204016A
TN05130204018 – 0200	Concord Creek	15.1	Not	Other Habitat Alterations Siltation	TN05130204016C
TN05130204018 – 0300	Kelley Creek	9.3	Not	Other Habitat Alterations Siltation	TN05130204016C
TN05130204018 – 0400	Cheatham Branch	3.4	Partial	Other Habitat Alterations Siltation	TN05130204016C
TN05130204018 – 2000	Harpeth River	7.4	Not	Other Habitat Alterations Siltation	TN05130204016A
TN05130204021 – 0100	Otter Creek	4.6	Partial	Other Habitat Alterations Siltation	TN05130204021
TN05130204021 – 0200	Beech Creek	7.7	Partial	Habitat Alteration Siltation	TN05130204021
TN05130204021 – 1000	Little Harpeth River	4.1	Partial	Other Habitat Alterations Siltation	TN05130204021

4.0 TARGET IDENTIFICATION

Several narrative criteria, applicable to siltation/habitat alteration, are established in *State of Tennessee Water Quality Standards, Chapter 1200-4-3 General Water Quality Criteria, October 1999* (TDEC, 1999):

Applicable to all use classifications (Fish & Aquatic Life shown):

> Solids, Floating Materials, and Deposits – There shall be no distinctly visible solids, scum, foam, oily slick, or the formation of slimes, bottom deposits or sludge banks of such size and character that may be detrimental to fish and aquatic life.
>
> Other Pollutants – The waters shall not contain other pollutants that will be detrimental to fish or aquatic life.

Applicable to the Domestic Water Supply, Industrial Water Supply, Fish & Aquatic Life, and Recreation use classifications (Fish & Aquatic Life shown):

> Turbidity or Color – There shall be no turbidity or color in such amounts or of such character that will materially affect fish and aquatic life.

Applicable to the Fish & Aquatic Life use classification:

> Biological Integrity - The waters shall not be modified through the addition of pollutants or through physical alteration to the extent that the diversity and/or productivity of aquatic biota within the receiving waters are substantially decreased or adversely affected, except as allowed under 1200-4-3-.06. The condition of biological communities will be measured by use of metrices suggested in guidance such as Rapid Bioassessment Protocols for Use in Streams and Rivers (EPA/444/4-89-001) or other scientifically defensible methods. Effects to biological populations will be measured by comparisons to upstream conditions or to appropriately selected reference sites in the same ecoregion (See definition).

This TMDL is being established to attain the fish and aquatic life designated use. A TMDL established to protect the fish and aquatic life use will protect all other uses for the identified waterbodies from adverse alteration due to sediment loading.

In order for a TMDL to be established, a numeric “target” protective of the uses of the water must be identified to serve as the basis for the TMDL. Where State regulation provides a numeric water quality criteria for the pollutant, the criteria is the basis for the TMDL. Where state regulation does not provide a numeric water quality criteria, as in the case of sediment, a numeric interpretation of the narrative water quality standard must be determined. For the purpose of this TMDL, the average annual sediment loading from a biologically healthy watershed, located within the same Level IV ecoregion as the impaired watershed, is determined to be the appropriate numeric interpretation of the narrative water quality standard for protection of fish and aquatic life. The biologically healthy watershed was identified from the State’s ecoregion reference sites. These ecoregion reference sites have similar characteristics and conditions as the majority of streams in the ecoregion. Detailed information regarding Tennessee ecoregion reference sites can be found in *Tennessee Ecoregion Project, 1994-1999* (TDEC 2000), which is summarized in Appendix D. In general, land use within the ecoregion watersheds contained less pasture, cropland, and urban

areas, and more forested areas compared to the impaired watersheds. The biologically healthy (reference) watersheds are considered the "least impacted" in the ecoregion and, as such, average annual sediment loading from these subwatersheds may serve as the appropriate target for the TMDL.

Using the methods described in Appendix A, the Watershed Characterization System (WCS) sediment "tool" was used to calculate the average annual sediment load for each of the biologically healthy (reference) subwatersheds. These were evaluated and the most appropriate reference load selected as the target for each Level IV ecoregion.

Level IV Ecoregion 71f

There were two reference sites in the 71f Level IV ecoregion that were used in the target identification. The two stations were ECO71F12 (South Harpeth River) and ECO71F16 (Wolf Creek). The average annual sediment load was 2320 lbs/acre/year from the ECO71F12 subwatershed and 220 lbs/acre/year from the ECO71F16 subwatershed. This large difference can be explained by the distribution of land use between the two sub-watersheds, namely row crops. Within the ECO71F16 sub-watershed, all of the land use is evenly distributed. Reference station ECO71F12, on the other hand, had more that 95% of its row crops grouped around the headwaters of the subwatershed. Since the land use C factor used for row crops in the Sediment Tool was large, row crops typically produced the highest percentage of sediment within a watershed. It is also important to note that the method used to calculate sediment delivery to the stream used both distance and slope. Therefore, if a watershed had a lot of relief, and also had a high concentration of its row crops surrounding the headwaters, that watershed should produce a high sediment load to the system. This scenario describes the ECO71F12 subwatershed. Due to the configuration of the ECO71F12 subwatershed, it was determined that the average annual sediment load calculated by the Sediment Tool may not be representative of other watersheds within the 71f Level IV ecoregion. Consequently, the average annual unit sediment load from ECO71F16 (220 lbs/acre/year) was selected as the target.

Level IV Ecoregion 71h

There were two reference sites in the 71h Level IV ecoregion that were used in the target identification. The two stations were ECO71H09 (Carson Fork) and ECO71H15 (West Harpeth River). Upon reviewing these two stations, it was noted that station ECO71H15 was dropped from the State of Tennessee's ecoregion reference site list due to massive development in the sub-watershed. A significant portion of this development is that associated with new Highway 840, which cuts directly through the subwatershed. Since ECO71H15 was dropped as an ecoregion site, this station was not used. The average annual unit sediment load was 660 lbs/acre/year from the ECO71H09 subwatershed.

Level IV Ecoregion 71i

There were two reference sites in the 71i Level IV ecoregion that were used in the target identification. The two stations were ECO71I03 (Stewart Creek) and ECO71I09 (West Fork Stones River). The average annual sediment load was 220 lbs/acre/year from the ECO71I03 subwatershed and was 300 lbs/acre/year from ECO71I09 subwatershed. Since an implicit margin of safety was applied to the TMDLs (conservative modeling assumptions), the ECO71I03 station (220 lbs/acre/year) was used for the target.

Since the impairment of biological integrity due to sediment build-up is generally a long-term process, using an average annual load is considered appropriate. The average annual sediment load TMDL target values for Level IV ecoregions 71f, 71h, and 71i are summarized in Table 4.

Table 4 TMDL Target Average Annual Sediment Loads

Level IV Ecoregion	Reference Watershed Monitoring Station	Target Sediment Load [lbs/acre/year]
71f	ECO71F16	220
71h	ECO71H09	660
71i	ECO71I09	220

5.0 WATER QUALITY ASSESSMENT AND DEVIATION FROM TARGET

Using the methodology described in Appendix A, the WCS Sediment Tool was used to estimate the existing average annual sediment load for all subwatersheds (corresponding to 12-digit HUCs) in the Harpeth River watershed (Figure 4). The estimated existing average annual sediment loads for subwatersheds with waterbodies listed as impaired for siltation/habitat alteration are summarized in Table 5.

Table 5 Existing Average Annual Sediment Loads in Subwatersheds With 303(d) Listed Waterbodies

Subwatershed	Subecoregion (Level IV)	Existing Sediment Load [lbs/acre/year]
0401	71f	1,276
0501	71f	1,444
0601	71f	2,012
0604	71f	1,199
0304	71f	959
0302	71h	808
0105	71h	1,895
0201	71h	982
0202	71h	1,258
0301	71h	977
0104	71i	759
0102	71i	863
0101	71i	351

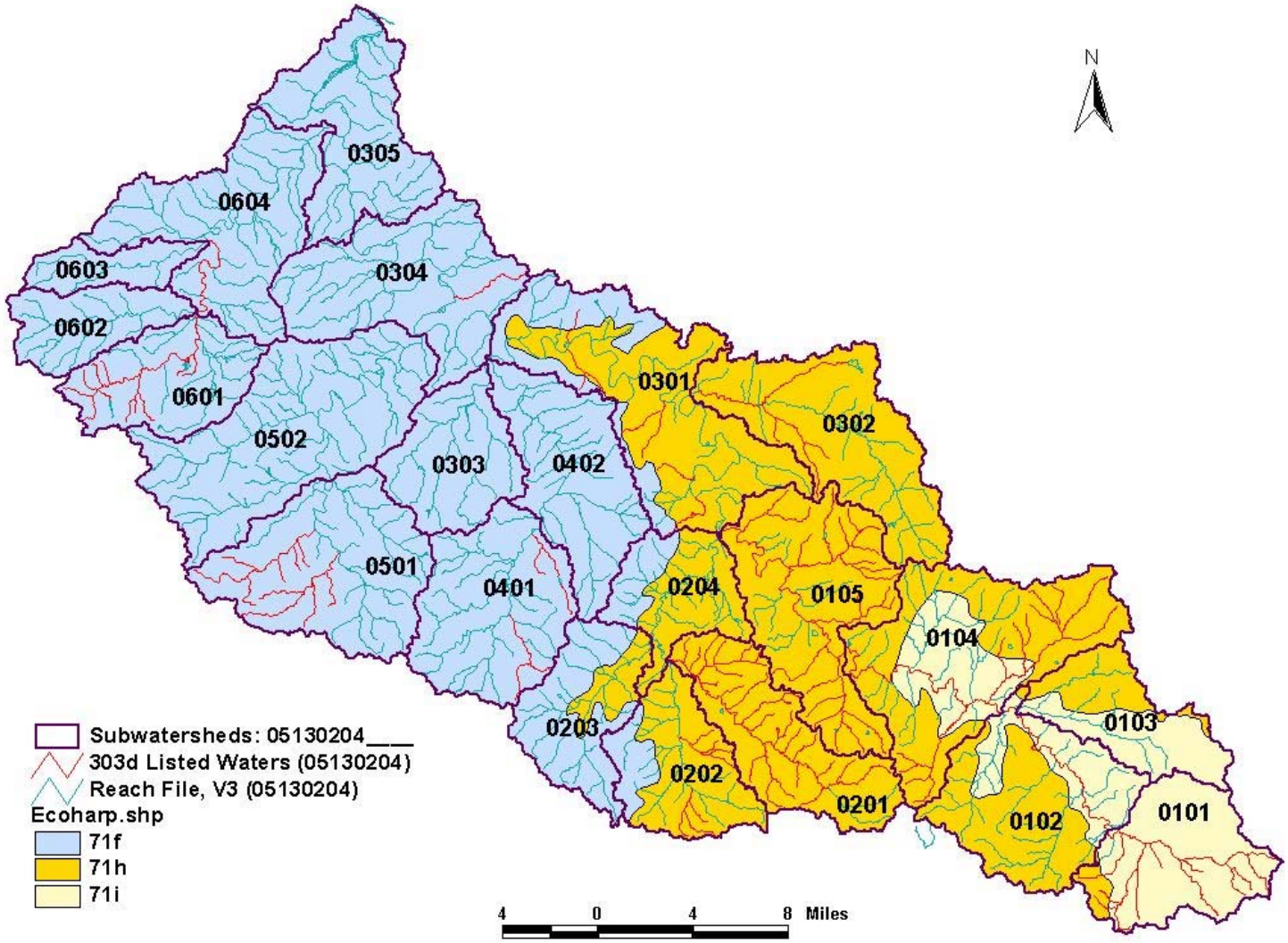


Figure 4 Harpeth River Watershed – Subwatershed Delineation (12 Digit HUC)

6.0 SOURCE ASSESSMENT

An important part of the TMDL analysis is the identification of individual sources, source categories, or source subcategories of siltation in the watershed and the amount of pollutant loading contributed by each of these sources. Under the Clean Water Act, sources are broadly classified as either point or nonpoint sources. Under 40 CFR §122.2, a point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. The National Pollutant Discharge Elimination System (NPDES) program regulates point source discharges. Point sources can be described by two broad categories: 1) NPDES regulated municipal and industrial wastewater treatment facilities (WWTFs) and 2) NPDES regulated industrial activities (which includes construction activities) and municipal storm water discharges (Municipal Separate Storm Sewer Systems [MS4s]). A TMDL must provide Waste Load Allocations (WLAs) for all NPDES regulated point sources. For the purposes of this TMDL, all sources of sediment loading not regulated by NPDES are considered nonpoint sources. The TMDL must provide a Load Allocation (LA) for these sources.

6.1 Point Sources

6.1.1 NPDES Regulated Municipal and Industrial Wastewater Treatment Facilities

Discharges from WWTFs may contribute sediment to receiving waters as Total Suspended Solids (TSS) and/or turbidity. There are 23 facilities with NPDES permits that require monitoring of TSS or turbidity in the Harpeth River watershed. These discharges are summarized in Table 6. Sediment loads to the receiving streams from WWTFs are negligible in relation to sediment discharges caused by storm water runoff. The cumulative total of all WWTF discharges to receiving waters in the Harpeth River watershed is calculated to be less than 2% of the total loading of sediment. The TSS component of WWTF discharges is generally composed more of organic material and, therefore, provides less direct impact to the biological integrity of the stream (through settling and accumulation) than would stream sedimentation due to soil erosion.

6.1.2 NPDES Regulated Construction Sites and Municipal Separate Storm Sewer Systems

Sediment loadings from NPDES regulated construction activities and Municipal Separate Storm Sewer Systems (MS4s) are considered point sources of sediment to surface waters. These discharges occur in response to storm events.

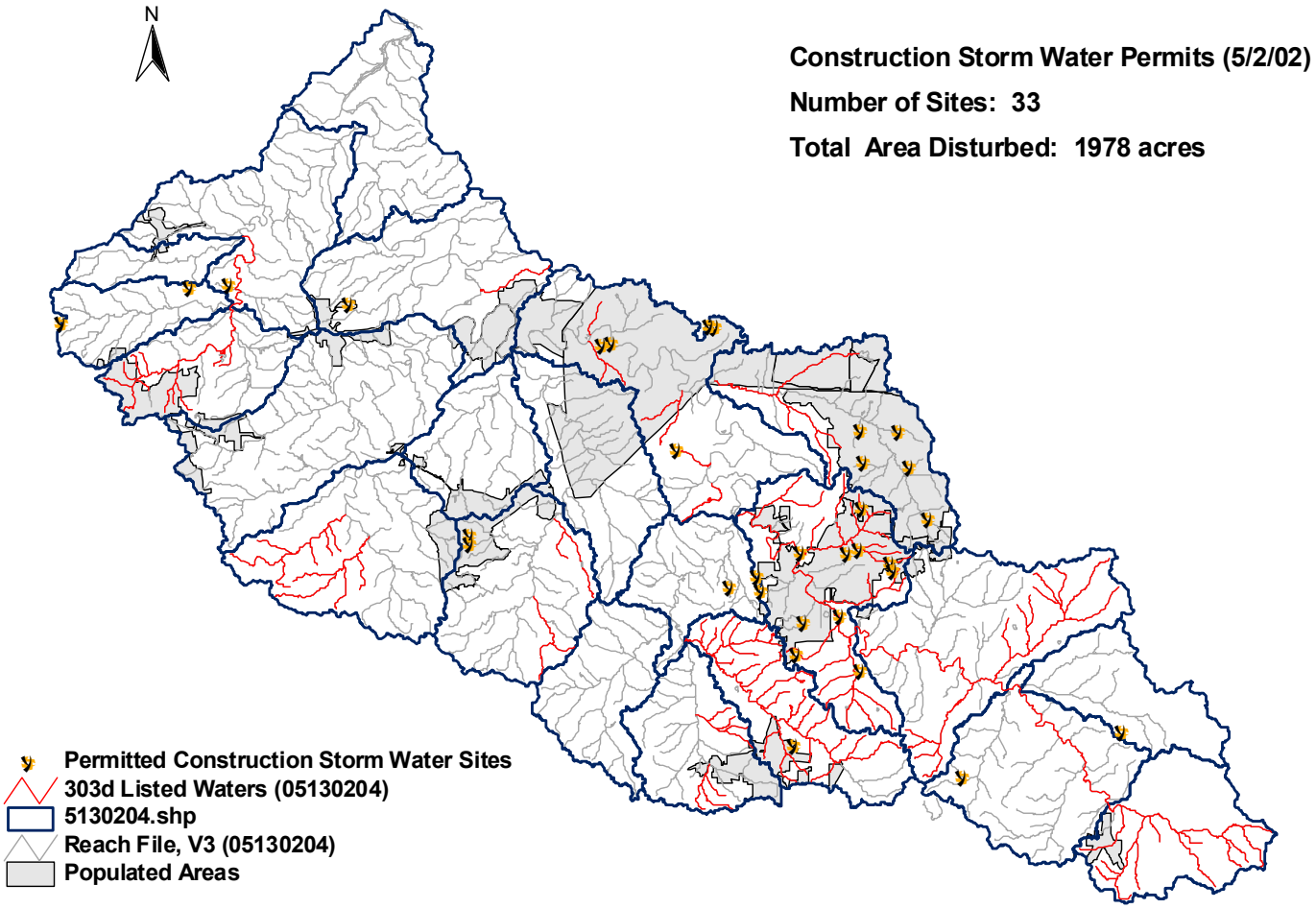
Currently, discharges of storm water from construction activities disturbing an area of five acres or more must be authorized by an NPDES permit. Most of these construction sites obtain coverage under NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activity*. In some cases, for discharges into 303(d) listed waters, sites may be required to obtain coverage under an individual NPDES permit. Beginning in March 2003, discharge of storm water from construction activities disturbing between one and five acres must also be authorized by an NPDES permit. The purpose of these NPDES permits is to eliminate or minimize the discharge of pollutants from construction activities. Since construction activities at a site are of a temporary, relatively short term nature, the number of construction sites covered by the general permit at any instant of time varies. In the Harpeth River watershed, there were 33 permitted construction sites, disturbing, 1,978 acres on May 2, 2002. The location of these sites is shown in Figure 5.

Table 6 NPDES Municipal and Industrial Wastewater Treatment Facilities Discharging TSS in the Harpeth River Watershed

Sub-watershed	Sub-watershed Area	NPDES Permit No.	Facility	Design Flow	NPDES Permit Limit - TSS				
					Monthly Average		Weekly Average		Daily Maximum
	[acres]			[MGD]	[mg/l]	[lbs/day]	[mg/l]	[lbs/day]	[mg/l]
0304	30,558.4	TN0020460	White Bluff STP	0.500	30	125	40	167	40
0304	30,558.4	TN0004294	Second South Cheatham U.D. WTP	0.080	--	--	--	--	45
0304	30,558.4	TN0020737	Ashland City STP	0.801	30	200	40	267	45
0304	30,558.4	TN0059790	Kingston Springs STP	0.250	100	209	110	229	120[a]
0301	40,162.4	TN0074586	Pegram STP	0.050	30	13	40	17	45
0301	40,162.4	TN0027278	Cartwright Creek Utility Co. STP	0.250	30	63	40	83	45
0301	40,162.4	TN0029718	Lynwood Utility STP	0.400	30	100	40	133	45
0105	33,023.4	TN0028827	Franklin STP	5.500[b]	30	1376	40	1835	45
0105	33,023.4	TN0060216	Goose Creek Inn	0.030	30	--	--	--	45
0105	33,023.4	TN0067873	Oakview Elementary School	0.010	30	--	--	--	40
0105	33,023.4	TN0073580	Nashville South Travel Center	0.0001	--	--	--	--	40
0104	39,857.3	TN0057835	Page School	0.020	30	--	--	--	45
0104	39,857.3	TN0064297	Trinity Elementary School	0.013	30	--	--	--	45
0102	28,563.2	TN0064475	Bethesda Elementary School	0.013	30	--	--	--	45
0102	28,563.2	TN0067164	College Grove Elementary School	0.012	30	--	--	--	40
0101	22,352.8	TN0057789	Eagleville School	0.018	30	--	--	--	45
0601	18,374.5	TN0066958	Dickson STP	3.000	30	750	40	1000	45
0502	40,218.0	TN0004855	Turnbull U.D. Burns WTP	0.362	--	--	--	--	40
0502	40,218.0	TN0028991	Bethany Hills Camp	0.0075	30	--	--	--	45
0502	40,218.0	TN0057002	Fairview Inn	0.012	30	--	--	--	45
0203	18,058.9	TN0057827	Hillsboro Elementary School	0.030	30	--	--	--	40
0303	17,259.2	TN0062332	Fairview STP	0.460	30	115	40	153	45
0502	40,218.0	TN0063878	Stuart Burns Elementary School	0.016	30	--	--	--	45

a. Daily Maximum Load is 250 lbs/day.
b. 16.0 MGD as of June 1, 2004.

Figure 5 Location of NPDES Permitted Construction Sites in the Harpeth River Watershed (May 2, 2002)



MS4s also discharge sediment to waterbodies in response to storm events through road drainage systems, curb and gutter systems, ditches, and storm drains. These systems convey urban runoff from surfaces such as bare soil and wash-off of accumulated street dust and litter from impervious surfaces during rain events. Large and medium MS4s serving populations greater than 100,000 people are required to obtain an NPDES storm water permit. At present, Metro Nashville/Davidson County is the only MS4 of this size in the Harpeth River watershed that is regulated by the NPDES program (TNS068047). In March 2003, small MS4s serving urbanized areas will be required to obtain a permit under the Phase II storm water regulations. An urbanized area is defined as an entity with a residential population of at least 50,000 people and an overall population density of at 1,000 people per square mile. Franklin, Brentwood, Dickson, Williamson County, and Rutherford County will be covered under Phase II of the NPDES Storm Water Program. The Tennessee Department of Transportation (TDOT) is also being issued MS4 permits for state roads in urban areas.

6.2 Nonpoint Sources

Nonpoint source discharges enter surface waters primarily during rain events as storm water. These sources account for a majority of sediment loading to surface waters and may include:

- Natural erosion occurring from the weathering of soils, rocks, and uncultivated land; geological abrasion; and other natural phenomena.

- Erosion from agricultural activities can be a major source of sedimentation due to the large land area involved and the land-disturbing effects of cultivation. Grazing livestock can leave areas of ground with little vegetative cover. Unconfined animals with direct access to streams can cause stream bank damage.

- Urban erosion from bare soil areas and washoff of accumulated street dust and litter from impervious surfaces.

- Erosion from existing unpaved roadways can be a significant source of sediment to rivers and streams. It occurs when soil particles are loosened and carried away from the roadway, ditch, or road bank by water, wind, or traffic. The actual road construction (including erosive road-fill soil types, shape and size of coarse surface aggregate, poor subsurface and/or surface drainage, poor road bed construction, roadway shape, and inadequate runoff discharge outlets or “turn-outs” from the roadway) may aggravate roadway erosion. In addition, external factors such as roadway shading and light exposure, traffic patterns, and road maintenance may also affect roadway erosion. Exposed soils, high runoff velocities and volumes, and poor road compaction all increase the potential for erosion.

- Surface mining activities that typically include removal of vegetation, displacement of soils and other significant land disturbing activities.

- Soil erosion from forested land that occurs during timber harvesting and reforestation activities. Timber harvesting includes the layout of access roads, log decks, and skid trails; the construction and stabilization of these areas; and the cutting of trees. Established forest areas produce very little soil erosion.

For the listed waterbodies within the Harpeth River Basin, the primary sources of nonpoint sediment loads come from agriculture, roadways, and urban sources.

7.0 DEVELOPMENT OF TOTAL MAXIMUM DAILY LOAD

The TMDL is the total amount of a pollutant that can be loaded into a waterbody (the loading capacity) and still attain the applicable water quality standard. A TMDL is expressed as Waste Load Allocations (WLAs) for point source discharges from facilities and activities regulated by the NPDES permit program and Load Allocations (LAs) for all nonpoint sources. The TMDL must also provide an appropriate margin of safety (MOS) which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

According to 40 CFR §130.2 (i), TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measure. In this case, an "other appropriate measure" is used to express the TMDL as the pounds of sediment that can be discharged from an acre of a subwatershed during a year (lbs/acre/year) and still attain the applicable water quality standard. For purposes of these TMDLs, sediment loads are expressed as average annual loads per unit area. The average annual load was considered to be more appropriate than a daily load for representing the long-term processes of accumulation of sediments in stream habitat areas and the associated effects on aquatic life.

Each subwatershed TMDL is established at the level consistent with the average annual existing sediment loading from the biologically healthy reference subwatershed located in the same ecoregion as the impaired subwatershed. An impaired subwatershed is a watershed with one or more waterbody segments listed on the State's 1998 Section 303(d) list (see Figure 6). The sediment TMDLs for impaired subwatersheds are summarized in Table 7. The TMDL establishes the average annual amount of sediment that may be discharged from the subwatershed into the waterbody over a year's time and still attain the applicable water quality standard.

7.1 Waste Load Allocations

7.1.1 Determination of Waste Load Allocations for NPDES Regulated Municipal and Industrial Wastewater Treatment Facilities

There are 23 facilities in the Harpeth River Watershed with individual NPDES permits that require monitoring of TSS or turbidity. The TMDL is providing these NPDES regulated WWTFs their current NPDES permit limits as individual WLAs for each facility (see Table 8). It is considered appropriate to provide these facilities their current discharge levels of TSS since the sediment loading from these facilities is negligible compared to other sources. WWTFs cumulatively contribute less than 2% of the total average annual sediment loading to surface waters. In addition, sediment loads from WWTFs are generally composed more of organic material and, therefore, provide less direct impact to biological integrity (through settling and accumulation) than would direct soil loss to the streams.

Figure 6 1998 303(d) Listed Waterbodies in the Harpeth River Watershed

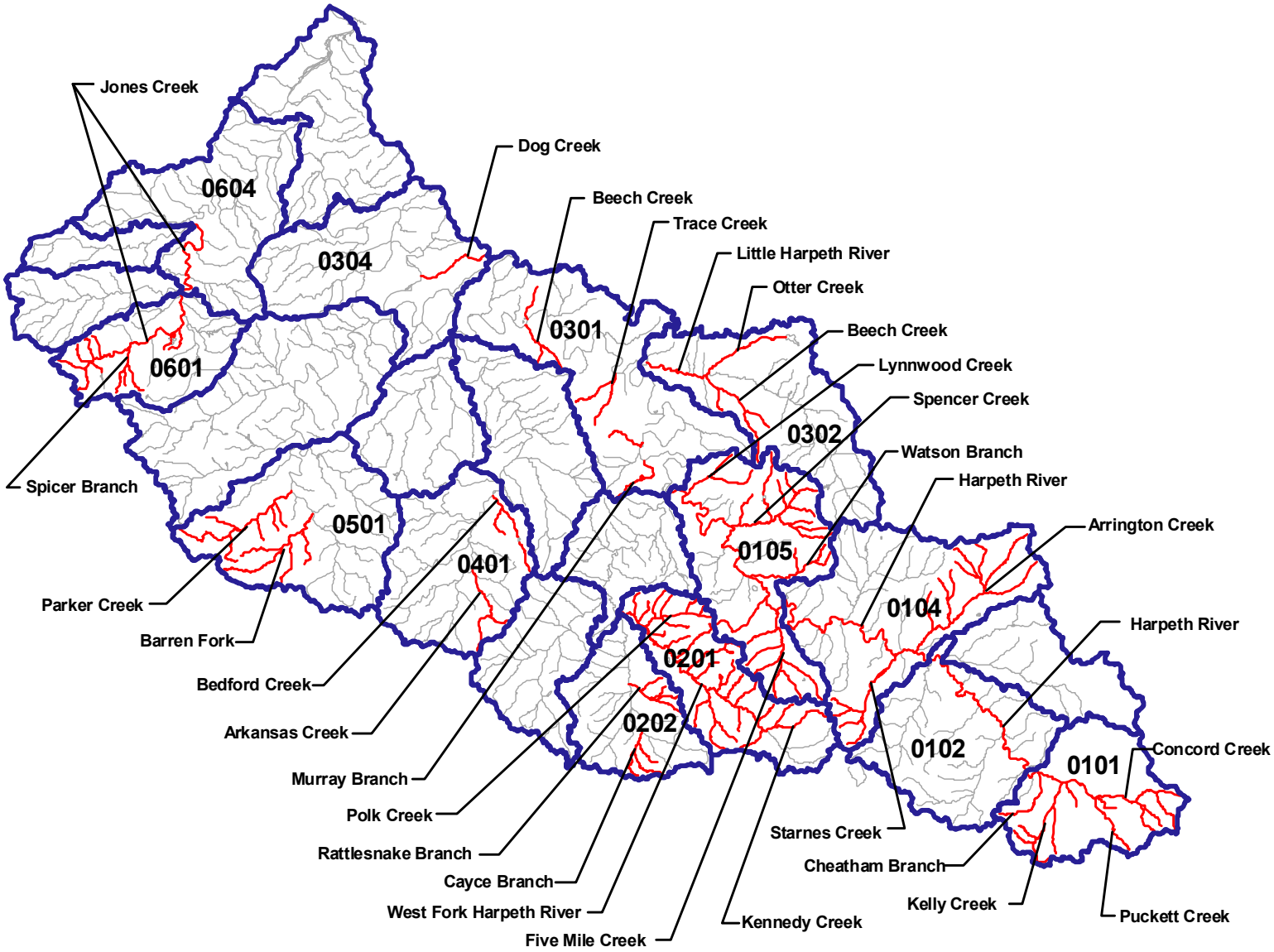


Table 7 Sediment TMDLs for Subwatersheds With 303(d) Listed Waterbodies

Subwatershed	Waterbody ID	1998 303(d) List Waterbody	Level IV Ecoregion	TMDL [lbs/acre/year]
0401	TN05130204010	Arkansas Creek; Bedford Creek	71f	220
0501	TN05130204006	Parker Creek; Barren Fork	71f	220
0601	TN05130204002	Jones Creek (Little Jones Ck. to headwaters); Spicer Branch	71f	220
0604	TN05130204002	Jones Creek (Sulphur Fork to Little Jones Ck.)	71f	220
0304	TN05130204001	Dog Creek	71f	220
0302	TN05130204021	Little Harpeth River; Beech Creek; Otter Creek	71h	660
0105	TN05130204016A	Harpeth River	71h	660
	TN05130204016B	Spencer Creek; Watson Creek; Five Mile Creek; Lynnwood Creek		
0201	TN05130204013A	W. Fork Harpeth River; Kennedy Ck.; Polk Ck.	71h	660
0202	TN05130204013B	Rattlesnake Branch	71h	660
	TN05130204013A	Cayce Branch		
0301	TN05130204009A	Unnamed tributary; Beech Creek	71h	660
	TN05130204009B	Newsome Ck.; Trace Ck.; Murray Branch		
0104	TN05130204016A	Harpeth River	71i	220
	TN05130204016B	Arrington Creek; Starnes Creek		
0102	TN05130204016A	Harpeth River	71i	220
0101	TN05130204016C	Kelly Ck.; Puckett Ck.; Concord Ck.; Cheatham Branch	71i	220

Table 8 WLAs for NPDES Permitted Municipal and Industrial Wastewater Treatment Facilities

Subwatershed	NPDES Permit No.	Facility	WLA (as TSS)	
			Flow	Monthly Average Permit Limit
			[MGD]	[mg/l]
0304	TN0020460	White Bluff STP	0.500	30
0304	TN0004294	Second South Cheatham U.D. WTP	0.080	a
0304	TN0020737	Ashland City STP	0.801	30
0304	TN0059790	Kingston Springs STP	0.250	100
0301	TN0074586	Pegram STP	0.050	30
0301	TN0027278	Cartwright Creek Utility Co. STP	0.250	30
0301	TN0029718	Lynwood Utility STP	0.400	30
0105	TN0028827	Franklin STP	5.500[b]	30
0105	TN0060216	Goose Creek Inn	0.030	30
0105	TN0067873	Oakview Elementary School	0.010	30
0105	TN0073580	Nashville South Travel Center	0.0001	b
0104	TN0057835	Page School	0.020	30
0104	TN0064297	Trinity Elementary School	0.013	30
0102	TN0064475	Bethesda Elementary School	0.013	30
0102	TN0067164	College Grove Elementary School	0.012	30
0101	TN0057789	Eagleville School	0.018	30
0601	TN0066958	Dickson STP	3.000	30
0502	TN0004855	Turnbull U.D. Burns WTP	0.362	b
0502	TN0028991	Bethany Hills Camp	0.0075	30
0502	TN0057002	Fairview Inn	0.012	30
0203	TN0057827	Hillsboro Elementary School	0.030	30
0303	TN0062332	Fairview STP	0.460	30
0502	TN0063878	Stuart Burns Elementary School	0.016	30

a Daily Maximum limit = 45 mg/l.
b Daily Maximum limit = 40 mg/l.

7.1.2 Determination of Waste Load Allocations for NPDES Regulated Construction Activities and Municipal Separate Storm Sewer Systems

Certain construction activities and MS4s are currently regulated by the State's NPDES program (see Section 6.1.2). Since these construction activities/MS4s discharge sediment to surface waters, the TMDL is providing a WLA for these categories of activities/facilities. These WLAs are established for each subwatershed containing a 1998 303(d) listed waterbody (ref. Table 2) at a level equal to the estimated average annual sediment loading of a biologically healthy (ecoregion reference) subwatershed located in the same Level IV ecoregion (see Table 9).

The WLAs provided to the NPDES regulated construction activities and MS4s will be implemented as Best Management Practices (BMPs)as specified in NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activit*y and Phase I & II MS4 permits. It is not technically feasible to incorporate numeric sediment limits into construction storm water or MS4 permits at this time. WLAs should <u>not</u> be construed as numeric permit limits. Ambient monitoring may be required for specific discharges to determine compliance with the TMDL for a particular segment. Properly designed and well-maintained BMPs are expected to provide attainment of WLAs. In some cases, it may be necessary to go beyond standard practices in the application of BMPs to assure compliance with the WLA (see Section 8).

7.2 Determination of Load Allocations for Nonpoint Sources

All sources of sediment loading to surface waters not covered by the NPDES program are provided a Load Allocation (LA) in this TMDL. LAs are provided in lbs/acre/year, and represent the average annual amount (in pounds) of nonpoint source sediment that can be discharged to the receiving water in a year for each acre of the nonpoint source activity (see Table 9). LAs are established for each subwatershed containing a 1998 303(d) listed waterbody (ref. Table 2) at a level equal to the estimated average annual sediment loading of a biologically healthy (reference) subwatershed located in the same Level IV ecoregion. Properly designed and well-maintained BMPs will be necessary to assure that LAs are achieved.

7.3 Margin of Safety

There are two methods for incorporating a MOS in the analysis: a) implicitly incorporate the MOS using conservative model assumptions to develop allocations; or b) explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations. In these TMDLs, an implicit MOS was incorporated through the use of conservative modeling assumptions. These include:

- Target values based on Level IV ecoregion reference sites. These sites represent the least impacted streams in the ecoregion.
- The use of appropriate ecoregion reference site average annual sediment loads as the target values for the calculation of load reductions.
- The use of the sediment delivery process that results in the most sediment transport to surface waters (Method 2 in Appendix A).

Table 9 Percent Reductions in Average Annual Sediment Loading for Impaired Subwatersheds

Subwatershed	Level IV Ecoregion	TMDL	WLAs	LAs	Estimated Reduction Needed to Achieve TMDL
		[lbs/ac/yr]	[lbs/ac/yr]	[lbs/ac/yr]	[%]
0401	71f	220	220	220	82.8
0501	71f	220	220	220	84.8
0601	71f	220	220	220	90.1
0604	71f	220	220	220	81.7
0304	71f	220	220	220	77.8
0302	71h	660	660	660	18.3
0105	71h	660	660	660	66.0
0201	71h	660	660	660	32.8
0202	71h	660	660	660	47.5
0301	71h	660	660	660	32.7
0104	71i	220	220	220	71.0
0102	71i	220	220	220	74.5
0101	71i	220	220	220	37.3

7.4 Seasonal Variation

Sediment loading is expected to fluctuate according to the amount and distribution of rainfall. The determination of sediment loads on an average annual basis accounts for these differences through the rainfall erosivity index in the USLE (See Appendix A). This is a statistic calculated from the annual summation of rainfall energy in every storm and its maximum 30-minute intensity.

7.5 Reductions in Average Annual Sediment Loading Needed to Attain TMDL

The Watershed Characterization System Sediment Tool was used to calculate the existing average annual sediment load for the impaired subwatersheds in the Harpeth River watershed. Impaired subwatersheds are those subwatersheds with one or more waterbodies on Tennessee's 1998 Section 303(d) list of impaired waters. These estimated existing average annual sediment loads for impaired subwatersheds are compared to the estimated existing average annual sediment loads for the appropriate biologically healthy subwatersheds to determine the percent reduction of sediment loading required to fully attain the fish and aquatic life designated use. The estimated percent reduction from current loads for each subwatershed is summarized in Table 9.

8.0 IMPLEMENTATION PLAN

8.1 Point Sources

8.1.1 NPDES Regulated Municipal and Industrial Wastewater Treatment Facilities

Calculations show that TSS discharges from facilities covered under individual NPDES permits account for less than two percent of the total existing average annual sediment loading in the Harpeth River watershed. This TMDL allows these facilities to discharge at their current permitted levels. The WLA for these facilities will be implemented through each facility's NPDES permit.

8.1.2 NPDES Regulated Construction Storm Water and Municipal Separate Storm Sewer Systems

The WLAs provided to the NPDES-regulated construction activities and municipal separate storm sewer systems (MS4s) will be implemented through Best Management Practices (BMPs) as specified in NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activit*y and Phase I & II MS4 permits. It is not technically feasible to incorporate numeric sediment limits into permits for these activities/facilities at this time. WLAs should <u>not</u> be construed as numeric permit limits.

Construction sites in Tennessee disturbing five acres or more are currently required to obtain coverage under the *General NPDES Permit for Storm Water Discharges Associated With Construction Activit*y (see Appendix E). This permit requires:

- Development and implementation of a site-specific Storm Water Pollution Prevention Plan (SWPPP) that addresses erosion and sediment control.
- Good engineering and best management practices in the design, installation, and maintenance of erosion and sediment controls.
- Erosion and sediment controls must be designed to function properly in a two-year, 24-hour storm event.

In addition, a number of special requirements in the permit apply to discharges entering waterbodies that have been identified on the 1998 303(d) list, or more recent assessments, as being impaired due to siltation. This includes all waterbodies provided a WLA under this TMDL. These additional requirements include:

- More frequent (weekly) inspections of erosion and sediment controls.
- Inspections and the condition of erosion and sediment controls must be reported to the Division of Water Pollution Control (DWPC).
- The SWPPP must be submitted to the DWPC prior to disturbing soil at the construction site.

- In order to assure that the WLA is achieved, the application of BMPs that go beyond the typical minimum elements generally undertaken to comply with the General Permit may be necessary.

Strict compliance with the provisions of the *General NPDES Permit for Storm Water Discharges Associated With Construction Activit*y can reasonably be expected to achieve reduced sediment loads to streams. The primary challenge for the reduction of sediment loading from construction sites to meet TMDL WLAs is in the effective compliance monitoring of all requirements specified in the permit and timely enforcement against construction sites not found to be in compliance with the permit.

For regulated discharges from municipal separate storm sewer systems, WLAs will be implemented through Phase II MS4 permits. These permits will require the development and implementation of a Storm Water Management Plan (SWMP) that will reduce the discharge of pollutants to the "maximum extent practicable" and not cause or contribute to violations of State water quality standards. The individual permittees will be responsible for identifying the specific BMPs to be applied to attain appropriate reduction in sediment loads. The SWMP will also include a number of programs/activities to identify sources of pollutants in municipal storm water runoff and verify SWMP effectiveness.

As the science and available data for wet weather discharges of sediment continues to grow, more advanced approaches to sediment TMDLs are expected to be developed. These new approaches will be applied, as appropriate, through the adaptive management process to enhance the effectiveness of TMDLs and to provide a sound basis for water quality management decisions. A discussion of U.S. Environmental Protection Agency's proposed future approach to sediment TMDLs is provided in Appendix C.

8.2 Implementation of Load Allocations for Nonpoint Sources

Reductions of sediment loading from nonpoint sources (NPS) will be achieved using a phased approach. Voluntary, incentive-based mechanisms will be used to implement NPS management measures in order to assure that measurable reductions in sediment loadings can be achieved for the targeted impaired water. Cooperation and active participation by the general public and various industry, business, and environmental groups is critical to successful implementation of TMDLs. Local citizen-led and implemented management measures offer the most efficient and comprehensive avenue for reduction of loading rates from nonpoint sources. TMDL implementation activities will be accomplished within the framework of Tennessee's Watershed Approach (ref: www.state.tn.us/environment/wpc/wshed1.htm).

The Watershed Approach is based on a five-year cycle and encompasses planning, monitoring, assessment, TMDLs, WLAs/LAs, and permit issuance. It relies on participation at the federal, state, local and nongovernmental levels to be successful. The *Harpeth River Watershed Management Plan* (TDEC, 2002) describes, in general, the partnerships among government agencies and stakeholder groups and the roles that each play in the effort to improve water quality in the Harpeth River watershed, including the reduction of pollutant loading.

Governmental agencies include:

- Natural Resources Conservation Service
- USGS Water Resource Programs—Tennessee District
- United States Army Corps of Engineers-Nashville District
- U.S. Environmental Protection Agency
- TDEC - Division of Water Supply
- TDEC Division of Community Assistance
- Tennessee Department of Agriculture
- Tennessee Wildlife Resources Agency

Local stakeholder groups include:

- Cumberland River Compact (CRC)
- Harpeth River Watershed Association (HRWA)
- The Nature Conservancy

With respect to the reduction of nonpoint source sediment loading and habitat alteration, government agencies and stakeholders should, at a minimum, be directed to:

- Implement and maintain conservation farming, including conservation tillage, contour strips and no till farming.
- Install grass buffer strips along streams.
- Reduce activities within riparian areas
- Minimize road and bridge construction impacts on streams

8.3 Aquatic Resource Alteration

There are a number of stream alteration activities that have the potential to effect sediment loading to surface waters in the Harpeth River watershed. In Tennessee, Aquatic Resource Alteration Permits (ARAPs) are required for <u>any</u> alteration of state waters not requiring a federal permit, including:

- Dredging, widening, straightening, or bank stabilization
- Levee construction (if excavation or fill of stream channel is involved)
- Channel relocation
- Flooding, excavating, draining, and/or filling a wetland
- Bridge construction
- Bridge scour repair
- Construction of road or utility line crossings
- Sand and gravel dredging
- Debris removal
- Emergency road repair

Aquatic Resource Alteration Permits are developed in accordance with Tennessee Rule 1200-4-7, *Aquatic Resource Alteration* (TDEC, 2000b) and contain provisions that minimize impacts to surface waters.

8.4 Evaluation of TMDL Effectiveness

The effectiveness of the TMDL will be assessed within the context of the State's rotating watershed management approach. Watershed monitoring and assessment activities will provide information by which the effectiveness of sediment loading reduction measures can be evaluated. This monitoring will be guided by the results of a Harpeth River watershed sediment study, conducted by the Harpeth River Watershed Association and the Cumberland River Compact. Monitoring data, ground-truthing, and source identification actions will also enable implementation of particular types of BMPs to be directed to specific areas in the subwatersheds. These TMDLs will be revaluated during subsequent watershed cycles and revised as required to assure attainment of applicable water quality standards.

9.0 PUBLIC PARTICIPATION

In accordance with 40 CFR §130.7, the proposed sediment TMDLs for the Harpeth River watershed were placed on Public Notice for a 35-day period and comments solicited. Steps that were taken in this regard include:

1) Notice of the proposed TMDLs was posted on the Tennessee Department of Environment and Conservation website on March 18, 2002 (see Appendix E). The announcement invited public comment until April 22, 2002. As of April 30, 2002, the Public Notice announcement was accessed 178 times and the TMDL document 580 times.

2) Notice of the availability of the proposed TMDLs (similar to the website announcement) was included in one of the NPDES permit Public Notice mailings which was sent to approximately 90 interested persons or groups who have requested this information.

3) A letter was sent to point source facilities in the Harpeth River study area that are permitted to discharge treated total suspended solids (TSS) advising them of the proposed sediment TMDLs and their availability on the TDEC website. The letter also stated that a written copy of the draft TMDL document would be provided on request. Letters were sent to the following facilities:

White Bluff STP (TN0020460)
Second South Cheatham U.D. WTP (TN0004294)
Ashland City STP (TN0020737)
Kingston Springs STP (TN0059790)
Pegram STP (TN0074586)
Cartwright Creek Utility Co. STP (TN0027278)
Lynwood Utility STP (TN0029718)
Franklin STP (TN0028827)
Goose Creek Inn (TN0060216)
Oakview Elementary School (TN0067873)
Nashville South Travel Center (TN0073580)
Page School (TN0057835)
Trinity Elementary School (TN0064297)
Bethesda Elementary School (TN0064475)

College Grove Elementary School (TN0067164)
Eagleville School (TN0057789)
Dickson STP (TN0066958)
Turnbull U.D. Burns WTP (TN0004855)
Bethany Hills Camp (TN0028991)
Fairview Inn (TN0057002)
Hiilsboro Elementary School (TN0057827)
Fairview STP (TN0062332)
Stuart Burns Elementary School (TN0063878)

4) A draft copy of the proposed fecal coliform TMDLs was sent to Metro Nashville/Davidson County, Tennessee Department of Transportation, City of Franklin, City of Brentwood, City of Dickson, Rutherford County, and Williamson County. Metro Nashville/Davidson County is covered under Municipal Separate Storm Sewer System (MS4) permit TNS068047. The other entities will be issued MS4 permits under the Phase II storm water regulations.

5) A meeting, sponsored by the Harpeth River Watershed Association (HRWA) and the Division of Water Pollution Control, was held in Nashville on January 16,2002. In this meeting, Tetra Tech, Inc. made a presentation of the analysis methodology used for the Harpeth River sediment TMDLs. An opportunity to ask questions and make comments followed.

Written comments were received from several parties during the public comment period. These comments are included in Appendix G and the Division of Water Pollution Control responses are contained in Appendix H. No requests to hold additional public meetings were received regarding the proposed TMDLs as of close of business on April 22, 2002.

10. FURTHER INFORMATION

Further information concerning Tennessee's TMDL program can be found on the Internet at the Tennessee Department of Environment and Conservation website:

www.state.tn.us/environment/wpc/tmdl.htm

Technical questions regarding this TMDL should be directed to the following members of the Division of Water Pollution Control staff:

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APPENDIX A

Watershed Sediment Loading Model

WATERSHED SEDIMENT LOADING MODEL

Determination of target average annual sediment loading values for reference watersheds and the sediment loading analysis of 303(d) listed waterbodies was accomplished utilizing the Watershed Characterization System (WCS) Sediment Tool (v.2.1). WCS is an Arcview geographic information system (GIS) based program developed by USEPA Region IV to facilitate watershed characterization and TMDL development. WCS consists of an initial set of spatial and tabular watershed data, stored in a database, and allows the incorporation of additional data when available. It provides a number of reporting tools and data management utilities to allow users to analyze and summarize data. Program extensions, such as the sediment tool, expand the functionality of WCS to include modeling and other more rigorous forms of data analysis (USEPA, 2001).

Sediment Analysis

The Sediment Tool is an extension of WCS that utilizes available GIS coverages (land use, soils, elevations, roads, etc), the Universal Soil Loss Equation (USLE) to calculate potential erosion, and sediment delivery equations to calculate sediment delivery to the stream network. The following tasks can be performed:

- 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.

The Sediment Tool can also be used to evaluate different scenarios, such as the effects of changing land uses and implementation of BMPs, by the adjustment of certain input parameters. Parameters that may be adjusted include:

- Conservation management and erosion control practices
- Changes in land use
- Implementation of Best Management Practices (BMPs)
- Addition/Deletion of roads

Sediment analyses can be performed for single or multiple watersheds.

Universal Soil Loss Equation

Erosion potential is based on the Universal Soil Loss Equation (USLE), developed by Agriculture Research Station (ARS) scientists W. Wischmeier and D. Smith. It has been the most widely accepted and utilized soil loss equation for over 30 years. The USLE is a method to predict the average annual soil loss on a field slope based on rainfall pattern, soil type, topography, crop system, and management practices. The USLE only predicts the amount of soil loss resulting from sheet or rill erosion on a single slope and does not account for soil losses that might occur from gully, wind, or tillage erosion. Designed as a model for use with certain cropping and management systems, it is also applicable to non-agricultural situations (OMAFRA 2000). While the USLE can be used to estimate long-term average annual soil loss, it cannot be applied to a specific year or a

specific storm. Based on its long history of use and wide acceptance by the forestry and agricultural communities, the USLE was considered to be an adequate tool for estimating the relative long-term average annual soil erosion of watersheds and evaluating the effects of land use changes and implementation of BMP measures.

Soil loss from sheet and rill erosion is primarily due to detachment of soil particles during rain events. It is the cause of the majority of soil loss for lands associated with crop production, grazing areas, construction sites, mine sites, logging areas, and unpaved roads. In the USLE, five major factors are used to calculate the soil loss for a given area. Each factor is the numerical estimate of a specific condition that affects the severity of soil erosion in that area. The USLE for estimating average annual soil erosion is expressed as:

$$A = R \times K \times LS \times C \times P$$

where:

A = average annual soil loss in tons per acre
R = rainfall erosivity index
K = soil erodibility factor
LS = topographic factor - L is for slope length and S is for slope
C = crop/vegetation & management factor
P = conservation practice factor

Evaluating the factors in USLE:

R - Rainfall Erosivity Index

The rainfall erosivity index describes the kinetic energy generated by the frequency and intensity of the rainfall. It is statistically calculated from the annual summation of rainfall energy in every storm, which correlates to the raindrop size, times its maximum 30-minute intensity. This index varies with geography.

K - Soil Erodibility Factor

This factor quantifies the cohesive or bonding character of the soil and its ability to resist detachment and transport during a rainfall event. The soil erodibility factor is a function of soil type.

LS - Topographic Factor

The topographic factor represents the effect of slope length and slope steepness on erosion. Steeper slopes produce higher overland flow velocities. Longer slopes accumulate runoff from larger areas and also result in higher flow velocities. For convenience L and S are frequently lumped into a single term.

C – Crop/Vegetation & Management Factor

The crop/vegetation and management factor represents the effect that ground cover conditions, soil conditions, and general management practices have on soil erosion. It is the most computationally complicated of USLE factors and incorporates the effects of: tillage

management, crop type, cropping history (rotation), and crop yield.

P - Conservation Practice Factor

The conservation practice factor represents the effects on erosion of Best Management Practices (BMPs) such as contour farming, strip cropping and terracing.

Estimates of the USLE parameters, and thus the soil erosion as computed from the USLE, are provided by the Natural Resources Conservation Service's (NRCS) 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.

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 lost in the field that is eventually delivered to the stream depends on several factors. These 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 will be delivered into the stream with runoff-producing rainfall.

Sediment Modeling Methodology

Using WCS and the Sediment Tool, average annual sediment loading to surface waters was modeled according to the following procedures:

1. A WCS project was setup for the watershed that is the subject of this TMDL. Additional data layers required for sediment analysis were generated or imported into the project. These included:

   DEM (grid) – The Digital Elevation Model (DEM) layers that come with the basic WCS distribution system are shapefiles of coarse resolution (300x300m). A higher resolution DEM grid layer (30x30m) is required. The National Elevation Dataset (NED) is available from the USGS website and the coverage for the watershed (8-digit HUC) was imported into the project.

   Road – A road layer is needed as a shape file and requires additional attributes such as road type, road practice, and presence of side ditches. If these attributes are not provided, the Sediment Tool automatically assigns default values: road type - secondary paved roads, side ditches present, and no road practices. This data layer was obtained from ESRI for areas in the watershed.

   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 is not available, the system uses the STATSGO Soil data (1:250k) by default.

   MRLC Land Use – The Multi-Resolution Land Characteristic (MRLC) data set for the watershed is provided with the WCS package, but must be imported into the project.

2. Using WCS, the entire watershed was delineated into 22 subwatersheds corresponding to USGS 12-digit Hydrologic Unit Codes (HUCs). These delineations are shown in Figure 4. Land use distribution for these delineations is summarized in Appendix B. All of the sediment analyses were performed on the basis of these drainage areas.

The following steps are accomplished using the WCS Sediment Tool:

3. For a selected watershed or subwatershed, a sediment project is set up in a new view that contains the data layers that will be subsequently used to calculate erosion and sediment delivery.

4. The stream grid for each delineated subwatershed, based on DEM grid data, was created so that the stream follows the elevation (i.e., the stream corresponds to the lower elevations in the subwatershed). The system uses a user input threshold to define the drainage area and location, relative to the subwatershed boundary, of stream grid headwater cells. The threshold value can be manipulated to increase or decrease the density of the resulting stream network. Reach File v. 3 (Rf3) or National Hydrology Dataset (NHD) is used as a reference, or basis of comparison, to obtain the desired stream density.

   For the Harpeth River watershed, a threshold value of 330 produced the best overall correlation with Reach File 3 with respect to stream network shape and total stream length. The stream grid and Rf3 for one of the delineated subwatersheds (051302040502) is shown in Figure A-1. Other subwatersheds are similar.

5. For each 30 by 30 meter grid cell within the subwatershed, the Sediment Tool calculates the potential erosion using the USLE based on the specific cell characteristics. The model then calculates the potential sediment delivery to the stream grid network. Sediment delivery can be calculated using one of the four available sediment delivery equations:

- Distance-based equation (Sun and McNulty 1998)

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

  where: Md = mass moved (tons/acre/yr)
  M = sediment mass eroded (ton)
  D = least cost distance from a cell to the nearest stream grid (ft)
  L = maximum distance the sediment may travel (ft)

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

  $DR = \exp(-0.4233 * L * Sf)$
  $Sf = \exp(-16.1 * r/L + 0.057)) - 0.6$

  where: DR = sediment delivery ration
  L = distance to the stream (m)
  r = relief to the stream (m)

- Area-based equation (USDASCS 1983)

  $DR = 0.417762 * A^{(-0.134958)} - 1.27097, \quad DR <= 1.0$

  where: DR = sediment delivery ratio
  A = area (sq miles)

- WEPP-based regression equation (Swift 2000)

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

  where: Z = percent of source sediment passing to the next grid cell
  X = cumulative distance downslope (X > 0)
  Y = percent slope in the grid cell (Y > 0)

The distance slope based equation (Yagow et al. 1998) was selected to simulate sediment delivery in the Harpeth River watershed. USLE parameters applied to the Harpeth River watershed are summarized in Table A-1.

6. The total sediment delivered upstream of each subwatershed "pour point" is calculated. 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.

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

   Calculated erosion, sediment loads delivered to surface waters, and unit loads (per unit area) for subwatersheds that contain 303(d) listed waters are summarized in Tables A-2, A-3, and A-4, respectively. Similar information for subwatersheds that do not contain 303(d) listed waters are summarized in Tables A-5, A-6, and A-7.

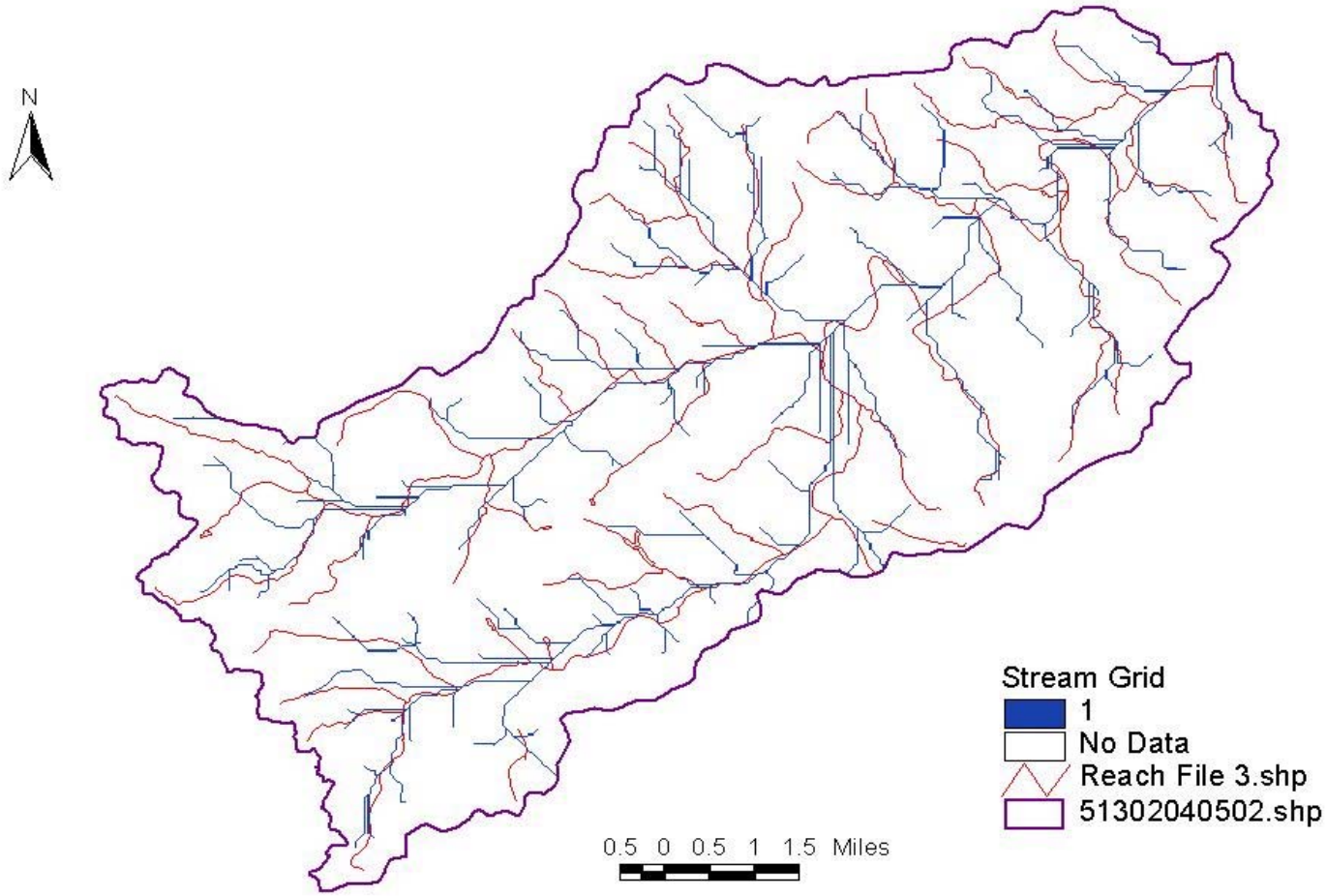

Figure A-1 Stream Grid and Reach File v.3 for Subwatershed 051302040502

Table A-1 USLE Parameters - Harpeth River Watershed

County	Crop Code	Crop	IRR	R	K	C	P	SL	SLP	Vintage	ERO
Cheatham	011	Corn (Row Crops)	0.0	210	0.43	0.05	1.0	140.0	2.0	1992	0.92
Cheatham	141	Grass (Hayland)	0.0	210	0.43	0.01	1.0	40.0	5.0	1992	0.18
Cheatham	180	Other Cropland Not Planted	0.0	210	0.43	0.02	1.0	100.0	3.0	1992	0.52
Cheatham	211	Grass (Pastureland)	0.0	210	0.28	0.01	1.0	100.0	3.0	1992	0.17
Cheatham	341	Forest Land (Grazed)	0.0	210	0.43	0.0	0.0	0.0	0.0	1992	0.0
Cheatham	342	Forest Land (Not Grazed)	0.0	210	0.21	0.0	0.0	0.0	0.0	1992	0.0
Cheatham	400	Farmsteads & Ranch HQ (Other Farmland)	0.0	210	0.43	0.01	1.0	50.0	2.0	1992	0.15
Davidson	211	Grass (Pastureland)	0.0	210	0.36	0.01	1.0	113.58	3.42	1992	0.18
Davidson	342	Forest Land (Not Grazed)	0.0	210	0.25	0.0	0.0	0.0	0.0	1992	0.0
Davidson	400	Farmsteads & Ranch HQ (Other Farmland)	0.0	210	0.28	0.01	1.0	87.5	5.5	1992	0.33
Dickson	011	Corn (Row Crops)	0.0	220	0.43	0.14	1.0	141.0	2.0	1992	2.91
Dickson	141	Grass (Hayland)	0.0	220	0.33	0.01	1.0	61.65	6.29	1992	0.26
Dickson	211	Grass (Pastureland)	0.0	220	0.3	0.01	1.0	109.28	12.32	1992	0.79
Dickson	213	Grass Forbs Legumes Mixed (Pastureland)	0.0	220	0.28	0.01	1.0	72.7	14.31	1992	1.28
Dickson	341	Forest Land (Grazed)	0.0	220	0.28	0.0	0.0	0.0	0.0	1992	0.0
Dickson	342	Forest Land (Not Grazed)	0.0	220	0.24	0.0	0.0	0.0	0.0	1992	0.0
Dickson	400	Farmsteads & Ranch HQ (Other Farmland)	0.0	220	0.25	0.12	1.0	143.0	4.2	1992	3.9
Rutherford	011	Corn (Row Crops)	0.0	230	0.32	0.16	1.0	200.0	1.44	1992	2.45
Rutherford	013	Soybeans (Row Crops)	0.0	230	0.32	0.14	1.0	200.0	1.0	1992	1.62
Rutherford	141	Grass (Hayland)	0.0	230	0.43	0.01	1.0	168.37	2.9	1992	0.21
Rutherford	211	Grass (Pastureland)	0.0	230	0.28	0.01	1.0	200.0	12.0	1992	1.97

Table A-1 USLE Parameters - Harpeth River Watershed (Continued)

County	Crop Code	Crop	IRR	R	K	C	P	SL	SLP	Vintage	ERO
Rutherford	213	Grass Forbs Legumes Mixed (Pastureland)	0.0	230	0.33	0.02	1.0	148.17	3.6	1992	1.26
Rutherford	342	Forest Land (Not Grazed)	0.0	230	0.27	0.0	0.0	0.0	0.0	1992	0.0
Rutherford	400	Farmsteads & Ranch HQ (Other Farmland)	0.0	230	0.28	0.01	1.0	100.0	8.0	1992	0.64
Williamson	000		0.0	230	0.0	0.0	0.0	0.0	0.0	1992	0.0
Williamson	011	Corn (Row Crops)	0.0	230	0.39	0.15	0.83	90.61	4.1	1992	3.66
Williamson	013	Soybeans (Row Crops)	0.0	230	0.37	0.19	0.92	90.49	2.91	1992	3.34
Williamson	016	Tobacco (Row Crops)	0.0	230	0.43	0.33	1.0	100.0	3.0	1992	9.49
Williamson	111	Wheat (Close Grown Cropland)	0.0	230	0.32	0.08	0.75	125.0	3.0	1992	1.27
Williamson	141	Grass (Hayland)	0.0	230	0.28	0.01	1.0	93.65	4.02	1992	0.11
Williamson	142	Legume (Hayland)	0.0	230	0.32	0.02	1.0	45.0	8.0	1992	0.98
Williamson	143	Legume Grass (Hayland)	0.0	230	0.37	0.0	1.0	36.1	3.95	1992	0.18
Williamson	180	Other Cropland Not Planted	0.0	230	0.38	0.13	1.0	85.56	5.0	1992	6.46
Williamson	211	Grass (Pastureland)	0.0	230	0.34	0.01	1.0	100.66	7.98	1992	0.68
Williamson	213	Grass Forbs Legumes Mixed (Pastureland)	0.0	230	0.37	0.01	1.0	62.22	8.08	1992	0.49
Williamson	341	Forest Land (Grazed)	0.0	230	0.24	0.0	0.0	0.0	0.0	1992	0.0
Williamson	342	Forest Land (Not Grazed)	0.0	230	0.27	0.0	0.0	0.0	0.0	1992	0.0
Williamson	400	Farmsteads & Ranch HQ (Other Farmland)	0.0	230	0.32	0.01	1.0	61.67	4.71	1992	0.28
Williamson	401	Other Land in Farms (Other Farmland)	0.0	230	0.32	0.01	1.0	200.0	1.0	1992	0.12
Williamson	410	Conservation Reserve Program Land (Other Farmland	0.0	230	0.43	0.0	1.0	73.33	4.67	1992	0.12

Table A-2 Calculated Erosion - Subwatersheds With 303(d) Listed Waterbodies

	Erosion (us ton/yr)				
SUBWATERSHEDS	SOURCE	ROAD	TOTAL	% SOURCE	% ROAD
0401	20120.20	12358.50	32478.70	61.95	38.05
0501	38889.90	8880.93	47770.83	81.41	18.59
0601	24837.70	9136.73	33974.43	73.11	26.89
0604	28650.00	8820.70	37470.70	76.46	23.54
0304	18280.50	11481.80	29762.30	61.42	38.58
0302	11374.50	11901.20	23275.70	48.87	51.13
0105	47592.70	12567.00	60159.70	79.11	20.89
0201	19544.90	4554.55	24099.45	81.10	18.90
0202	18848.20	5318.79	24166.99	77.99	22.01
0301	20042.70	19068.50	39111.20	51.25	48.75
0104	25868.10	7183.12	33051.22	78.27	21.73
0102	25089.40	4994.09	30083.49	83.40	16.60
0101	8639.76	1818.27	10458.03	82.61	17.39

Table A-3 Calculated Sediment Delivery to Surface Waters - Subwatersheds With 303(d) Listed Waterbodies

	Sediment (us ton/yr)				
SUBWATERSHEDS	SOURCE	ROAD	TOTAL	% SOURCE	% ROAD
0401	9313.62	8205.60	17519.22	53.16	46.84
0501	18257.90	5289.03	23546.93	77.54	22.46
0601	12853.50	5773.00	18626.50	69.01	30.99
0604	13436.70	4953.37	18390.07	73.06	26.94
0304	8488.97	6265.27	14754.24	57.54	42.46
0302	4932.66	7175.93	12108.59	40.74	59.26
0105	23396.40	7791.72	31188.12	75.02	24.98
0201	8268.14	3065.98	11334.12	72.95	27.05
0202	8278.57	3602.33	11880.90	69.68	30.32
0301	8959.11	10795.20	19754.31	45.35	54.65
0104	10666.30	4514.41	15180.71	70.26	29.74
0102	9576.74	2975.80	12552.54	76.29	23.71
0101	3176.44	794.66	3971.10	79.99	20.01

Table A-4 Unit Loads - Subwatersheds With 303(d) Listed Waterbodies

SUBWATERSHEDS	Unit Loads		
	Erosion	Sediment	
	[tons/acre/year]	[tons/acre/year]	[lbs/acre/year]
0401	1.183	0.638	1,276
0501	1.465	0.722	1,444
0601	1.815	0.995	1,990
0604	1.221	0.599	1,199
0304	0.958	0.475	950
0302	0.776	0.404	808
0105	1.805	0.936	1,872
0201	1.044	0.491	982
0202	1.280	0.629	1,258
0301	0.960	0.485	970
0104	0.826	0.379	759
0102	1.034	0.431	863
0101	0.462	0.175	351

Table A-5 Calculated Erosion - Subwatersheds Without 303(d) Listed Waterbodies

SUBWATERSHEDS	Erosion (us ton/yr)				
	SOURCE	ROAD	TOTAL	% SOURCE	% ROAD
0305	10200.30	5630.85	15831.15	64.43	35.57
0603	9315.54	1770.29	11085.83	84.03	15.97
0602	15806.50	2692.06	18498.56	85.45	14.55
0402	11549.00	4521.86	16070.86	71.86	28.14
0502	26496.60	13441.00	39937.60	66.34	33.66
0303	6748.53	5249.64	11998.17	56.25	43.75
0204	9553.60	4105.95	13659.55	69.94	30.06
0203	8952.07	5467.97	14420.04	62.08	37.92
0103	9028.22	1698.79	10727.01	84.16	15.84

Table A-6 Calculated Sediment Delivery to Surface Waters - Subwatersheds Without 303(d) Listed Waterbodies

SUBWATERSHEDS	Sediment (us ton/yr)				
	SOURCE	ROAD	TOTAL	% SOURCE	% ROAD
0305	4198.50	2650.65	6849.15	61.30	38.70
0603	4312.87	1181.50	5494.37	78.50	21.50
0602	7598.72	1789.25	9387.97	80.94	19.06
0402	6564.22	2937.30	9501.52	69.09	30.91
0502	13139.80	7989.33	21129.13	62.19	37.81
0303	3042.38	2791.32	5833.70	52.15	47.85
0204	4278.54	2439.99	6718.53	63.68	36.32
0203	4388.60	3340.87	7729.47	56.78	43.22
0103	3500.26	898.21	4398.47	79.58	20.42

Table A-7 Unit Loads - Subwatersheds Without 303(d) Listed Waterbodies

SUBWATERSHEDS	Unit Loads		
	Erosion	Sediment	
	[tons/acre/year]	[tons/acre/year]	[lbs/acre/year]
0305	0.632	0.274	547
0603	1.515	0.751	1,502
0602	1.543	0.783	1,566
0402	0.660	0.390	781
0502	0.977	0.517	1,034
0303	0.684	0.332	665
0204	0.905	0.445	890
0203	0.791	0.424	848
0103	0.646	0.265	530

APPENDIX B

Subwatershed Land Use

Table B-1 Harpeth River Watershed – Subwatershed Land Use Distribution

Land Use	Subwatershed											
	0101		0102		0103		0104		0105		0201	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Open Water	6.4	0.0	65.2	0.2	4.2	0.0	157.7	0.4	218.2	0.7	41.4	0.2
Low Intensity Residential	181.2	0.8	81.8	0.3	33.1	0.2	337.4	0.8	2505.6	7.6	86.1	0.4
High Intensity Residential	4.9	0.0	0.7	0.0			6.7	0.0	405.6	1.2		
High Intensity Commercial/Industrial /Transportation	62.5	0.3	68.9	0.2	13.8	0.1	119.6	0.3	1333.9	4.0	96.1	0.4
Bare Rock/Sand/Clay												
Transitional	108.5	0.5			79.8	0.5	1.1	0.0	53.2	0.2	40.5	0.2
Deciduous Forest	7272.3	32.5	6762.3	23.7	5658.6	34.8	11142.0	28.0	7368.1	22.3	5490.1	24.1
Evergreen Forest	1427.3	6.4	1100.6	3.9	722.5	4.4	1393.5	3.5	1036.3	3.1	483.9	2.1
Mixed Forest	3368.9	15.1	4482.2	15.7	2753.4	16.9	6648.7	16.7	4508.2	13.7	2672.6	11.7
Pasture/Hay	5712.2	25.6	11987.5	42.0	5258.6	32.3	15514.6	38.9	8248.1	25.0	10805.1	47.4
Row Crops	4094.6	18.3	3669.2	12.8	1742.6	10.7	3935.1	9.9	4654.1	14.1	2986.4	13.1
Other Grasses (Urban/Recreational)	113.9	0.5	23.1	0.1			600.9	1.5	2527.9	7.7	83.0	0.4
Woody wetlands			310.0	1.1					24.5	0.1		
Emergent Herbaceous Wetlands			11.6									
Quarries/Strip Mines /Gravel Pits									139.7	0.4		
Total	**22352.8**	**100.0**	**28563.2**	**100.0**	**16266.7**	**100.0**	**39857.3**	**100.0**	**33023.4**	**100.0**	**22785.1**	**100.0**

Table B-1 Harpeth River Watershed – Subwatershed Land Use Distribution (Continued)

Land Use	Subwatershed											
	0202		0203		0204		0301		0302		0303	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Open Water	11.6	0.1	6.7	0.0	113.0	0.8	602.2	1.5	78.3	0.3	23.8	0.1
Low Intensity Residential	90.7	0.5	57.8	0.3	127.4	0.9	2311.5	5.8	2045.1	6.9	93.0	0.5
High Intensity Residential	3.3	0.0	0.2	0.0	10.2	0.1	342.3	0.8	71.4	0.2	5.1	0.0
High Intensity Commercial/Industrial /Transportation	18.2	0.1	24.0	0.1	40.7	0.3	507.7	1.3	746.1	2.5	62.7	0.4
Bare Rock/Sand/Clay												
Transitional			0.4	0.0			16.0	0.0			6.0	0.0
Deciduous Forest	6967.6	37.6	12663.4	70.1	5923.7	40.1	19143.7	47.7	8988.2	30.5	13859.4	80.3
Evergreen Forest	238.4	1.3	194.4	1.1	419.6	2.8	1190.4	3.0	1672.8	5.7	183.2	1.1
Mixed Forest	1680.4	9.1	1014.1	5.6	1792.0	12.1	5237.2	13.0	6230.2	21.1	572.0	3.3
Pasture/Hay	7675.5	41.4	3370.7	18.7	4721.5	32.0	7287.4	18.2	6071.6	20.6	1565.4	9.1
Row Crops	1835.6	9.9	705.4	3.9	1572.9	10.6	2049.3	5.1	1584.5	5.4	839.1	4.9
Other Grasses (Urban/Recreational)			21.8	0.1	43.6	0.3	1346.3	3.4	2008.4	6.8	49.6	0.3
Woody wetlands							90.1	0.2				
Emergent Herbaceous Wetlands												
Quarries/Strip Mines /Gravel Pits					9.1	0.1	38.3	0.1				
Total	**18521.3**	**100.0**	**18058.9**	**100.0**	**14773.8**	**100.0**	**40162.4**	**100.0**	**29496.5**	**100.0**	**17259.2**	**100.0**

Table B-1 Harpeth River Watershed – Subwatershed Land Use Distribution (Continued)

Land Use	Subwatershed											
	0304		0305		0401		0402		0501		0502	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Open Water	320.0	1.0	195.0	0.8	10.5	0.0	14.0	0.1	22.7	0.1	35.1	0.1
Low Intensity Residential	372.7	1.2	77.4	0.3	212.2	0.8	31.6	0.1	124.5	0.4	332.7	0.8
High Intensity Residential	42.3	0.1			38.7	0.1			3.6	0.0	40.3	0.1
High Intensity Commercial/Industrial /Transportation	193.5	0.6	29.1	0.1	46.7	0.2	160.1	0.7	41.6	0.1	572.4	1.4
Bare Rock/Sand/Clay												
Transitional	38.0	0.1	207.9	0.9	1.3	0.0	17.3	0.1	228.2	0.7	149.2	0.4
Deciduous Forest	21961.4	71.9	19514.5	80.3	20860.8	77.0	20087.3	83.6	15109.0	46.8	26045.7	64.8
Evergreen Forest	321.3	1.1	155.7	0.6	179.9	0.7	118.5	0.5	1064.3	3.3	746.3	1.8
Mixed Forest	1647.9	5.4	852.6	3.5	740.8	2.7	793.7	3.3	2194.7	6.8	2524.1	6.3
Pasture/Hay	3137.2	10.3	1967.0	8.1	3357.4	12.4	2188.7	9.1	9823.7	30.4	6994.1	17.4
Row Crops	2219.4	7.3	1169.3	4.8	1506.2	5.6	616.0	2.6	3568.0	11.0	2528.1	6.3
Other Grasses (Urban/Recreational)	131.7	0.4	61.8	0.3	125.9	0.5	3.1	0.0	126.8	0.4	193.9	0.5
Woody wetlands	173.0	0.6	68.9	0.3							7.6	0.0
Emergent Herbaceous Wetlands			0.4	0.0								
Quarries/Strip Mines /Gravel Pits											48.5	0.1
Total	**30558.4**	**100.0**	**24299.8**	**100.0**	**27080.3**	**100.0**	**24030.5**	**100.0**	**32307.0**	**100.0**	**40218.0**	**100.0**

Table B-1 Harpeth River Watershed – Subwatershed Land Use Distribution (Continued)

Land Use	Subwatershed							
	0601		0602		0603		0604	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Open Water	87.8	0.5	7.3	0.1	0.7	0.0	6.4	0.0
Low Intensity Residential	821.1	4.5	51.6	0.4	17.3	0.2	187.0	0.6
High Intensity Residential	203.3	1.1	10.0	0.1			8.7	0.0
High Intensity Commercial/Industrial /Transportation	572.4	3.1	23.8	0.2	4.9	0.1	92.1	0.3
Bare Rock/Sand/Clay								
Transitional	5.3	0.0					71.6	0.2
Deciduous Forest	7775.3	42.3	6305.3	53.4	3650.3	50.8	22273.2	73.5
Evergreen Forest	502.1	2.7	145.0	1.2	134.8	1.9	386.3	1.3
Mixed Forest	1361.0	7.4	765.2	6.5	673.8	9.4	1623.9	5.4
Pasture/Hay	4239.1	23.1	3086.3	26.2	1797.8	25.0	3266.9	10.8
Row Crops	2311.5	12.6	1402.6	11.9	900.9	12.5	2197.0	7.3
Other Grasses (Urban/Recreational)	400.7	2.2	2.7	0.0	3.6	0.0	149.7	0.5
Woody wetlands							29.6	0.1
Emergent Herbaceous Wetlands								
Quarries/Strip Mines /Gravel Pits	94.7	0.5						
Total	**18374.5**	**100.0**	**11799.9**	**100.0**	**7184.0**	**100.0**	**30292.2**	**100.0**

Table B-2 Ecoregion Reference Site Drainage Area Land Use Distribution

Land Use	Ecoregion Reference Site Drainage Areas					
	ECO71F16		ECO71H09		ECO71I09	
	[acres]	[%]	[acres]	[%]	[acres]	[%]
Open Water			35.6	0.5	1.3	0.0
Low Intensity Residential					15.3	0.3
High Intensity Residential	1.3	0.0				
High Intensity Commercial/Industrial /Transportation			4.9	0.1	4.7	0.1
Bare Rock/Sand/Clay						
Transitional	0.7	0.0				
Deciduous Forest	7735.3	98.3	6135.2	79.9	1847.4	31.6
Evergreen Forest	14.5	0.2	233.1	3.0	321.3	5.5
Mixed Forest	46.0	0.6	697.2	9.1	733.2	12.5
Pasture/Hay	73.4	0.9	452.6	5.9	1590.3	27.2
Row Crops	0.2	0.0	122.1	1.6	1215.1	20.8
Other Grasses (Urban/Recreational)			0.2	0.0	3.6	0.1
Woody wetlands					104.7	1.8
Emergent Herbaceous Wetlands					10.0	0.2
Quarries/Strip Mines /Gravel Pits						
Total	**7871.4**	**100.0**	**7680.8**	**100.0**	**5847.0**	**100.0**

APPENDIX C

Future Sediment TMDL Related Work in EPA Region IV

1.0 Existing Approach

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).) Most State Water Quality Standards 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.

The TMDL sediment linkage is defined as the cause and effect relationship between the biological integrity, habitat alteration and identified sediment sources.

An analysis of watershed sediment loading can 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 most regional watersheds prevented EPA from presently using a detailed dynamic watershed runoff model. Instead, EPA determined the sediment contributions to the impaired segments based on an average annual load of sediment from the upstream watershed. Comparing this impaired segment's watershed sediment load to an average annual sediment load from a biologically and habitat unimpaired watershed provides the basis for estimating any needed load reductions for the impaired segments.

Watershed-scale loading of sediment in water and sediment are estimated using the Watershed Characterization System (WCS) Sediment Tool. The Arcview based WCS Sediment Tool loading function model, based on the Universal Soil Loss Equation, 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 or spatial variability. The WCS Sediment Tool provides a mechanistic, simplified simulation of precipitation-driven runoff and sediment delivery, yet is intended to be applicable without calibration. Sediment load from runoff can be used to estimate pollutant delivery to the receiving waterbody from the watershed. This estimate is based on sediment concentrations in storm water and an estimate of the average annual sediment load ultimately delivered to the receiving waterbody by runoff and erosion.

2.0 Future Work

Region IV is working with the Region IV States, Federal and State agencies and a Technical Advisory Group, to develop better and more technically sound TMDLs procedures for sediment. This ongoing work includes:

2.1 Development of ecoregion sediment loading curves for unimpaired streams

Development of allowable instream ecoregion based sediment concentrations (for various flow conditions;

Given that a major source of sediment in the impaired unstable streams are from eroding channel banks, in-stream loadings will be simulated using the channel-evolution model; and

Develop a more effective and transferable monitoring strategy for evaluating sediment impacts in streams.

2.2 Development of Ecoregion Sediment Loading Curves

Development of ecoregion sediment loading curves in EPA Region IV will require the establishment of the link between geomorphic, sediment and biologic characteristics of streams in the Southeast USA. Ongoing work, with the USDA - Agricultural Research Service, National Sedimentation Laboratory entails the review of 282 stream sites in seven Level III ecoregions in EPA Region IV. The tasks involve evaluating those streams that have existing records of flow and sediment transport as measured by other Federal agencies (U.S. Geological Survey and U.S. Department of Agriculture). Field and analytic work will be performed on this existing data to determine "reference" sediment-transport conditions and the likelihood that streams are impacted and/or impaired due to excess sediment.

The output of this work will be the results of the analysis of "reference" sediment-transport conditions and describe a rapid approach that TMDL practitioners can use to determine impairment in streams due to excess sediment.

USDA - Agricultural Research Service, National Sedimentation Laboratory will:

- Conduct rapid geomorphic assessments (RGA's) and determine stage of channel evolution at the 282 sites in seven Level III ecoregions in EPA Region IV. From the total number of 282 sites, select a minimum of two "reference" and two impacted sites in each ecoregion to perform detailed analysis of flow, sediment transport and aquatic community structure. Sites will be used to evaluate links between stage of channel evolution, sediment indices, and biologic integrity. All sites will be located within the states of EPA Region IV.

- Acquire from USDA and USGS existing historical flow and sediment-transport data for all sites selected in Task A. Evaluate sediment yields at the effective discharge and determine from detailed gage records, the channel stability conditions at the time of historical sediment sampling. Characterize the sediment-transport rate at the effective discharge at all sites.

- Acquire 15-minute discharge data and combine with sediment-transport data to determine the frequency, and duration of sediment transport at the four selected sites in each ecoregion. Develop frequency and duration relations for "reference" and impacted sites and compare with available biologic data to assess potential threshold levels of concentration.

- Acquire all existing historical data that may be available on the stream/reach and collect information on bank-material shear strength, bed-material size and erodibility, channel cross-sections and profiles.

- Assemble all sediment-transport results into data tables and histograms for each ecoregion and compare these values with stage VI "reference conditions."

2.3 Development of allowable instream ecoregion based sediment concentrations

EPA Region IV is participating on Sediment TMDL Technical Advisory Group sponsored by the Georgia Nature Conservancy and the University of Georgia in Athens. A preliminary recommendation from the group is that a TMDL should be expressed as an annual sediment load and a daily sediment load and concentration. The daily load will depend on flow. If an average flow is used for daily load, then this would represent an upper limit for base-flow or chronic conditions. If sediment rating curve slope is available, a flow and sediment concentration for storm flow conditions can be used to calculate a daily-load upper limit that would represent acute condition. Work is ongoing to refine the proposal and to test the proposal in various ecoregions in Georgia.

2.4 Instream loadings simulated using the channel-evolution model

Given that a major source of sediment in the region's stream is from eroding channel banks, in-stream sediment loads will be simulated using other more complex, process-based models like GSTARS or CONCEPTS. These models require a more robust sediment and flow database in the individual watershed. One useful exercise will be to compare the model outputs from some of the preliminary Phase I TMDLs produced by Region IV via BASINS within the South Fork Broad Watershed (noted above) to other more complex, process-based models.

The EPA ORD work on the Broad River sediment data collection project will be useful to compare with other efforts within the Region to develop sediment TMDLs in the Piedmont, Coastal Plain and Interior Plateau. It will also be useful to compare the results of the ORD project to some of the work currently underway between EPA Region IV and the USDA-ARS, National Sedimentation Laboratory in Oxford, Mississippi.

2.5 Develop a more effective and transferable monitoring strategy for evaluating sediment impacts in streams

Monitoring is a key component of the TMDL process and should be particularly emphasized in the Phased TMDLs because of the uncertainty surrounding their establishment. At a minimum, the monitoring program will have to address the issues of discharge, sediment concentrations and loads, and very importantly, temporal resolution (daily, weekly, monthly, seasonally, yearly). The monitoring plan must incorporate the use of consistent and accurate sampling and analytical procedures.

In EPA Region IV's Science and Ecosystem Support Division (SESD) and Water Management Division (WMD) and EPA's Office of Research and Development (ORD) are working on the refinement and implementation of both habitat and biological assessments and sediment storm water monitoring strategies to gather the data and information necessary to develop the more complex TMDLs. These strategies include the measurement of sediment reaching the stream and instream sediment sources.

APPENDIX D

Tennessee Ecoregion Project

Tennessee Ecoregion Project

Note: Major portions of the following narrative, as well as the data in Table D-1, are excerpted or summarized from *Tennessee Ecoregion Project, 1994-1999* (TDEC, 2000). Detailed information regarding the Tennessee Ecoregion Project can be found in this reference

Several narrative criteria, applicable to siltation/habitat alteration, are established in *State of Tennessee Water Quality Standards, Chapter 1200-4-3 General Water Quality Criteria, October 1999* (TDEC, 1999):

Applicable to all use classifications (Fish & Aquatic Life shown):

> Solids, Floating Materials, and Deposits – There shall be no distinctly visible solids, scum, foam, oily slick, or the formation of slimes, bottom deposits or sludge banks of such size and character that may be detrimental to fish and aquatic life.
>
> Other Pollutants – The waters shall not contain other pollutants that will be detrimental to fish or aquatic life.

Applicable to the Domestic Water Supply, Industrial Water Supply, Fish & Aquatic Life, and Recreation use classifications (Fish & Aquatic Life shown):

> Turbidity or Color – There shall be no turbidity or color in such amounts or of such character that will materially affect fish and aquatic life.

Applicable to the Fish & Aquatic Life use classification:

> Biological Integrity - The waters shall not be modified through the addition of pollutants or through physical alteration to the extent that the diversity and/or productivity of aquatic biota within the receiving waters are substantially decreased or adversely affected, except as allowed under 1200-4-3-.06. The condition of biological communities will be measured by use of metrices suggested in guidance such as Rapid Bioassessment Protocols for Use in Streams and Rivers (EPA/444/4-89-001) or other scientifically defensible methods. Effects to biological populations will be measured by comparisons to upstream conditions or to appropriately selected reference sites in the same ecoregion····.

Terms such as "detrimental to fish & aquatic life" and "materially affect fish & aquatic life" are not defined. A method was needed for comparing the existing conditions found in streams to the "natural" or reference condition in healthy, relatively unimpaired streams. The reference data needed to be from similar geographic areas to avoid inappropriate comparisons. It was important that the chosen approach provide scientific, practical, and defensible background data for the different parts of the state.

In the 1980's, EPA developed a geographical framework called the ecoregion approach. In this approach, the United States is delineated into 76 different Level III ecoregions based on a similarity in climate, landform, soil, natural vegetation, hydrology and other ecologically relevant variables. Tennessee is divided into eight of these regions. The ecoregion approach was

considered to be a reasonable way to determine regionally specific information for use in narrative criteria interpretation and application.

The Tennessee Ecoregion Project was initiated in 1993 and had several long-term objectives:

- Refine Level III ecoregions and delineate Level IV ecoregions (subregions) in Tennessee.
- Locate least impacted and minimally disturbed reference streams in each subregion.
- Determine baseline physical, chemical, and biological conditions in reference streams.
- Explore the use of reference data to assist in the interpretation of existing narrative criteria.

Delineation of Subregion Boundaries

The eight Level III ecoregions comprising Tennessee were too large and diverse to be useful for the establishment of water quality goals. It was therefore necessary to refine and subdivide the ecoregions into smaller, more homogeneous units. Beginning in 1993, the Division of Water Pollution Control (DWPC) arranged for James Omernik and Glenn Griffith of EPA's Corvalis Laboratory to subregionalize and update Tennessee's ecoregions (USEPA, 1997). Experts in many disciplines from 27 state and federal agencies, as well as universities and private organizations, were involved in this process. Maps containing information on bedrock and surface geology, soils, hydrology, physiography, topography, precipitation, land use and vegetation were reviewed. The result was the sub-delineation of Tennessee's eight (Level III) ecoregions into 25 (Level IV) ecological subregions.

Reference Stream Selection

Reference sites were chosen to represent the best attainable conditions for all streams with similar characteristics in each of the 25 subregions. An initial candidate list of 241 streams were evaluated as potential reference sites. A set of guidelines developed by Alabama and Mississippi (1994) were used as the basis for field reconnaissance. Potential sites were rated as to how well they met the following criteria:

- The entire watershed was contained within the subregion.
- The watershed was mostly or completely forested (if forest was the natural vegetation type) or has a typical land use for the subregion The watershed may be contained within a National Forest, State Refuge or other protected area.
- The geologic structure and soil pattern was typical of the region.
- The watershed did not contain a municipality, mining area, permitted discharger or any other obvious potential sources of pollutants, including non-regulated sources.
- The watershed was not heavily impacted by nonpoint source pollution.
- The stream flowed in its natural channel and had not been recently channelized. There were no flow or water level modification structures such as dams, irrigation canals or field drains.

- No power or pipelines crossed upstream of the site.
- The watershed contained few roads.

Initial site evaluations were conducted by experienced field biologists. Abbreviated screenings of the benthic community, focusing on clean water indicator species, were conducted at each potential site. Measurements of dissolved oxygen, pH, conductivity and water temperature were obtained, habitat assessments were conducted, and upstream watershed areas were investigated for potential impacts. During field reconnaissance, an additional 122 sites were added to the original candidate list and 139 sites were dropped due to observable impacts during the initial field reconnaissance, leaving 214 sites left for consideration.

The original goal was to select three final reference sites per subregion. This was determined as the minimal number necessary to generate a statistically valid database. Three streams could not always be located in smaller subregions. A total of 70 candidate reference sites were selected by August 1996 for intensive monitoring.

Intensive Monitoring of Reference Streams

From 1996 to 1999, the reference sites were monitored quarterly for chemicals and bacteria. Chemical sampling generally included the parameters historically sampled by the DWPC in its long-term ambient monitoring network. Macroinvertebrate samples and habitat assessments were conducted biannually in spring and fall. Since 1999, the reference streams have been monitored in accordance with the watershed cycle (each stream is visited every five years). Macroinvertebrate biometric and index scores for the ecoregion reference sites used as targets for the Harpeth River watershed sediment TMDL (ECO71F16, ECO71H09, and ECO71I09) are summarized in Table D-1.

Table D-1 Biometric & Index Scores of Target Ecoregion Reference Sites

Reference Stream Identification Code	Collection Method *	Sample Date	Total Number of Individuals	Taxa Richness	EPT Taxa Richness	EPT Abundance	% Chironomidae	North Carolina Biotic Index	% Clingers	% Tolerant Organisms	Tennessee Stream Condition Index
ECO71F16	SQKICK	5/29/98	189	30	13	37.6	3.2	4.25	58.2	4.5	36
ECO71F16	SQKICK	5/10/99	203	30	10	30.5	42.9	3.93	40.4	8.9	29
ECO71F16	SQKICK	9/9/98	190	27	10	41.6	16.3	4.85	43.7	7.7	32
ECO71H09	SQKICK	4/30/97	183	21	10	63.9	14.2	3.68	33.9	0.6	32
ECO71H09	SQKICK	4/13/98	172	15	8	34.3	1.2	5.71	32.6	1.2	24
ECO71H09	SQKICK	6/11/99	199	28	10	45.2	20.6	5.22	37.2	14.4	29
ECO71H09	SQKICK	10/16/96	200	26	10	61.6	14.5	5.19	46.2	8.0	34
ECO71H09	SQKICK	8/19/97	210	33	15	54.3	12.4	5.11	40.5	6.2	34
ECO71H09	SQKICK	8/31/98	199	21	10	58.8	9.0	5.53	34.7	20.1	29
ECO71I09	SQBANK	4/23/97	225	45	12	44.4	24.0	5.81	24.4	50.2	18
ECO71I09	SQBANK	5/19/98	218	43	8	9.2	18.3	6.64	6.9	69.7	22
ECO71I09	SQBANK	6/3/99	187	42	6	13.9	27.3	5.80	22.5	43.7	26
ECO71I09	SQKICK	10/8/96	200	31	7	55.5	8.1	6.74	21.3	68.5	24
ECO71I09	SQKICK	10/1/97	162	36	4	5.6	46.9	5.57	13.6	29.9	36
ECO71I09	SQBANK	9/1/98	178	44	8	6.7	58.4	5.87	31.5	23.1	30

* SQKICK = Semiquantitative Kick; SQBANK = Semiquantitative Bank

APPENDIX E

NPDES Permit No. TNR10-0000

General NPDES Permit for Storm Water Discharges Associated With Construction Activity

NPDES Permit No. TNR10-0000
General NPDES Permit for Storm Water Discharges Associated With Construction Activity

Information regarding permitting requirements for construction storm water may be downloaded from the TDEC website at:

http://www.state.tn.us/environment/permits/conststrm.htm

NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activit*y may also be downloaded from the TDEC website at:

http://www.state.tn.us/environment/permits/conststrmrul.pdf

The following is a summary of key provisions of NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activit*y, that relate directly to implementation of Waste Load Allocations (WLAs) for sediment in impaired waterbodies in the Harpeth River watershed.

Tennessee General Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activity* became effective on July 1, 2000 and is required for construction sites that disturb five acres or more. The permit authorizes storm water discharges from construction activities, storm water discharges from construction support activities, and certain non-storm water discharges associated with construction activities. The permit also covers discharges from construction sites that disturb less than five acres if the Director of the Division of Water Pollution Control has determined that the discharge from the site contributes to, or is likely to contribute to, a violation of a State water quality standard, or is likely to be a significant contributor of pollutants to the waters of the State. Discharges that result in violations of State water quality standards are prohibited. Construction activities are required to be carried out in such a manner to prevent violations of State water quality standards.

The permitted construction activity is required to develop, maintain, and implement a site-specific Storm Water Pollution Prevention Plan (SWPPP) to minimize erosion of soil and the discharge of pollutants to waters of the State. At a minimum, the SWPPP must include:

- Description of the site, description of the intended sequence of major activities which disturb soil, estimates of total area of the site and area disturbed, any data describing the soil or the quality of any site discharge, site location, identification of storm water outfalls, identification of receiving waters.

- Description of appropriate control measures and the general timing during the construction process that measures will be implemented. (The permit describes in some detail minimum requirements for: 1) erosion and sediment controls designed to retain sediment on site; 2) stabilization practices for disturbed portions of the site; 3) structural practices to divert flows from exposed soils, store flows, or otherwise limit runoff and pollutant discharge resulting from a 2 year, 24 storm (approximately 3.5 inches/24 hours for the Harpeth River watershed); and 4) storm water management measures that will be installed after construction operations have been completed).

- Maintenance procedures to ensure that vegetation, erosion, and sediment control measures are kept in good and effective operating condition.

- A schedule of inspections by qualified personnel of disturbed areas of the construction site that are not fully stabilized, storage areas exposed to precipitation, structural control measures, outfall points, and locations where vehicles enter and exit the site. These inspections must be performed before certain anticipated storm events, within 24 hours after storm events of 0.5 inches , or greater, and at least once every two weeks (once per week for receiving streams listed on the 303(d) list for siltation). Based on the results of inspections, inadequate or damaged control measures must be modified or repaired as necessary before the next anticipated storm event (within seven days maximum). Also based on the results of inspections, pollution prevention measures must be revised as necessary within a specified time frame. Inspections must be documented.

- Sources of authorized non-storm water that are combined with storm water discharges associated with construction activity must be identified in the plan and appropriate pollution prevention measures for the non-storm water component of the discharge identified and implemented.

<u>Additional requirements are specified for discharges into waters listed on the Tennessee 303(d) list for siltation</u>. These additional requirements include:

- The SWPPP must be submitted to the local Environmental Assistance Center (EAC) prior to the start of construction.

- More frequent (weekly) inspections of erosion and sediment controls. Inspections and the condition of erosion and sediment controls must be certified to TDEC on a weekly basis.

- If TDEC learns that a discharge is causing a violation of water quality standards or contributing to the impairment of a 303(d) listed water, the discharger will be notified that the discharge is no longer eligible for coverage under the general permit and that additional discharges must be covered under an individual permit.

APPENDIX F

Public Notice Announcement

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER POLLUTION CONTROL

PUBLIC NOTICE OF AVAILABILITY OF PROPOSED TOTAL MAXIMUM DAILY LOADS (TMDLs) FOR SILTATION & HABITAT ALTERATION IN THE HARPETH RIVER WATERSHED (HUC 05130204), TENNESSEE

Announcement is hereby given of the availability of Tennessee's proposed Total Maximum Daily Loads (TMDLs) for siltation and habitat alteration in the Harpeth River watershed located in middle Tennessee. Section 303(d) of the Clean Water Act requires states to develop TMDLs for waters on their impaired waters list. TMDLs must determine the allowable pollutant load that the water can assimilate, allocate that load among the various point and nonpoint sources, include a margin of safety, and address seasonality.

A number of waterbodies in the Harpeth River watershed are listed on Tennessee's final 1998 303(d) list as not supporting designated use classifications due, in part, to siltation and habitat alteration associated with land development, road construction, riparian loss, and agricultural sources. The TMDLs utilize Tennessee's general water quality criteria, ecoregion reference site data, land use data, digital elevation data, a sediment loading and delivery model, and an appropriate Margin of Safety (MOS) to establish allowable loadings of sediment which will result in reduced in-stream concentrations and the attainment of water quality standards. The TMDLs require reductions in sediment loading of approximately 32% to 90% in the listed waterbodies.

The proposed siltation/habitat alteration TMDLs may be downloaded from the Department of Environment and Conservation website:

http://www.state.tn.us/environment/wpc/tmdl.htm

Technical questions regarding this TMDL should be directed to the following members of the Division of Water Pollution Control staff:

Bruce R. Evans, P.E., Watershed Management Section
Telephone: 615-532-0668

Sherry H. Wang, Ph.D., Watershed Management Section
Telephone: 615-532-0656

Persons wishing to comment on the TMDLs are invited to submit their comments in writing no later than April 22, 2002 to:

Division of Water Pollution Control
Watershed Management Section
6th Floor, L & C Annex
401 Church Street
Nashville, TN 37243-1534

All comments received prior to that date will be considered when revising the TMDL for final submittal to the U.S. Environmental Protection Agency.

The TMDL and supporting information are on file at the Division of Water Pollution Control, 6th Floor, L & C Annex, 401 Church Street, Nashville, Tennessee. They may be inspected during normal office hours. Copies of the information on file are available on request.

APPENDIX G

Public Comments Received

Comments from the U.S. Department of the Interior, Fish and Wildlife Service

Sherry

United States Department of the Interior

FISH AND WILDLIFE SERVICE
446 Neal Street
Cookeville, TN 38501

February 13, 2002

Ms. Stephanie Fulton
Tennessee State TMDL Coordinator
U.S. Environmental Protection Agency
Atlanta Federal Center
61 Forsyth Street
Atlanta, Georgia 30303-8960

Dear Ms. Fulton:

Thank you for your letter and enclosures of January 15, 2002, regarding the establishment and approval of Total Maximum Daily Loads (TMDL) in the State of Tennessee. A siltation and habitat alteration TMDL for various waterbodies in the Harpeth River watershed was submitted for review and a determination of compliance with Section 7 of the Endangered Species Act. U.S. Fish and Wildlife Service (Service) personnel have reviewed the information submitted and offer the following comments for consideration.

Endangered species collection records available to the Service do not indicate that federally listed or proposed endangered or threatened aquatic species occur within the Harpeth River watershed. We note, however, that collection records available to the Service may not be all-inclusive. Our data base is a compilation of collection records made available by various individuals and resource agencies. This information is seldom based on comprehensive surveys of all potential habitat and thus does not necessarily provide conclusive evidence that protected species are present or absent at a specific locality. However, based on the best information available at this time, we believe that the requirements of Section 7 of the Endangered Species Act of 1973, as amended, are fulfilled. Obligations under Section 7 of the Act must be reconsidered if (1) new evidence reveals impacts of the proposed action that may affect listed species or critical habitat in a manner not previously considered, (2) the proposed action is subsequently modified to include activities which were not considered during this consultation, or (3) new species are listed or critical habitat designated that might be affected by the proposed action.

The narrative for the siltation and habitat alteration TMDL states that voluntary, incentive-based mechanisms will be used to implement nonpoint source management measures in order to assure that measurable reductions in pollutant loadings can be achieved for the targeted impaired water. It is also stated that local, citizen-led and implemented management measures offer the most efficient and comprehensive avenue for reduction of loading rates from nonpoint sources. We agree that this type

of approach has been partially successful in agricultural areas through the implementation of various incentive-based programs administered by Federal and State agencies. This TMDL, however, does not address regulatory measures such as Tennessee's stormwater and aquatic resource alteration permitting programs. Effective enforcement of these programs is vital in controlling erosion and aquatic habitat loss, especially in urban areas experiencing rapid development such as Davidson, Williamson, and Rutherford Counties, Tennessee. We are concerned that a comprehensive review of these program areas, including current inspection and enforcement statistics, was not included in the narrative for this siltation and habitat alteration TMDL and, ultimately, raises questions regarding the eventual effectiveness of its implementation in the Harpeth River watershed.

These constitute the comments of the U.S. Department of the Interior in accordance with provisions of the Endangered Species Act (87 Stat. 884, as amended: 16 U.S.C. 1531 et seq.) and the Memorandum of Agreement between the U.S. Fish and Wildlife Service, Environmental Protection Agency, and National Marine Fisheries Service. Thank you for the opportunity to comment on this action. If you have any questions, please contact Steve Alexander of my staff at 931/528-6481 (ext. 210).

Sincerely,

Robert T. Bacy

for Lee A. Barclay, Ph.D.
Field Supervisor

xc: Paul Davis, TDEC, Nashville
Dave McKinney, TWRA, Nashville

Comments from the Southern Environmental Law Center - April 22, 2002

April 22, 2002

Mr. Paul E. Davis, Director **BY FACSIMILE**
Ms. Sherry H. Wang **AND U.S. MAIL**
Division of Water Pollution Control
Tennessee Department of Environment and Conservation
6th Floor, L&C Annex
401 Church Street
Nashville, TN 37243-1534

Re: Proposed Total Maximum Daily Load (TMDL) for siltation and habitat alteration in the Harpeth River watershed (HUC 05130204)

Dear Paul and Sherry:

These comments are submitted on behalf of the Tennessee Clean Water Network and the Tennessee Environmental Council regarding the proposed Total Maximum Daily Load (TMDL) for siltation and habitat alteration in the Harpeth River Watershed, dated March 12, 2002. In addition, I would like to incorporate by reference the March 13, 2002 comments I submitted on behalf of TCWN regarding the preliminary draft version of this proposed TMDL (copy enclosed).

As noted in our March 13, 2002 comments, there are some positive elements in the proposed sediment TMDL for the Harpeth River for which we applaud your efforts. However, we still do not believe that the proposed TMDL satisfies federal regulations, in particular the requirement that waste load allocations be calculated for point source discharges of problem pollutants, 40 C.F.R. 130.2(h), nor do we believe the discussion is presented in such a way as to convey to the public the enormity of the challenge facing all who are concerned about restoring water quality in the Harpeth River. Finally, though we appreciate TDEC's public forum on the preliminary draft sediment TMDL for the Harpeth River, and the opportunity to comment on the preliminary draft as well as this proposed TMDL, we do not believe that without more meaningful give and take, this constitutes meaningful public participation or indicates a sincere commitment on the part of TDEC to including the public in the TMDL process.

Since most of our concerns are contained in the March 13, 2002 comments, we will not repeat them here. We do understand that those comments were not received until after the proposed TMDL was completed. Nonetheless, we believe most of those comments are still valid and do incorporate them by reference in this letter.

1. The proposed TMDL does not contain adequate wasteload allocations (WLAs) for point sources subject to general NPDES permits.

We appreciate your recognition that construction sites over five acres in size now constitute point sources requiring general NPDES permits for the discharge of sediment driven by stormwater, but the proposed TMDL still does not contain any numeric wasteload allocation (WLA) for such sources. Mere reference to best management practices (BMPs) required by the general NPDES stormwater permits does not satisfy your requirement that a TMDL contain an actual wasteload allocation, defined as the "portion of a receiving water's

loading capacity that is allocated to one of its existing or future point sources of pollution." 40 C.F.R. 130.2(h). There is no demonstration whatsoever that the BMPs offered as a substitute for the required WLAs would ever lead to compliance with the water quality standard for sediment in the Harpeth River.

In fact, we believe TDEC's requirement of more frequent inspections and reporting of BMPs, and possible requirement of "better BMPs," for construction stormwater discharges into impaired waters will likely fall short of restoring water quality in the Harpeth River. We propose that all such construction stormwater permits be denied or conditioned such that additional discharges of sediment into the Harpeth River are prohibited until numeric allocations for them are provided in an approved TMDL, as required by 40 C.F.R. 122.4(i).

Finally, the proposed TMDL does not contain any identification of the location or number of regulated construction sites, current or proposed, that would contribute to the ongoing violation of water quality standards in the Harpeth River. It would certainly be a simple matter to include a list of existing sites operating under the general NPDES permit for construction of stormwater discharges, and it would be helpful to public understanding of the problems in the Harpeth River if some minimal effort were made to include reasonably expected construction projects that would require this permit. Since regulated construction sites are point sources, each individual permitted source should be identified and allocated a portion of the safe loading capacity for the Harpeth River.

2. The proposed TMDL does not contain any total maximum daily loads.

As noted in our March 13, 2002 comments, TDEC does not propose to establish a total maximum daily load for each listed segment as required by EPA regulations. 40 C.F.R. 130.2(i). An average annual sediment load might be appropriate for some analytic purposes, such as identifying water quality trends, but it is not adequate by itself as a TMDL without more explanation "since (storm driven pollutants) vary within a watershed on a seasonal basis". See, e.g., Natural Resources Defense Council v. Muszynski, -- F.3d -- (2nd Cir. 2001). While the average annual sediment load may be useful for purposes of comparison, using it alone will not protect aquatic life in the Harpeth River and its impaired tributaries. A single, devastating wet weather event could cause considerable damage to aquatic life in the Harpeth and still be in compliance with an annual average load limitation. We again request that the sediment TMDL include dry weather daily loads (presumably negligible) and wet weather daily loads (the most important variable), as well as some analysis indicating the likelihood of meeting those loads, in addition to average annual load limitations.

The difficulty of establishing daily limits is exaggerated in this instance by the refusal to compare Harpeth River data with generic assumptions used for purposes of modeling this TMDL. It is essential that some comparison be made between actual sediment load delivery and those textbook figures upon which this TMDL is based. If such data are not yet available, despite years of data collection by numerous agencies, individuals and organizations, then this proposed TMDL is premature.

EPA and others have set daily maximum sediment loads, as described in other TMDLs or reports that your office should have in its possession. For information, we refer you to the recently published report, "A Protocol for Establishing Sediment TMDLs" from the Technical Advisory Group at the University of Georgia, February 2002, and sediment TMDLs containing daily

loads for Stekoa Creek, Georgia (4th version, EPA Region 4, April 2001) and for the Cimarron River, New Mexico (State of New Mexico, August 1999). We are happy to provide copies of these three documents if you have difficulty locating them.

We will close by again referring you to additional comments contained in our March 13, 2002 letter (copy attached). We believe it is more important than ever that the public have a chance to discuss this proposed TMDL, and the prospects for its successful restoration of water quality in the Harpeth River, in a public setting before steps are taken to finalize it. We would appreciate the opportunity to meet in person with the staffs from TDEC, Tetra-Tech and EPA, or to participate in a public discussion of this proposed TMDL, at your earliest convenience. Please contact me or Barry Sulkin if you have any questions about the comments contained in this letter or the May 13, 2002 letter. Thank you again for the opportunity to submit these comments.

Sincerely,

Richard A. Parrish
Senior Attorney

cc via email: Stephanie Fulton, EPA Region 4
Jim Greenfield, EPA Region 4
Gail Mitchell, EPA Region 4
Craig Higgison, EPA Region 4
Garland Wiggins, TDEC
Greg Denton, TDEC
Danielle Droitsch, TCWN
Gwen Griffith, TEC
Dorie Bolze, HRWA

Comments from the Southern Environmental Law Center (March 13, 2002)

March 13, 2002

Mr. Paul E. Davis, Director **BY FACSIMILE**
Division of Water Pollution Control
Tennessee Department of Environment and Conservation
6th Floor, L&C Annex
401 Church Street
Nashville, TN 37243

Re: Total Maximum Daily Load (TMDL) for siltation and habitat alteration in the Harpeth River watershed (HUC 05130204)

Dear Paul:

On behalf of the Tennessee Clean Water Network, the Southern Environmental Law Center is pleased to comment on the preliminary draft Total Maximum Daily Load for siltation and habitation alteration in the Harpeth River Watershed (HUC 05130204).

This TMDL warrants special attention, not only from residents of the Harpeth River watershed, but also from residents of other watersheds in Tennessee because it will likely serve as a model for other sediment TMDLs across the state. A properly executed TMDL should provide the state, local communities, and other stakeholders with important, action-forcing information that will actually lead to restoring water quality. Our review indicates that this preliminary draft, while taking steps in that direction, does not yet reach that goal. We believe EPA, TDEC and other interested parties should work together to refine this TMDL to meet federal requirements, especially to better address construction stormwater problems and their role in causing or contributing to sediment impairment, in an effort to produce a TMDL or series of TMDLs that actually stands some chance of succeeding.

TDEC should work with all stakeholders (including point and non-point source contributors, concerned citizens, local officials, utilities, and others) in developing TMDLs as significant as the Harpeth sediment TMDL. Including all stakeholders early in the process provides them with an opportunity to help identify the causes of the impairment and develop the best possible inventory of sources that might be contributing to the impairment. Once the inventory of potential sources is created, TDEC can use models, statistical analyses or additional water quality monitoring to determine the relative magnitude of the contributions of different sources. Then all parties can consider alternative ways of solving the underlying problems.

We would like to thank TDEC for releasing the draft TMDL to the community and for reaching out to the Harpeth River Watershed Association and others with their recent presentation. This opportunity, however, still fell short of our longstanding request and recommendation that TDEC work more directly with communities from the start in developing
TMDLs. It appears that a number of preliminary decisions had already been made that will now have to be revisited.

1. The use of ecoreference streams is commendable, but the discussion of affected watersheds and necessary reductions needs additional data, information and explanation to be useful to the public.

First, we applaud your use of ecoreference streams for the target condition. However, it would be helpful if you included a brief discussion of how the biological assessments used to identify the "least impacted" streams also demonstrated the health of those streams, that they were in acceptable biological condition themselves.

Similarly, you should explain the basis for identifying the numerous segments as impaired for siltation and

habitat alteration. It appears they were listed on the basis of bioassessments, yet the discussion is almost entirely in terms of sediment delivery as calculated by USLEs on a 'per acre' basis. The public would benefit from an explanation of the bases for these listing decisions, i.e., a general description of the data and information that supported the initial decision to list these segments, as well as the 2000 reassessment, especially in the absence of numeric sediment criteria against which to measure compliance. In addition, it would be useful to the public if you would explain how the existing sediment loads in subwatersheds without 303(d) listed waters (Table 6) were calculated to uniformly exceed the target condition and were, in fact, fairly close to the sediment loads calculated for the impaired waters (Table 5). Perhaps they (Table 6) should have been listed as well. Again, it appears as if you are treating those additional sub-watersheds as impaired, but that is not clear.

It was also unclear whether any sampling was conducted to verify sediment delivery calculations and estimates made in support of this TMDL. Also, the relative contribution of 'nonpoint sources' (which, in this example, include stormwater point sources) provided in Table 8 would be much more relevant if presented in tons/acre/year rather than just in tons/year. As presented, it appears that construction and urban runoff are relatively minor factors when compared to agriculture. We suspect this may not be accurate for the Harpeth River watershed, and you imply as much in noting that soil erosion from construction sites can be a significant source of sediment (p. 19).

In fact, it would be helpful to the public if the situation were put in perspective by acknowledging the extraordinary reductions that will have to be achieved in order for this TMDL to succeed. It is clear from the face of the draft that up to 80-90% reductions in existing sediment loads (as calculated using USLE) will be required to comply with water quality standards in some of the target sub-watersheds, over 1000 pounds/acre/year in some cases. It is less clear that these reductions, as multiplied by acreage in these individual sub-watersheds, would amount to a total of 30-40 **million** pounds of sediment per year (or 15,000 - 20,000 **tons** per year) in some cases. These figures make the challenge of restoring water quality and aquatic habitat in the Harpeth River watershed appear rather daunting. But before stakeholders will accept the need to make drastic reductions in sediment delivery to the river, they have to understand just how serious the challenge is.

2. The draft TMDL does not provide waste load allocations (WLAs) to all point sources, especially construction sites that fall under the NPDES Construction Stormwater General Permit.

Federal regulations provide that a TMDL is "the sum of the *individual* WLAs for point sources and LAs for nonpoint sources and natural background"(emphasis added). 40 CFR 130.2(i). The draft TMDL (on page 13) defines the relevant point sources of sediment as only those facilities permitted under individual NPDES permits, as summarized on Table 7. The draft TMDL inexplicably excludes any facilities, operations or sites covered by NPDES Permit No. TNR10-000, the general NPDES permit for stormwater discharges associated with construction activity (discussed on page 19). The TMDL states that "in general, for sediment loads to the receiving streams, the point source discharge levels are negligible in relation to the non-point sources." While this may be the case for STPs, the primary point sources of concern with sediment limited waters are construction sites, and they are not included. Again, the draft acknowledges on page 19 that "Soil erosion from construction sites can be a significant source of sediment in waterbodies". And as you know, compliance with general permit requirements, primarily BMPs, can reduce but would not eliminate sediment running off of such sites. Finally, you have indicated in various public forums that sediment runoff from construction sites is one of the major water pollution problems currently facing Tennessee. With this in mind, it is even more unrealistic not to include construction stormwater as a major point source of sediment to the Harpeth River.

The Harpeth sediment TMDL should include a listing of all individual construction sites that fall under NPDES No. TNR10-0000. For each impaired segment of the river, the Loading Capacity (LC) of the stream should be determined and an evaluation of existing loadings made in order to estimate whether available allocations exist or if the LC is being exceeded. If the loading capacity is being exceeded, reductions must be set and no new loads allowed.

If there is available loading capacity to be allocated, each WLA should set the amount of the total loading capacity allocated to an individual, identified point source. The TMDL should also describe the *sum* of individual waste load allocations, but it still requires the initial determination of the individual WLAs. 40 C.F.R. 130.2 (h). In short, construction sites covered under this NPDES permit are not exempt, nor can they be presumed to be insignificant. Thus, they should be treated like any other point source discharges.

3. The draft TMDL describing the loading capacity in terms of annual loading or in "tons per acre per year" is inadequate because it does not define the greatest amount of daily loading a water can receive without violating the Tennessee water quality standards.

A TMDL must define loading capacity as the greatest amount of loading that a water can receive without violating water quality standards, taking into account ". . . critical conditions for stream flow, loading, and water quality parameters." 40 CFR §130.2 (f) and §130.2(c)(1). A TMDL is both a calculation and a plan: a calculation of the maximum amount of a pollutant that a river, lake or other waterbody can receive before becoming unsafe, and a plan to lower pollution to that safe level, both taking into account seasonal variations and uncertainty (in the form of a margin of safety). The appropriate measure for sediment cannot and should not be based on an annual loading alone, or on a basis that is not tied directly to water quality, such as delivery to the river on a per acre basis.

The "annual load" measurement will not assure compliance with the applicable water quality standard as it relates to the streams' designated uses. Tennessee water quality standards are not based on annual or even seasonal loadings. Most importantly, the water quality standards are designed to protect designated uses. The nature of silt and its impacts on the properties of waters (discussed in detail in Section 3.0 of the draft) requires a daily maximum simply to protect designated uses, particularly for *acute* effects. While the TMDL regulations allow for various units of measure, a daily maximum value is needed, preferably one that distinguishes between dry weather and wet weather loading, and annual loads alone are not sufficient.

Also the "annual load" is simply not implementable in its current form, as it could not logically be applied to point sources, particularly construction stormwater sites. The TMDL needs waste load allocations and a clear explanation of whether the current conditions meet or exceed those WLAs. For example, there is no indication of the amount of sediment likely to flow off of construction sites during stormwater events, either under the best-case scenario (i.e., full compliance with stormwater BMPs) or under the more likely scenario that has caused so many water quality reports to TDEC offices around the state. It is critical that the public understand how such discharges compare to and fit within the allowable TMDL, whether presented in tons per acre or concentrations in the runoff or receiving waters. Again, our strong preference is for some indication of the likely concentration in the runoff and the receiving waters.

4. There is no reasonable assurance that the Harpeth sediment TMDL can be implemented.

The draft TMDL also fails to satisfy EPA's requirement of reasonable assurances that the nonpoint source reductions will actually be achieved. In fact, though this is a commendable effort to describe potential problems and discuss potential ways to address them, the monitoring and assessment activities intended to help identify necessary corrective measures should be conducted <u>before</u> attempting to spell out how the problems will be addressed, and all of that information should be contained in the initial TMDL. TDEC does note that specific measures will be incorporated into later versions of this TMDL, based on feedback from stakeholders and public comments (page 20), but it is essential that the final TMDL, even Phase I of a phased TMDL, include specific management measures and some indication of why we can be assured they will be undertaken and are likely to succeed in restoring water quality. We strongly support your solicitation of input from stakeholders as to how sediment problems in the Harpeth River should be addressed, but it is also important to remember that ultimately, it will be TDEC's responsibility to make the difficult choices that will lead to restoration.

5. The draft TMDL should have an explicit Margin of Safety.

The Clean Water Act requires that a TMDL have a Margin of Safety (MOS) that takes into account any lack of knowledge concerning the relationship between effluent limitations (or load allocations) and water quality. 33 U.S.C. §1313(d)(1)(c); 40 CFR 130.7(c)(1). The draft TMDL has no identifiable MOS, but rather relies on a claim of conservative assumptions without specifically identifying them. However, the draft TMDL uses or is based upon non-conservative assumptions as well, using out of date information (on land use, for example), failing to verify assumptions or estimates with any field data and failing to include any recognition of or allocation for construction stormwater runoff. We do not believe this draft TMDL contains the required MOS.

We understand that this is an ongoing process, and that changes have likely been made since the presentation of the preliminary draft TMDL. Before more time is spent on this effort, however, we would like to meet with you and your staff to discuss these issues. Many of these issues have been pursued in other states, including the efforts of the Sediment Technical Assistance Group (TAG) in Georgia, and we urge that such work be used to help guide this TMDL. Our goal is to help produce TMDLs that satisfy the letter and intent of the Clean Water Act, and that can be implemented in a way that measurably reduces existing pollution and prevents additional sediment problems.

We look forward to reviewing the next draft of this important set of TMDLs. We would also appreciate a response to our concerns, either in person or in writing, and request the opportunity to fully participate in the TMDL process so that we can help you attain the goal of restoring water quality in the Harpeth River.

Sincerely,

Richard A. Parrish
Senior Attorney

cc via email: Stephanie Fulton, EPA Region 4
Jim Greenfield, EPA Region 4
Gail Mitchell, EPA Region 4
Craig Higgison, EPA Region 4
Garland Wiggins, TDEC
Greg Denton, TDEC
Sherry Wang, TDEC
Danielle Droitsch, TCWN
Dorie Bolze, HRWA

Comments from the City of Franklin

CITY OF FRANKLIN
TENNESSEE

Date: 4-19-02

Division of Water Pollution
Watershed Management Section
6th Floor, L & C Annex
401` Church Street
Nashville, TN 37243-1534

RE: Proposed Total Maximum Daily Load (TMDL) for Siltation and Habitat alteration in the Harpeth River Watershed (HUC 05130204) Cheatham, Davidson, Dickson, Hickman, Rutherford, and Williamson County, Tennessee

To Whom It May Concern:

Thank you for allowing us to comment on the Harpeth River Watershed TMDL. The TMDL process can be a very important effort in beginning to restore and protect the waters of the state of Tennessee. The accelerated pace that the TMDL process has been subjected has resulted in less than expected quality.

* Section 7.1.2 says, "Ambient monitoring may be required for specific discharges to determine compliance with the TMDL for a particular segment. "The entire process is a "relative comparison of sediment loads between referenced watershed and the impaired watersheds" and the subwatershed annual average permit limits will be based on these "relative" numbers. What would the results of requiring an MS4 to do Waste Load Allocation ambient monitoring? How would the real world ambient monitoring data compare to the "relative" ecoregion target number?

* Page iv: "This TMDL primarily addresses wet weather sources of sediment which are discharged to a receiving waterbody as a result of the storm event". Since a majority of the sediment load in the streams occur in response to storm events, it seems that sampling of the storm events in the ecoregion streams and in the subwatersheds would be necessary to calibrate the model and determine how each stream reacts to storm events. Since sampling was not designed for storm events, the process seems to be flawed.

* Better and more up-to-date landuse data that reflects the most recent development in the watershed would also be advantageous. The land use data was MRLC 1990-93 (page 3 of 27). Ground truthing of this data would seem to be necessary to obtain usable land use data since the land use in many of these subwatersheds have changed considerable in the last 10 years in the fastest developing county in Tennessee. Consulting with knowledgeable local technical professions would also help develop more usable modeling data.

* Page C-2 2.0 and C-4 2.4: One of the major sources of sediment in the impaired unstable steams are from eroding channel banks and gully erosion; apparently this TMDL did not account for these processes/sediment sources. How will these sources be factored into the required real-world reduction of the MS4/NPDES permittees in the watersheds?

* Section 8.3 page 26: The TMDL states the effectiveness monitoring is to be 'guided by the results of a Harpeth River watershed sediment study, conducted by the Harpeth River Watershed Association and Cumberland River Compact': why did you not use data that was already collected to calibrate the TMDL model? How can the information gathered by the volunteer sediment study be compared to the TMDL model numbers? Are the 'ground-truthing and source identification' actions also to be put on the onerous of the Harpeth River Watershed Association and Cumberland River Compact? What will happen if this volunteer effort does not reach the desired levels?

* If the MS4/NPDES permits are going to be monitored for success as to the amount of sediment in the streams according to the Harpeth River Watershed Association and Cumberland River Compact sediment study, where is the approved protocol for this effort? Since much of their samples come from storm events, how can you compare these findings to the TMDL modeling numbers?

Again thank you for the opportunity to comment on this important process.

Don Green
Stormwater Coordinator
City Hall Mall
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Franklin, TN 37065
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xc: David Parker, City Engineering

Comments from Camp, Dresser, & McKee, Inc.

April 22, 2002

Dr. Sherry Wang, Ph.D., Manager
Division of Water Pollution Control
Watershed Management Section
7th Floor L&C Annex
401 Church Street
Nashville, Tennessee 37243-1534

Subject: Harpeth River Watershed Draft Total Maximum Daily Load (TMDL) for Sediment

Dear Dr. Wang:

CDM has completed a review of the Total Maximum Daily Load (TMDL) for Sediment proposed for the Harpeth River Watershed. There are several concerns with the study and the subsequent watershed TMDLs developed using the study methodology. These concerns, addressed in the following paragraphs, are focused on the following items:

- Basis for 303(d) listing decision
- Data availability
- Reference watershed methodology
- Proposed TMDLs
- Implementation plan as it affects NPDES Phase II permits

Basis for 303(d) Listing Decision

No explanation for how the 303(d) listing was determined is provided. The listing is assumed to be based on physical, chemical and biological data. The basis for listing should be provided since it is not based on a numeric water quality standard but a narrative water quality standard.

The calculated sediment load of the sub-watersheds with 303(d) listed waterbodies and that of the sub-watersheds without 303(d) listed waterbodies (Tables A4 and A7 respectively) do not appear to be statistically different. This makes the basis for the 303(d) listing significant.

Data Availability

In general, data reference sites are not clear. Data that should be documented in the TMDL include the Universal Soil Loss Equation (USLE) parameters for the reference sites such as the rainfall erosivity index, soil erodibility factor, topographic factor, crop/vegetation and management factor and the conservation practice factor. This would make it easier to evaluate the similarity of the reference sites to the targeted watersheds.

Additionally, there are data for significant portions of the Harpeth River Watershed that are more recent, defined and detailed. These data include soils information, landuse information, topography data, best management practice information and other data readily available from entities within the watershed. Much of this is available in electronic form from cities and counties in the watershed.

Reference Watershed Methodology

The use of a "reference watershed" is an acceptable method for TMDL analysis, as explained in EPA's *Protocol for Developing Sediment TMDLs* (EPA 841-B-99-004):

> "Where narrative standards are involved, assessing environmental conditions in receiving waters often depends on comparing observed conditions to expected conditions. This comparison is typically done by comparing data collected from impaired sites to similar data from the same sites collected before impairment and/or from one or more appropriate reference sites where designated uses are in good condition. Conditions at the reference site (e.g., suspended sediment concentrations) can then be interpreted as approximate targets for the indicators at the impaired site."

The selection of the reference watersheds for the Harpeth River Watershed TMDL study area, however, do not appear ***representative*** of watersheds in the TMDL study area. EPA's *Protocol for Developing Sediment TMDLs* (EPA 841-B-99-004) continues:

> "Selection of an appropriate reference site should reflect a clear understanding of the overall system. The reference sites may be within the study watershed or in nearby or even distant watersheds, and they should be selected based on careful comparison of key watershed characteristics and processes (e.g., geology, soils, topography, land use). In general, though, the most useful reference sites are located within the watershed, relatively near the point where impact is expected. Reference sites may be difficult to find."

The reference watersheds do not appear to be located within the Harpeth River Watershed nor have consistent landuse characteristics.

More appropriate watersheds would be those of similar landuse, soil type, and topography that meet water quality standards. The watersheds in Table A-7 would be more appropriate for this TDML study area as they are within the watershed and meet the designated use of the waterbody. Essential backup data were not furnished for the reference sites selected, however the narrative does not indicate that the reference watersheds have similar characteristics or stressors of the Harpeth River Watershed and a quick comparison of the landuse characteristics (Appendix B) of the reference sites and the Harpeth River Watersheds also show considerable differences.

Proposed Sediment TMDLs

In general, the study has limited support for the conclusion that the waterbodies of the Harpeth River Watershed reach the impairment threshold established by the proposed TMDLs. A disadvantage of the Reference Watershed Methodology "is that it might not aid in determining an impairment threshold. Reference sites may represent the completely unaffected state, a relatively unaffected state, or increasing degrees of existing impact" (EPA's *Protocol for Developing Sediment TMDLs* – EPA 841-B-99-004).

In this case, the target sediment loads for the Harpeth River Watershed are based on the average annual sediment loads for the least impacted streams in each of the three sub-ecoregions as stated in Section 7.3, Margin of Safety, of the proposed TMDL. The proposed TMDL justifies the use of the least impacted streams as a means to establish a margin of safety, however in doing so, the study appears to disregard key watershed characteristics and processes as discussed earlier. This in effect makes the TMDL conservatively low with limited technical justification.

Additionally, EPA guidelines, presented in the ASIWPCA Mid-Winter Meeting, Current TMDL Program and New Watershed Rule, March 10-13, 2002, state that the load allocation be "reasonably achievable". As indicated in Table A-7 of the Draft TMDL, "healthy" sub-watersheds within the Harpeth River Watershed are failing to meet the standard set by the proposed TMDL. This raises concerns about whether or not the TMDL is "reasonably achievable", or overly stringent to achieve water quality goals.

Implementation Plan as it Affects NPDES Phase II Permits

TDEC has not established numeric limits for MS4 NPDES permits, however it is recommended that the "special requirements" or "appropriate permit conditions" (see Section 8.1.2) for future Phase II MS4 permits be further clarified. The application of BMPs that go beyond the typical minimum elements generally undertaken to comply with the current regulations should be defined and costs associated with these BMPs should be provided.

The implementation of load allocations for non-point sources should also be clarified. Specifically, the voluntary, incentive-based mechanisms and the general recommendations do not provide an explicit mechanism to establish the recommended directives or incentives.

Please contact me at your convenience if you have any questions regarding this, or any other matter.

Very truly yours,

CAMP DRESSER & McKEE INC.

Christopher A. Provost, P.E.
Associate

cc: Mark S. Hilty, CDM
David Parker, City of Franklin, Tennessee
Floyd Heflin, Williamson County, Tennessee

Comments from the Harpeth River Watershed Association

Harpeth River Watershed Association

April 22, 2002

Dr. Sherry Wang
Watershed Management Section
TDEC
6th Floor, L & C Annex
401 Church Street
Nashville, TN 37243

Dear Dr.Wang,

The Harpeth River Watershed Association would like to submit the following comments and suggestions for next steps in developing the sediment TMDL for the 28 impaired segments in the Harpeth River watershed. As you know, there is a lot of interest in addressing sediment loading in the Harpeth. On a regional level within EPA Region IV and nationally, expertise is being pulled together to wrestle with sediment loading and how to design TMDLs to reduce these loads to levels that receiving streams can handle. The HRWA is in the position to be able to collaborate with these efforts to develop and test approaches in the Harpeth that will be useful in other watersheds with similar geomorphological characteristics in the region.

1. Establish a Sedimentation Working Group for TN.

Here are some of our thoughts with the draft TMDL and some suggestions for next steps. There is a time line at the end of this comment which we offer in the spirit of moving the process forward and giving people something to work from. One of the most important recommendations we would like to make is the need to establish a formal TN working group on sediment load reduction and TMDLs similar to the Technical Advisory Group that was convened in GA to work on sediment TMDL issues. Members of the working group would include the EPA, TDEC, NRCS, municipal MS4 permittees, agricultural interests, the HRWA and similar organizations, experts from academic, consulting, and public sectors, and so forth. This working group would be a great forum to work with EPA and Tetratech on integrating our sediment study data with the computer modeling work to calibrate and improve the models so they are more valuable to entities who need to assess cost effective options for reducing sediment loads and so forth. The working group would start working off the preliminary recommendation from the GA TAG to design a daily maximum sediment load tied to flow rates. The working group would address management and regulatory aspects for the MS4 stormwater permittees, prioritize areas for nonpoint source efforts in agricultural areas, and the like.

2. The latest draft TMDL does not establish allocations for impaired streams yet.

You have received comments in the past from other organizations about this issue and it is a common issue with sediment TMDLs. We would like to re-enforce this point since a TMDL will need to ultimately set a limit on sediment loads for each impaired stream and allocate that limit among all the point and nonpoint sources. This is going to be a challenge, but we believe it is important to keep this in mind and explicitly indicate in the TMDL document the process and timeline for determining limits, assessing their effectiveness, and refining them. Our concern with the TMDL document in its current format is that it is not something any entity can implement. The loading per acre offers a target that could be used to monitor the TMDL over the long run, but our experts do not see how these average loads/acre can be used

to develop enforceable standards that are required in the Clean Water Act. Since this TMDL is the first step it also needs to use an explicit margin of safety according to the federal regulations as we all work on the next iteration.

The GA TAG recommended a preliminary approach to setting a sediment standard. The HRWA Science and Policy Committee is ready to work with TDEC, EPA, developers, experts, and others to gather the needed stream specific data to take a first step at setting a standard, doing a pilot, and otherwise work on devising an approach that works. Though the sediment tool used by EPA generated relative figures in terms of sediment load by acre, a TMDL is going to need an in-stream criterion to measure and use for regulatory purposes. We recognize that the EPA and TDEC are under tight time frames to issue TMDLs, but it is important to develop a plan and a process that are supported by the community and are defensible as a TMDL.

3. Recommendations for the TMDL: focus on specifying BMPs for construction sites

While a defensible and sensible in-stream standard is being developed, we would like to recommend that the TMDL expand in the direction of expressly prescribing BMPs for construction sites. This will enable the TMDL to have some clear implementing strategies that will immediately address sediment loading. As you know, the Cumberland River Compact and Harpeth River Watershed Association have collected a dataset on sediment load levels based on turbidity and TSS measurements during rain events throughout the Harpeth river watershed. The data so far indicate how dramatic the sediment load is from large storm events. For example, since the study began in September 2001, the largest single daily load was on February 25 during a several day rain event of over 4 inches. This event alone contributed 12,500 tons of sediment to the Harpeth. As you know, these big events create flooding, fast waters rushing off impervious surfaces and through storm drain systems that directly flow to creeks, and overwhelm erosion control measures on construction sites.

Construction sites are an important source of sediment that have to be addressed as part of the sediment TMDL. As the TMDL notes, construction sites are required to have a NPDES Construction General Permit for Stormwater Discharges from Construction Activities. Since these sites are point sources, they will need to have a specific allocation of load assigned to them according to the regulations. Currently the TMDL does not do this, and relies on sites to have adequate BMPs in place to control erosion. We recently did an aerial over-flight of the watershed the day after the mid-March 4-inch rain event to get a bird's-eye view of construction activities and how they may be a contributor. Large construction sites are numerous and concentrated in Bellevue, Dickson, and Franklin. In large rain events, most of the cover used as a BMP for bare ground is of little value in retaining sediment, and impoundments tend to overflow in large rain events.

The TMDL needs to address construction sites more directly. We suggest that it require an individual NPDES Construction permit for sites adjacent to the 303d streams covered in the TMDL. In addition, specific BMPs need to be described for varying terrain, for varying distances from streams, and so forth that would be required for permittees to use in their Stormwater Pollution Prevention Plans. These plans need to withstand a 4.5-inch rain event. We suggest that a working group that includes a construction industry representative draft those BMPs descriptions in a short period of time, and then these could be assessed at particular sites for revision. Because road construction and widening is a major construction activity in the watershed, we also suggest delineating specific stormwater retention and management designs for roads, and water crossings for 303d streams, that would be required for ARAP permits.

This immediate focus on construction sites is warranted because there are many large sites and many small ones along most of the 303d streams. Nonetheless, there are also storm drain systems creating streambank erosion, electrical utility crossings and agricultural practices that are also creating erosion tied to lack of riparian vegetation. The HRWA just completed a site-specific visual stream assessment of the 303d streams looking for potential sites that might be the cause of impairment. We are proud that TDEC awarded us the 2002 Aquatic Resources Conservation Award for this study. We have provided this database to TDEC. It offers a starting point for prioritizing efforts to reduce sedimentation problems as part of a comprehensive approach across the watershed to reduce sediment.

4. BMPs for the NPDES permit for MS4 stormwater permits:

There are various entities in the watershed that will need to have stormwater management programs in place to meet their MS4 NPDES permit. They include Rutherford and Williamson Counties, and the cities of Brentwood, Franklin, and Dickson. Metropolitan Nashville was a Phase I permittee so the rapidly suburbanizing area of Bellevue is included under their jurisdiction. Managing stormwater is going to be a critical factor in the overall hydrological dynamics of the Harpeth. Stormwater control and retrofits that slow down storm flows, even manage them so that inputs to receiving waters mimic pre-development conditions will address the major issue of streambank erosion. Thus, an important step is for the various MS4 permittees to convene, as they have done once recently, under the umbrella of the TN Sediment Working Group to develop BMPs that would be required and those suggested for 303d streams. BMPs would include buffer areas, infiltration techniques, and impoundments that are designed with flow needs in mind. Then a standard can be devised on flow rates for stormwater systems for 303d streams for the TMDL.

5. Brief comments on the Sediment Tool and the CRC/HRWA sediment study data:

As EPA staff and Brian Watson of TetraTech have explained, the sediment tool they have developed to form the basis of a sediment TMDL is a reasonable approach to take as a starting point when there is not on-the-ground data or manpower to get it. The first cut with the sediment tool, however, is very preliminary. One of our concerns is that the initial data by subwatershed of annual sediment loads does not differ much between subwatersheds with 303d streams and those without. Statistical comparisons using both the t-test and Wilcoxon test of the estimated sediment loads between the two groups of subwatersheds indicate that the differences are not statistically significant at the 90 percent confidence limit. The figures for the later group were not included in this version of the TMDL.

But, we have the opportunity in the Harpeth to work with EPA and Tetratech on the sediment tool and to use our on-the-ground data from the sediment study to calibrate the model. In addition, we can work with EPA on the effort to add subroutines to incorporate the effect of impervious surfaces, to provide sediment loading curves, to provide data for instream loadings, and adjust the model so that it is a more useful tool for the Working Group and its members to assess the effectiveness of BMPs and other measures to reduce sediment loading to meet TMDL standards. Thus, the Harpeth offers all of us the opportunity to expand on efforts in a coordinated fashion to improve approaches to implement and assess practices and policies designed to reduce sedimentation. As a result, the future sediment TMDLs for other streams in similar geographic regions would be more refined.

The HRWA has already proposed to the Non-point Source Program to conduct work to implement BMPs based on our Visual Stream Assessment work, devise a study of streambank erosion, and gather site-specific benthic data so that we can assess specific efforts to address water quality improvements directly tied to aquatic health. This is very valuable information to integrate into the TMDL implementation plan. We hope to expand on this further to include addressing the water quality improvements from stormwater design and land use planning with 2003 funds from the Non-Point Source Program.

6. A suggested time line and activities for the TMDL:

We offer the set of activities below and time lines as a preliminary proposal for discussion by all interested parties. Most of these would belong in an implementation plan, but several would be incorporated into a revised version of the TMDL before the May deadline.

ACTIVITY	ENTITIES INVOLVED	DATE COMPLETE
I. TMDL modifications		
Establish a TN Sediment Working Group (Harpeth and Stones specific?)	TDEC, EPA, NRCS, NPS, USGS, HRWA, MS4 permittees, reps. From agriculture, development, etc.	Immediately. As part of TMDL implementation
Modify sediment Tool: Preliminary standard set using GA TAG as starting point and working with CRC/HRWA sediment study data	EPA, Tetratech, TDEC, HRWA experts, etc.	End of 2002
Develop data gathering needs and coordinate with EPA committees mentioned in Appendix C	EPA, Tetratech, TDEC, NPS, NRCS, HRWA, etc.	Fall 2002
Update MRLC with 2000 data from Cumberland Region Tomorrow	Tetratech	Summer 2002
Add subroutines on imperviousness, in-stream flows, etc to sediment tool	Working Group coordinate	End 2002? EPA and Tetratech know and lead
Determine in-stream standards from data from reference streams	EPA, TetraTech, USGS (gages), HRWA, etc.	End 2003
Provide a implementation assessment model from the sediment tool to local stakeholders	Working Group coordinate	End 2003
Determine required BMPs for construction sites on 303d streams and institute	Working Group	Fall 2002
Determine BMPs, including flow	Working Group	Spring 2003

rates off site for MS4 permittees		
MS4 permittees submit MS4 plans	Williamson and Rutherford Counties, Cities of Dickson, Brentwood, Franklin, others?	March 2003
Review and requires specific approaches for road stormwater control and crossings for ARAP permits	TDEC, HRWA, experts, others?	Fall 2002
Require individual NPDES permits for construction stormwater on 303d streams	TDEC	Immediately as part of TMDL revision
II. Monitoring		
Devise monitoring plan for in-stream standard	TDEC, EPA, USGS (gages), HRWA, working group	End of 2002
III. Prioritize focus areas for non-point sources		
Work off HRWA visual stream assessment to start—agr, old stormwater, residential, etc.	Working Group or subset	End of 2002
Initiate pilot BMPs and assess with pre-/post-implementation benthic data	HRWA (lead) with NRCS, NPS, Ag. Extension, etc.	Begin Spring 2002
Integrating sediment reduction strategies and plans into TDEC Harpeth Watershed Plan	TDEC	2003
IV. Education and Outreach		
Coordinate public materials with MS4 requirements: use existing, make new ones, etc.	All MS4 permittees, HRWA, etc.	2003

Let us know how you would like to proceed with establishing a working group and gathering responses to this list of activities above. Thank you for your thoughtful review of these comments.

Sincerely,

Dorene Bolze
Executive Director
615-591-9095
Dorie@DorieBolze.com

Cc: Paul Davis
Environmental Protection Agency—
Beverly Banister
Bill Melville
Tom Welborn
Bill Cox
Jim Greenfield
Stephanie Fulton
HRWA science and policy committee
Alice Keyes—GA Conservancy
Don Green-- City of Franklin, Stormwater Coordinator
Robert Karesh—Williamson County Stormwater Coordinator
Scott Potter—Metro Water Services for Davidson County
Michael Hunt—Metro Public Works NPDES Program for Davidson County
Alton Brown—Dickson city administrator
Mike Walker—Brentwood city Manager
NRCS district conservationists

Comments from Williamson County

From: "Floyd Heflin" <FloydH@williamson-tn.org>
To: <Bruce.Evans@state.tn.us>
Date: 4/22/02 2:44PM
Subject: Draft Sediment TMDL

Mr. Evans:

Williamson County supports the reduction of sediment load in an effort to reduce adverse environmental impacts. Concerning the TMDL methodology we offer only the following general comment:

We believe that this draft is a good first step in understanding how a final TMDL could be calculated. However, some of the generalizations used will hopefully be more accurately revised "As the science and available data for wet weather discharges of sediment continues to grow...". Furthermore, efforts will hopefully be made to equitably distribute the burden of implementing BMPs. If permitted point sources are grandfathered, and non-point LAs difficult to regulate, one could imagine a large portion of enforcement falling upon the Phase II MS4s.

Thank you for your efforts.

Floyd Heflin
Williamson County Engineer
1320 West Main Street, Suite 400
Franklin, TN 37064

CC: <RobertK.aoc-po.wcg-mail@williamson-tn.org>

APPENDIX H

Response to Public Comments

A. Response to SELC Comments (March 13, 2002)

1. No. 1, paragraph 1

Comment:
The commenter asks for information as to how the biological assessments used to identify the "least impacted" streams (ecoregion reference sites) also demonstrated the health of those streams, that they were in acceptable biological condition themselves.

Response:
Information regarding the Tennessee Ecoregion Project, selection of reference sites, and reference site monitoring, including biometric and index scores of the reference sites used in the Harpeth River watershed sediment TMDL, have been added as Appendix D. More detailed information about the Tennessee Ecoregion Project may be found in *Tennessee Ecoregion Project 1994–1999* (TDEC, 2000). An explicit reference to this document was added in Section 4.0 of the TMDL.

2. No. 1, paragraph 2, first three sentences

Comment:
The commenter asks for an explanation of the basis for the identification of streams as impaired for siltation and habitat alteration in the 1998 303(d) list and the 2000 assessment.

Response:
In 1997, TDEC's Nashville Field Office developed a comprehensive monitoring plan to implement Tennessee's Watershed Initiative. A Rapid Bioassessment Protocol (Plafkin, et al, 1989), using a quick screening technique, was conducted at approximately 100 sites in the Harpeth River watershed. The purpose of this monitoring strategy was to assess water quality conditions and locate pollution sources. Biological surveys were performed using a Rapid Bioassessment (RBP1) screening procedure that included a cursory benthic macroinvertebrate overview, a habitat assessment, and a measure of general field parameters (conductivity, dissolved oxygen, temperature, pH). This RBP1 methodology allowed field office staff to evaluate many sites in a relatively short period of time. The information collected was used to complete a waterbody assessment sheet for each site which included a map illustrating the stream site location.

The methodology used to assess the water quality and habitat quality of a waterbody, and ultimately its ability to support designated uses, has evolved since 1989. A watershed assessment now includes site characterization and waterbody assessment. Site characterization involves field observation of the land use patterns and cursory site habitat characterization with photographic documentation. Some of the parameters examined include siltation, riparian vegetation status, channel alterations, and streamside activities such as the presence of livestock or fertilizer application. Visual water quality impacts, such as metal staining of rocks or algal mats enriched by nutrients, are also recorded on an assessment sheet. Waterbody assessment involves cursory examination of instream biota using benthic macroinvertebrates. The benthic collection methodology is identical to the current BioRecon method (Barbour, et. al, 1997), but less time is spent preserving and recording every individual taxon observed. The community as a whole is examined and compared to reference sites and other sites in adjacent watersheds. Some field water

quality parameters may also be recorded, such as pH and dissolved oxygen content. Typically, a full BioRecon was performed near the mouth of a waterbody, whereas quick screening techniques were used along minor tributaries and in upper portions of the watershed for comparison of benthic communities and support status of designated uses.

For the 2000 assessment, two new EPA developed computer software tools (Assessment Database & the GIS based Reach Indexing Tool) and a different assessment philosophy have led to improved assessment methodologies. A detailed discussion of the water quality assessment process and source data used in 2000 may be found in *The Status of Water Quality in Tennessee, Year 2000 305(b) Report* (TDEC, 2000a).

3. **No. 1, paragraph 2, last four sentences**

Comment:
The commenter stated it would be useful to the public if it were explained how the existing sediment loads in subwatersheds without 303(d) listed waters (Table 6) were calculated to uniformly exceed the target condition and were, in fact, fairly close to the sediment loads calculated for the impaired waters (Table 5). Perhaps they (Table 6) should have been listed as well. Again, it appears as if the TMDL is treating those additional sub-watersheds as impaired, but that is not clear.

Response:
The subwatersheds that were not listed (Table 6 referred to was in a preliminary version and has been deleted) may not have sufficient biological or habitat data collected to make an impairment decision. Since waterbodies in these subwatersheds were not identified as impaired due to sediment on either the 1998 303(d) List or the 2000 assessment, the TMDL does not address these waterbodies. However, the information developed for these watersheds will be used to target future monitoring efforts.

4. **No. 1, paragraph 3, first sentence**

Comment:
The commenter states that it was also unclear whether any sampling was conducted to verify sediment delivery calculations and estimates made in support of this TMDL.

Response:
No sampling was conducted to verify sediment delivery calculations and estimates for this TMDL.

5. **No. 1, paragraph 3, last three sentences**

Comment:
The commenter indicates that the nonpoint source information in Table 8 (in a preliminary proposed version of the TMDL) was presented in tons/year rather than tons/acre/year.

Response:
TDEC acknowledges that sediment delivery from construction and urban storm water runoff may be an important contributor to sediment impairments in the Harpeth River watershed. However, the information concerning nonpoint source contributions to sediment loading was

derived from national data and was included as Table 8 in a preliminary version of the TMDL document (a version distributed prior to the January 16, 2002 public meeting) to illustrate the magnitude of nonpoint source sediment loading. The national data from were expressed in tons/year. It was not intended to represent sediment loading for specific land uses in the Harpeth River watershed. This table was deleted from the document prior to placement on Public Notice on March 18, 2002.

6. **No. 1, paragraph 4**

Comment:
The commenter indicates that the magnitude of reductions in sediment loading required by the TMDL should be acknowledged so that the public will recognize the seriousness of the problem and that drastic measures will be needed to restore water quality.

Response:
As stated in Section 3.0 of the TMDL document (cited from *The Status of Water Quality in Tennessee, Year 2000 305(b) Report [TDEC, 2000a])*, siltation has long been recognized as a major water quality problem in Tennessee. The load reductions specified in Table 9 emphasize the magnitude of this problem. TDEC agrees that education of the public on this issue by governmental agencies, local stakeholder groups, and environmental organizations is a necessary prerequisite to effective sediment load reduction measures.

The Tennessee Watershed Management Approach includes provisions for several public meetings during the five-year watershed cycle. These meetings provide an opportunity to inform stakeholders about watershed issues, such as sediment, and to receive feedback from the public. In the Harpeth River watershed, the following watershed meetings have been held:

Meeting	Date	Attendance
Year 1 Public Meeting	8/19/96	48
Year 3 Public Meeting	5/20/98	40
Meeting Held at Citizens' Request	10/13/98	60

Year 3 public meetings for the second five-year cycle are scheduled for the second quarter in 2003.

Additional public meetings were conducted by the Cumberland River Compact and Greater Nashville Regional Council through an EPA 604(b) Planning Grant administered by the Tennessee Department of Environment and Conservation. The goal of the grant was to "build a local forum in the Harpeth River Watershed in which a diverse group of citizenry could meet and discuss the issues and challenges of the watershed…" Meetings held in 1999 included:

Date	Attendance
5/11/99	47
6/15/99	22
7/22/99	35
8/31/99	35
9/28/99	20
10/26/99	25

7. **No. 2, paragraphs 1, 2 (last two sentences), and 3 (first two paragraphs)**

Comment:
The commenter states that the draft TMDL does not provide waste load allocations (WLAs) to all point sources, especially construction sites that fall under the NPDES Construction Storm Water General Permit.

Response:
The TMDL report proposed on March 18, 2002, has adopted changes that address this comment. The TMDL report includes WLAs for annual average discharges from regulated construction activities. The TMDL has established sediment load targets in pounds/acre/year for each subwatershed which are based upon the estimated loadings from a biologically healthy watershed located in the same ecoregion as the impaired segment. The TMDL also identifies a percent reduction in sediment needed for each subwatershed to attain the target levels. As stated in Section 8.1.2, the TMDL will be implemented through Tennessee General Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activity* (see Appendix E). This permit requires the development of a Storm Water Pollution Prevention Plan (SWPPP) to eliminate or minimize the discharge of pollutants from regulated construction sites through best management practices (BMPs). It is considered that strict compliance with the provisions of this general permit will reasonably be expected to achieve reduced sediment loading to streams. EPA considers the following documents and websites to be useful sources for the development of effective BMPs:

- *Preliminary Data Summary of Urban Storm Water Best Management Practices*, EPA-821-R-99-012, August 1999.

- National Stormwater Best Management Practices (BMP) Database, www.bmpdatabase.org, American Society of Civil Engineers, Urban Water Resources Research Council, updated April 2002 and later updated versions.

- National Menu of Best Management Practices for Storm Water Phase II, www.epa.gov/npdes/menuofbmps/menu.htm EPA Office of Wastewater Management, updated January 2002.

- *Draft Data Summary for the Construction and Development Industry*, EPA-821-R-01-022, February 2001.

- *The Practice of Watershed Protection*, Thomas R. Schueler and Heather K. Holland, 2000.

- A *Current Assessment of Urban Best Management Practices - Techniques for Reducing Non-Point Source Pollution in the Coastal Zone*, Metropolitan Washington Council of Governments, March 1992.

- *Urban Runoff Pollution Prevention and Control Planning*, EPA/625/R-93/004, September 1993.

- *Storm Water Management for Construction Activities - Developing Pollution Prevention Plans and Best Management Practices*, EPA 832-R-92-005, September 1992.

8. <u>No. 2, paragraph 3</u>

Comment:
The commenter states that regulated construction activities should be treated like any other point source discharge.

Response:
40 CFR §122.44(k) authorizes the NPDES permitting authority to write permits based upon BMPs when numerical limits are infeasible or when the practices are reasonably necessary to achieve effluent limitations and standards or to carry out the purpose and intent of the CWA. Therefore, it is appropriate to address regulated construction activities in the TMDL as a storm water WLA to be implemented through the application of BMPs that are reasonably expected to attain the TMDL target.

Requiring numeric permit limits is considered infeasible for this class of activities because of technical and economic considerations. For many construction sites, it would be technically infeasible to construct runoff flow collection devices that can be calibrated for flow measurement for all discharge points on the construction site. Since most BMPs encourage sheet runoff flow regimes to minimize erosion potential, it would be counterproductive to focus runoff to flow through discrete channels. Even if one could configure the construction site to quantify the storm water runoff volume, the sampling techniques required to calculate flow-weighted averages necessary to quantify the event load per storm event are expensive and would not be economically feasible for most construction site owners/operators.

In addition to the technical and economic impediments, there are currently no Federal or State protocols for establishing numeric limits for such facilities. Since the sediment load discharged from the site will be governed by the duration, magnitude, the intensity of the storm events, as well as the antecedent conditions, it is infeasible, at this point in time, to assign allowable loadings per storm event that could be translated into enforceable permit limits. Additional technical analysis is needed to consider how to aggregate the loads from multiple storm events to develop time averaged permit limits. These limits will need to take into consideration extreme force majeur events as well as climatological impacts such as an unusual rainy period and how such rainfall patterns impact the long-term health of the water body. TDEC and EPA are considering how best to attain the information needed for the technical analysis and protocol development for addressing construction activities through numeric permit limits.

9. <u>No. 2, paragraph 2, first sentence</u>

Comment:
The commenter states that the Harpeth sediment TMDL should include a listing of all individual construction sites that fall under NPDES No. TNR10-0000.

Response:
Section 6.1.2 of the TMDL has been revised to include a summary of permitted construction sites in the Harpeth River watershed, including the number of active sites and the total number of acres disturbed. In addition, a map has been added (new Figure 5) to show the location of these sites in the watershed. It should be noted that the construction site data presented is a "snapshot" as of May 2, 2002. Specific information regarding active sites in the watershed at a specific time may be obtained from the Nashville Environmental Assistance Center (EAC).

10. <u>No. 3, paragraph 1</u>

Comment:
The commenter states that the draft TMDL describing the loading capacity in terms of annual loading or in “tons per acre per year” is inadequate because it does not define the greatest amount of daily loading a waterbody can receive without violating the Tennessee water quality standard.

Response:
40 CFR §130.2 allows TMDLs to be expressed in appropriate measures other than daily load. In this case, expressing the TMDL as an average annual load is considered to be appropriate. Impairment of biological integrity due to sediment build-up is generally a long-term process which includes effects from many storm events, and, therefore, the maximum daily load from a single storm event is not considered particularly meaningful. For this reason, the TMDL has been expressed as an average yearly load.

11. <u>No 3, paragraph 2, first 2 sentences</u>

Comment:
The commenter states that "The annual load…will not assure compliance with the applicable water quality standard…Tennessee water quality standards are not based on annual loads or even seasonal loadings."

Response:
The State does not have a numeric water quality standard for sediment. The 303(d) listings are based on biological assessments, therefore, the TMDL did not have a numeric instream standard to serve as the target. For the purpose of this TMDL, the average annual sediment loading from a biologically healthy watershed located within the same Level IV ecoregion as the impaired watershed has been determined to be the appropriate numeric interpretation of the narrative water quality standard for protection of fish and aquatic life. This annual load is protective of Tennessee's narrative water quality criteria for fish and aquatic life.

12. <u>No 3, paragraph 2, last 2 sentences</u>

Comment:
The commenter states that a daily maximum limit is needed to protect designated uses, particularly for acute effects.

Response:
This sediment TMDL is designed to address the narrative criteria to protect aquatic life from excess siltation and habitat alteration. Siltation impacts on the biological community typically occur where there is exposure to many storm water events which produce excess sediment. A severe thunderstorm which causes a flash flood might fall under the force majeur provisions of the NPDES regulations. Such severe storm events may scour and disrupt the river system but natural processes enable the system to recover. The impairment results from the systematic exposure to excess sediment loading which physically alter the natural system to the point that it cannot fully restore. The average annual load, which measures the result of all of the storm events occurring in a year, protects the designated uses.

See Response to Comments, A.8.

13. <u>No 3, paragraph 3</u>

Comment:
The commenter states that the annual load could not be logically applied to construction sites. It is critical that the public understand how discharges fit with the TMDL. The TMDL should preferably be expressed as a concentration in the runoff.

Response:
The data and information currently available are not sufficient to identify a concentration limit for these sources. Using the available methodology and data/information, an annual load in pounds of sediment per acre per year is the appropriate current approach for the TMDL. An approach for developing stream specific numeric targets for sediments has been developed by a Sediment TMDL Technical Advisory Group in Georgia in a "white paper" entitled *A Protocol for Establishing Sediment TMDLs* (TGC/IOE, 2002). This methodology requires

detailed flow and sediment sampling of both the impaired stream and a reference stream. These data were not available for this TMDL. Also, EPA is developing and field-testing a methodology to evaluate instream impacts due to increased flow, eroding stream banks and stream bottom scour. In the future, as more data and information are collected, the methodology for sediment TMDLs will be modified to adopt improved procedures.

14. <u>No. 4, paragraph 1, first sentence</u>

Comment:
The commenter states that the draft TMDL fails to satisfy EPA's requirement of reasonable assurances that the nonpoint source reductions will actually be achieved.

Response:
This comment was written in response to a preliminary version of the TMDL report that included construction sources in the nonpoint source load allocation (LA). The TMDL report proposed on March 18 includes these activities under the waste load allocation (WLA). WLAs for regulated construction sites will be implemented through General Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activity* (see Appendix E). Assurance that the TMDL target is met will be through <u>compliance</u> with this permit. "Reasonable assurance" applies to the nonpoint (unregulated) sources of sediment to the watershed. Since nonpoint sources are exempt from discharge permit programs, load allocations cannot be implemented in the same way waste load allocations are implemented for point sources. As stated in Section 8.2 of the TMDL, load allocations will be implemented within the context of Tennessee's Watershed Management Approach (initiated in 1996) through partnerships among federal, state, and local government agencies and stakeholder groups. The *Harpeth River Watershed Management Plan* (TDEC, 2002) describes this activity. The committed involvement of local government and stakeholder groups is vital to the ultimate success of sediment loading reduction measures. As stated in Section 8.3 of the TMDL, the effectiveness of pollution reduction measures will be evaluated based on watershed monitoring and assessment activities, and implementation measures revised if necessary. This TMDL represents the first phase of a long-term restoration effort to eliminate sediment impairment of waterbodies in the Harpeth River watershed.

15. <u>No. 4, paragraph 1, remainder of paragraph</u>

Comment:
The commenter states that the TMDL should 1) spell out the monitoring and assessment measures intended to help identify necessary corrective measures, 2) include specific management measures, and 3) provide some indication of why these management measures are likely to succeed in restoring water quality.

Response:
The TMDL, as proposed, establishes percent load reduction targets for existing sources and a pounds/acre/year loading target for new sources. General Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activity* requires that construction sites develop a site specific SWPPP and implement BMPs to minimize the discharge of pollutants (see Appendix E). Monitoring of waterbodies will be conducted through the Watershed Management Approach to verify the performance of BMP

measures and document trends in the sediment loading. See Response to Comments, A.7. for references to source material for BMP development.

16. **No. 5**

Comment:
The commenter states that the draft TMDL should have an explicit Margin of Safety.

Response:
The federal regulations and guidelines provide TDEC and EPA discretion regarding the use of an explicit or implicit Margin of Safety (MOS). For this TMDL, an implicit MOS was selected due to the uncertainties involved with quantifying the sediment loading target equivalent to a water quality standard. Implicit MOS was provided by the choice of reference watersheds that were meeting more than the minimum acceptable degree of biological integrity necessary to be fully supporting of the fish & aquatic use classification. The sediment load targets derived from these reference watersheds are considered to be conservative.

B. Response to SELC Comments (April 22, 2002)

1. **No. 1, paragraph 1**

Comment:
The commenter states that the proposed TMDL does not contain numeric waste load allocations for the point sources subject to construction general NPDES permit.

Response:
The TMDL provides a numeric waste load allocation expressed as a load in pounds/acre/year (see Response to Comments, A.7.). This area-based loading is based on the sediment loading from a minimally-impacted, biologically-healthy subwatershed in the same ecoregion as the impaired subwatershed. Therefore, based on the analysis conducted, this WLA will attain the water quality standard. The commenter appears to be concerned that the TMDL is not providing numeric limits to be incorporated into individual permits for these activities. Please see Response to Comments, A.8.

2. **No. 1, paragraph 2**

Comment:
The commenter states that there is no demonstration that BMPs for construction storm water discharges will lead to compliance with the water quality standard for the Harpeth and that TDEC's implementation will fall short of restoring water quality. The commenter also states that all construction storm water permits should be denied or conditioned to prohibit additional discharges of sediment into the Harpeth River until numeric allocations for them are provided in an approved TMDL.

Response:
Numeric permit limits are currently infeasible (see Response to Comments, A.8.). As stated in Section 8.1.2,Implementation of the TMDL will be provided through General Permit No.

TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activity.* TDEC considers this permit to be detailed, comprehensive, and adequate as an implementation mechanism for the WLAs specified in the TMDL. It is further considered that strict compliance with the provisions of this permit can reasonably be expected to achieve reduced sediment loads to streams. Information regarding key provisions of this general permit have been added as Appendix E. The primary challenge for the reduction of sediment loading from construction sites to meet TMDL WLAs is in the effective compliance monitoring of all requirements specified in the *General NPDES Permit for Storm Water Discharges Associated With Construction Activity* and timely enforcement against construction sites not found to be in compliance with this permit. Please see Response to Comments, A.7. and Appendix E.

3. **No. 1, paragraph 3**

Comment:
The commenter states that a list of existing storm water construction activities covered by a storm water permit should be provided in the TMDL, and also identify construction activities reasonably expected in the future that will require a permit. The TMDL should then allocate a portion of the TMDL loading capacity to each individual permitted source.

Response:
Information regarding permitted construction sites (active on May 2, 2002) has been added to Section 6.1.2 and new Figure 5 (see Response to Comments, A.9.). TDEC has little ability to accurately anticipate future construction activities in the Harpeth. Since this TMDL provides an area-based WLA (pounds/acre/year), a projection of future growth is not necessary to the allocation of the loading capacity. Each new regulated construction storm water source is covered by the WLAs specified in Table 9.

4. **No. 2, paragraph 1**

Comment:
The commenter states that the proposed TMDL does not contain any total maximum daily loads.

Response:
See the Response to Comments, A.10., A.11., & A.12.

5. **No. 2, paragraph 2**

Comment:
The commenter states that the TMDL is based on generic assumptions and that some comparison of the generic assumptions should be made to actual sediment load delivery from the Harpeth River.

Response:
The TMDL, as proposed, is based upon a relative comparison between an impaired watershed and a biologically healthy watershed. It is considered that this approach, given the watershed used for the relative comparison, provides a conservative estimate regarding the sediment load reductions necessary to achieve a healthy aquatic community. A

quantitative analysis of the actual sediment loads to the Harpeth would be beneficial in fine-tuning outputs of the analytical approach used to calculate existing sediment loading. Currently these data are not available. EPA is developing an enhanced sediment TMDL protocol to address bank sloughing as well as overland runoff which will be based on site-specific instream sediment and related data. This approach may be used if the TMDL is revised.

6. **No. 2, paragraph 3**

Comment:
The commenter states that "EPA has set daily limits for sediments in other TMDLs…", implying that daily limits should be established for this TMDL.

Response:
EPA has established TMDLs in the past with daily limits for sediment. This was done in response to a request by plaintiff groups in the Georgia TMDL lawsuit to provide such daily limits. TDEC does not agree that this is an appropriate way to express sediment TMDLs, and EPA concurs with this position. The Georgia Sediment TMDL "white paper" (TGC/IOE, 2002) recognizes that sediment TMDLs should be expressed as annual loads. The "white paper" recommends that TMDLs also be expressed as a daily load based on the average annual flow. This daily load could be easily calculated from the annual average load but is a meaningless calculation that is an inappropriate way to express sediment TMDLs. The sediment load during an annual average load period will vary extensively depending on whether the sediment load is measured during a rainfall event or during steady state conditions. EPA has recommended changes to the "white paper" to clarify this issue.

See also Response to Comments, A.10., A.11., & A.12.

C. Responses to Camp, Dresser & McKee Comments (April 22, 2002)

1. **Basis for 303(d) Listing, paragraph 1**

Comment:
The commenter states that the basis for listing should be provided since it is not based on a numeric water quality standard but a narrative water quality standard.

Response:
See Response to Comments, A.2.

2. **Basis for 303(d) Listing, paragraph 2**

Comment:
The commenter states that the calculated sediment loads of the subwatersheds with 303(d) listed waterbodies and those of the subwatersheds without 303(d) listed waterbodies (Tables A4 and A7 respectively) do not appear to be statistically different and this makes the basis for the 303(d) listing significant.

Response:
See Response to Comments, A.3.

3. **Data Availability**

Comment:
The commenter states that the data used in the sediment modeling should have been included in the TMDL and that there are more recent data that should have been incorporated into the TMDL.

Response:
To include all the sediment modeling data and information in the TMDL would have made the TMDL unnecessarily long and difficult to understand. These data are available in the administrative record and are available for review.

TDEC established this TMDL based on the most current data and information readily available to it at the time that the TMDL was developed. TDEC agrees that the additional sampling and land use data referred to in this comment would be helpful in determination of the existing sediment loads and the impacts of instream sediment sources. TDEC will consider any data and information made available to it before the TMDL revisions are developed.

4. **Reference Watershed Methodology**

Comment:
The commenter suggests that while the use of a reference watershed is an acceptable method for TMDL analysis reference watersheds selected for this TMDL do not appear to be representative of watersheds in the TMDL study area.

Response:
Reference watersheds for this TMDL were based upon the Tennessee Ecoregion Project, 1994-1999 (TDEC, 2000). This project was undertaken as "…a tool to implement the requirements of the Tennessee Water Quality Control Act which requires the protection of state waters and their designated uses as defined by the Tennessee Water Quality Standards." A summary of the Tennessee Ecoregion Project has been added as Appendix D. More detailed information about the Tennessee Ecoregion Project may be found in *Tennessee Ecoregion Project 1994–1999* (TDEC, 2000).

The data collected at ecoregion reference sites are "…representative of background conditions…from "least disturbed and minimally impacted reference streams…" from each level IV ecoregion (TDEC, 2000). Ecoregions are defined as having similar "…geology, physiography, vegetation, climate, soils, land use, wildlife, and biology." Therefore, while the reference sites may not have been located within the Harpeth River watershed, they are located in the three Level IV ecoregions that represent key Harpeth River watershed characteristics and processes such as geology, soils, topography, and climate.

Land uses can vary quite differently at different scales. The land uses in the small subwatersheds defined by ecoregion sites can, and do, vary greatly from those at the 8-digit watershed level (i.e., the Harpeth River watershed) and at the 12-digit subwatershed level

where the TMDL applies. Some of the subwatersheds in Table A-7 may better represent the spectrum of land uses in subwatersheds in the Harpeth River watershed while still maintaining biological integrity. However, the data to verify that these watersheds are biologically healthy may not exist at this time.

The ecoregion reference site data is the best available data at this time to develop a TMDL that will protect fish and aquatic life. The subwatersheds listed in Table A-7 may not have sufficient biological or habitat data collected to make an impairment decision. It would be premature to develop TMDLs based on sediment loadings and delivery to those watersheds. TDEC encourages the collection of additional data, including biocriteria, habitat assessments, TSS, turbidity, and other sediment related criteria in subwatersheds with a full spectrum of land uses. Further, this may allow TDEC to determine whether watersheds undergoing development and potentially receiving higher sediment loads than "minimally impacted" watersheds can maintain biological integrity. This would allow TDEC to document and substantiate a higher TMDL loading target that is still protective of the uses of the watershed in future TMDLs for sediment.

5. <u>Proposed Sediment TMDLs, paragraph 1</u>

Comment:
The commenter states that the Reference Watershed methodology might not be appropriate for determining the impairment threshold.

Response:
TDEC agrees that using ecoregion reference watersheds will not identify impairment thresholds. However, better data and information are not currently available to identify impairment thresholds. In lieu of that information, the use of ecoregion reference watersheds as the basis for this TMDL is considered protective of the uses of the waterbody and will attain the water quality standard. As more data and information become available in the future, this data will be considered for future revisions of the TMDL.

6. <u>Proposed Sediment TMDLs, paragraph 2:</u>

Comment:
The commenter states that the use of least impacted streams as a means to establish a margin of safety disregards key watershed characteristics and, in effect, makes the TMDL conservatively low with limited technical justification.

Response:
See Response to Comments, C.4. A TMDL is required to have a Margin of Safety (MOS). The use of a least-impacted (reference) watershed for the TMDL target is environmentally conservative and, therefore, inherently has an implicit MOS built into the analysis methodology. While the TMDL may be conservatively low, it is based on the best available data, and will assure attainment of the water quality standard. TDEC will consider any data that scientifically supports an increased loading that is still properly protective of the use of the waterbody.

7. <u>Proposed Sediment TMDLs, paragraph 3, first sentence:</u>

Comment:
The commenter stated that EPA guidelines state that the load allocation should be "reasonably achievable" and that concerns are raised about whether or not the TMDL is "reasonably achievable."

Response:
The commenter is referring to a draft rule regarding the TMDL program known as the Watershed Rule. Since the "reasonably achievable" language is contained within a draft rule, it is not applicable to this TMDL. This TMDL was written in accordance with currently applicable Federal regulations. Also, see Response to Comments, A.14.

8. <u>Proposed Sediment TMDLs, paragraph 3, remainder of paragraph:</u>

Comment:
The commenter states that since "healthy" subwatersheds within the Harpeth River Watershed (as indicated by Table A-7) are failing to meet the standard set by the proposed TMDL, this raises concerns about whether or not the TMDL is "reasonably achievable", or overly stringent to achieve water quality goals.

Response:
See Response to Comments, A.3 & C.6.

9. <u>Implementation Plan as It Affects NPDES Phase II Permits, paragraph 1</u>

Comment:
The commenter states that TDEC has not established numeric limits for MS4 NPDES permits. The commenter recommends that the "special requirements" or "appropriate permit conditions" (see Section 8.1.2) for future Phase II MS4 permits be further clarified. In addition, the commenter states that the application of BMPs that go beyond the typical minimum elements generally undertaken to comply with the current regulations should be defined and costs associated with these BMPs should be provided.

Response:
The existing General Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activity*, Part III.F lists several additional requirements for construction site discharges into waters listed on the 303(d) for siltation or identified as "high quality". It is anticipated that the Phase II MS4 permits will also contain additional requirements for discharges into these types of waters. TDEC considers it both reasonable and appropriate to require additional protection for identified impaired or high quality waters.

Phase II MS4 permits have not been issued and, therefore, runoff from these urban areas is addressed in the load allocation (LA) portion of the TMDL. The permitting strategy for these future NPDES MS4 permitted sources has not yet been fully defined, but it is anticipated that these permits will require the development and implementation of a Storm Water Management Plan (SWMP) that will reduce the discharge of pollutants to the "maximum extent practicable" and not cause or contribute to violations of State water quality standards.

The individual permittees will be responsible for identifying the specific BMPs to be applied to attain appropriate reduction in sediment loads. Therefore, it is not yet appropriate or possible for the TMDL to determine the costs associated with the implementation of these BMPs. Also, see the Response to Comments, A.7. regarding reference documents for BMP development.

10. <u>Implementation Plans as It Affects NPDES Phase II Permits, paragraph 2</u>

Comment:
The commenter states that the implementation of load allocations for nonpoint sources should also be clarified. Specifically, the voluntary incentive-based mechanisms and the general recommendations do not provide an explicit mechanism to establish the recommended directives or incentives.

Response:
See Response to Comments, A.14 & A.15.

D. Response to Harpeth River Watershed Association Comments (April 22, 2002)

1. <u>No. 1 Establish a Sedimentation Working Group for TN</u>

Comment:
The commenter recommends the establishment of a formal working group, similar to the Technical Advisory Group (TAG) in Georgia, to work on sediment issues in Tennessee.

Response:
TDEC is aware of the Georgia TAG and its "white paper" (*A Protocol for Establishing Sediment TMDLs*, February, 2002) on sediment TMDLs. TDEC is strongly committed to addressing this major water quality problem in the state, but the formation of a TAG is beyond the scope of this TMDL. TDEC welcomes recommendations and suggestions from stakeholder groups with respect to the implementation of sediment TMDLs.

2. <u>No. 2 The latest draft TMDL does not establish allocations for impaired streams yet, paragraph 1, first five sentences, and paragraph 2</u>

Comment:
The commenter states that the TMDL document in its current format cannot be implemented, i.e., the commenter's experts do not see how the average loads/acre can be used to develop enforceable standards required in the Clean Water Act. The commenter believes that the TMDL needs an instream criterion to measure and use for regulatory purposes.

Response:
TDEC agrees that an instream criterion may be helpful in assuring compliance with NPDES storm water permits, but the science does not exist at this time to establish an appropriate instream sediment criterion for protection of the aquatic life uses. The TMDL, as written, will be implemented through the NPDES permitting program and through the watershed

stakeholder process to encourage voluntary measures for reduction of sediment from the nonpoint sources. Monitoring of waterbodies will be conducted through the Watershed Management Approach to verify the performance of BMP measures and document trends in the sediment loading. For further discussion, please see the response to comments, A.8., A.11., A.14., & A.15.

3. **No. 2 The latest draft TMDL does not establish allocations for impaired streams yet, paragraph 6**

Comment:
The commenter states that an explicit margin of safety is needed. In addition, the commenter would like the TMDL to establish specific implementation processes and time lines.

Response:
The federal regulations and guidelines provide the State and EPA discretion regarding the use of an explicit or implicit Margin of Safety. For this TMDL, an implicit Margin of Safety was chosen because of the uncertainties involved with quantifying the sediment loading target equivalent to a water quality standard. Also, see Response to Comments, A.14, A.15., A.16., & C.6.

4. **No. 3 Recommendations for the TMDL: Focus on Specifying BMPs for Construction Sites, paragraphs 1, 3, and 4**

Comment:
The commenter states that the TMDL should expressly prescribe BMPs for construction sites, and require individual NPDES permits for construction sites adjacent to the 303(d) streams covered in the TMDL. A working group with industry representatives and other stakeholder group should be convened to develop these specific BMPs.

Response:
See Response to Comments, A.7., A.8., A.14., A.15., B.2., C.9., & Appendix E. TDEC has no immediate plan to convene a working group for the design specific BMP measures, but would consider any specific measures recommended by a stakeholder-initiated BMP working group or any other source.

5. **No. 4 BMPs for the NPDES permit for MS4 storm water permits**

Comment:
The commenter states that various entities in the watershed will need to have storm water management programs in place to meet their MS4 NPDES permits. The various MS4 permittees should convene, as they have done once recently, under the umbrella of the TN Sediment Working Group to develop BMPs that would be required and those suggested for 303(d) listed streams. BMPs would include buffer areas, infiltration techniques, and impoundments that are designed with flow needs in mind. Then a standard can be devised on flow rates for storm water systems for 303(d) listed streams for the TMDL.

Response:
See Response to Comments, C.9. & D.1. In situations where two or more regulated MS4s are subject to the WLAs in a TMDL, it is anticipated that the individual MS4 permits will include provisions requiring coordination of efforts to reduce pollutant loading. TDEC would welcome BMP recommendations for MS4s from a stakeholder-initiated sediment working group.

6. **No. 5 Brief Comments on the Sediment Tool and the CRC/HRWA Sediment Study Data, paragraphs 2 and 3**

Comment:
The commenter indicates a desire to work with EPA and TetraTech on the sediment tool and to use HRWA sediment study data to calibrate the Harpeth River watershed sediment model. The commenter could work with EPA on the effort to add subroutines to incorporate the effect of impervious surfaces, to provide sediment loading curves, to provide data for instream loadings, and adjust the model so that it is a more useful tool for the Working Group and its members to assess the effectiveness of BMPs and other measures to reduce sediment loading to meet TMDL standards.

Response:
Any data or information gathered by the HRWA would be considered by EPA with respect to modifying the existing sediment tool, or developing new sediment models, as applicable. Turbidity data collected by the HRWA could be useful for evaluating the effectiveness of implemented BMPs and prioritizing restoration efforts.

7. **No. 6 A Suggested Time Line and Activities for the TMDL**

Comment:
The commenter proposes a set of activities and a time-line for their completion as a preliminary proposal for discussion by interested parties. The commenter further indicates that "most of the proposed activities would belong in an implementation plan, but several would be incorporated into a revised version of the TMDL before the May deadline."

Response
TDEC believes that responsibility for specific activities and milestones must be agreed upon by all involved parties for the effort to be effective. The suggested activities and time-line could serve as an outline for action by stakeholders during the second phase of the TMDL.

E. Response to City of Franklin Comments (April 19, 2002)

1. Page 1, paragraph 2, first asterisked comment

Comment:
The commenter asks "How would ambient monitoring by MS4s compare to the 'relative' ecoregion target numbers in the TMDL for determining compliance with the MS4 permit?"

Response:
Currently, the State does not have instream numeric water quality criterion for sediment for protection of aquatic life. Therefore, the ambient monitoring discussed in the TMDL report refers to biological monitoring TDEC would conduct as part of the Watershed Management Approach monitoring program. TDEC will be considering in its future MS4 permitting process whether to require the MS4 permittee to conduct appropriate ambient monitoring. This monitoring could include requiring the MS4 to establish baseline biological conditions instream as well as baseline sediment loads discharged from selected catchment areas. This data could be compared with future data collected after the permittee installs BMPs required by the permit to be consistent with the TMDL. This data comparison could then be used to assess whether the BMPs are effective in restoring the water body.

2. Page 1, paragraph 3, 2nd asterisked comment

Comment:
The commenter states that the process to develop the TMDL seems to be flawed because sampling for sediment during storm events in the appropriate ecoregion was not conducted and not used to calibrate the model.

Response:
See the response to comments, A.10., A.11., A.12., B.6., & C.4

The TMDL was calculated using the Watershed Characterization Sediment Tool which is a loading model that calculates long-term erosion and sediment delivery to streams. It is not a water quality model, and, therefore, is not suitable for calibration to in-stream data. As stated in Appendix A, while "the USLE can be used to estimate long-term average annual soil loss, it cannot be applied to a specific year or a specific storm." Storm event sediment data would be useful to help characterize existing sediment loads to the river, as well as instream sediment sources, but is not necessary for this approach to the TMDL. Future methodologies for sediment TMDLs may rely more on these data than the current method.

3. Page 1, paragraph 4, 3rd asterisked comment

Comment:
The commenter states that using more recent land use data would be advantageous.

Response:
See the Response to Comments, C.3.

4. **Page 2, paragraph 1, 4th asterisked comment**

Comment:
The commenter asks "How will eroding channel banks and gully erosion be factored into the reduction of sediment required in future MS4 permits?"

Response:
Sufficient data and information were not available to factor instream sources of sediment into this TMDL. Flow alteration as a result of urbanization is one likely cause of eroding channel banks. TDEC and EPA are investigating a variety of tools for assessing the sediment loading to the stream from eroding channel banks. It may be possible to simulate in-stream sediment loads using other more complex, process-based models like GSTARS or CONCEPTS. These models require a more robust sediment and flow database in the individual watershed. EPA is examining and testing the use of these models for application in the next phase of the sediment TMDLs.

5. **Page 2, paragraph 2, 5th asterisked comment, first two sentences**

Comment:
The commenter asks "Why did the TMDL not utilize data collected as part of the effectiveness monitoring effort conducted by the Harpeth River Association?"

Response:
The methodology used to develop this TMDL was based on average annual conditions, and as such, storm event sediment monitoring data (such as that collected during the Harpeth River Association's effectiveness monitoring effort) were not utilized. See the Response to Comments, A.11., A.12., & C.4.

6. **Page 2, paragraph 6 (5th asterisked comment, last two sentences)**

Comment:
The commenter asks if "ground-truthing and source identification actions" will become the responsibility of the HRWA and CRC and what will happen if this volunteer effort does not reach desired levels?

Response:
WLAs will be implemented through NPDES permits (individual permits, construction storm water permits, MS4 permits). As stated in the Response to the Comments A.14. & A.15, LAs will be implemented within the context of Tennessee's Watershed Management Approach through partnerships among federal, state, and local government agencies and stakeholder groups (ref: *Harpeth River Watershed Management Plan* [TDEC, 2002]). The participation of the HRWA, CRC, and other stakeholder groups in "ground-truthing and source identification actions" is entirely appropriate, but not a TDEC mandated action. If watershed monitoring and assessment activities do not show improvement of waters in the Harpeth River watershed, with respect to sediment, the TMDL will be revised as necessary.

7. **Page 2, paragraph 7 (6th asterisked comment)**

Comment:
The commenter asks "If the MS4/NPDES permits are going to be monitored for success as to the amount of sediment in the streams according to the Harpeth River Watershed Association (HRWA) and Cumberland River Compact (CRC) sediment study, where is the approved protocol for this effort? Since much of their samples come from storm events, how can you compare these findings to the TMDL modeling numbers?"

Response:
There is no State plan for the HRWA and CRC to be the State's sole representative in monitoring the success of MS4 permits with regard to required sediment reductions. Therefore, there is no State-approved protocol for such an effort. The WLA for small municipal separate storm sewer systems (MS4s) will be implemented through Phase II MS4 permits. These permits will require the development and implementation of a Storm Water Management Plan (SWMP) to comprehensively manage the quality of storm water discharged through the MS4. The SWMP will include a number of programs/activities to identify sources of pollutants in municipal storm water runoff and verify SWMP effectiveness (see Response to Comments, C.9.). TDEC encourages citizens and stakeholders to provide information regarding non-compliance with NPDES permits. Existing and future data from HRWA/CRC efforts may provide insights into the location and identification of sources of sediment loading. Monitoring of waterbodies will be conducted through the Watershed Management Approach to verify the performance of BMP measures.

F. U.S. Department of the Interior, Fish & Wildlife Service Comments (February 13, 2002)

1. **Paragraph 3**

Comment:
The commenter states that effective enforcement of Tennessee's storm water and aquatic resource alteration permitting programs is vital in controlling erosion and habitat loss, especially in urban areas experiencing rapid development, such as Davidson, Rutherford, and Williamson Counties. The commenter expresses concern that a comprehensive review of these program areas, including current inspection and enforcement statistics, was not included in the TMDL narrative and raises questions regarding the eventual effectiveness of the TMDL implementation.

Response:
TDEC agrees that the storm water and Aquatic Resource Alteration Permit (ARAP) programs are important elements of effective reduction of sediment loading in the Harpeth River watershed. Both of these programs are well established in Tennessee. The Construction Storm Water Permit is described in Appendix E and Response to Comments, A.14. & B.2. The Phase II MS4 permit is discussed in Response to Comments, C.9, & D.5. Section 8.3, describing the ARAP program, has been added to the TMDL (the Evaluation of TMDL Effectiveness section has been renumbered as Section 8.4). TDEC has procedures in place for inspection and enforcement of permit programs.

G. Response to Williamson County Comments (email dated April 22, 2002)

1. **Comment:**
   The commenter states that "This draft is a good first step in understanding how a final TMDL could be calculated. However, some of the generalizations used will hopefully be more accurately revised 'As the science and available data for wet weather discharges of sediment continues to grow...'. Furthermore, efforts will hopefully be made to equitably distribute the burden of implementing BMPs. If permitted point sources are grandfathered, and nonpoint LAs difficult to regulate, one could imagine a large portion of enforcement falling upon the Phase II MS4s."

   Response:
   This comment has been noted.