Approved
June 2004

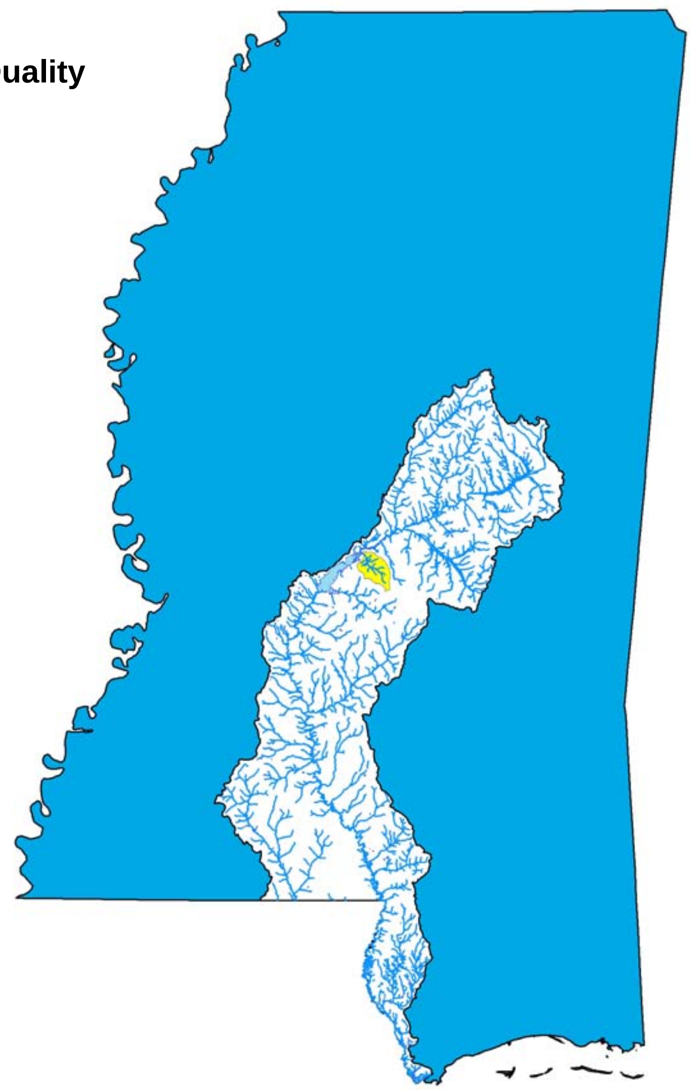
Total Maximum Daily Load

Fannegusha Creek Watershed

Including Red Cane Creek and Hurricane Creek
for

Biological Impairment Due to Sediment

Pearl River Basin



Prepared By

Mississippi Department of Environmental Quality
Office of Pollution Control
TMDL/WLA Branch

MDEQ
PO Box 10385
Jackson, MS 39289-0385
(601) 961-5171
www.deq.state.ms.us

FOREWORD

This report contains one or more Total Maximum Daily Loads (TMDLs) for water body segments found on Mississippi's 1996 Section 303(d) List of Impaired Waterbodies. Because of the accelerated schedule required by the consent decree, many of these TMDLs have been prepared out of sequence with the State's rotating basin approach. The implementation of the TMDLs contained herein will be prioritized within Mississippi's rotating basin approach.

The amount and quality of the data on which this report is based are limited. As additional information becomes available, the TMDLs may be updated. Such additional information may include water quality and quantity data, changes in pollutant loadings, or changes in landuse within the watershed. In some cases, additional water quality data may indicate that no impairment exists.

Conversion Factors

To convert from	To	Multiply by	To convert from	To	Multiply by
$mile^2$	acre	640	acre	ft^2	43560
km^2	acre	247.1	days	seconds	86400
m^3	ft^3	35.3	meters	feet	3.28
ft^3	gallons	7.48	ft^3	gallons	7.48
ft^3	liters	28.3	hectares	acres	2.47
cfs	gal/min	448.8	miles	meters	1609.3
cfs	MGD	0.646	tonnes	tons	1.1
m^3	gallons	264.2	µg/l * cfs	gm/day	2.45
m^3	liters	1000	µg/l * MGD	gm/day	3.79

Fraction	Prefix	Symbol	Multiple	Prefix	Symbol
10^{-1}	deci	d	10	deka	da
10^{-2}	centi	c	10^2	hecto	h
10^{-3}	milli	m	10^3	kilo	k
10^{-6}	micro	:	10^6	mega	M
10^{-9}	nano	n	10^9	giga	G
10^{-12}	pico	p	10^{12}	tera	T
10^{-15}	femto	f	10^{15}	peta	P
10^{-18}	atto	a	10^{18}	exa	E

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TMDL INFORMATION PAGE

Table i. Listing Information

Name	ID	County	HUC	Cause	Mon/Eval
Fannegusha Creek	MS151FE	Rankin Scott	03180002	Biological Impairment	Monitored
Near Branch: From headwaters to the Pearl River					
Red Cane Creek	MS151FM2	Rankin	03180002	Biological Impairment	Monitored
Near Leesburg: From headwaters north west of Leesburg to mouth at Fannegusha Creek					
Hurricane Creek	MS151FM1	Rankin Scott	03180002	Biological Impairment	Monitored
Near Leesburg: From headwaters north of Leesburg to mouth at Fannegusha Creek					

Table ii. Water Quality Standard

Parameter	Beneficial use	Narrative Water Quality Criteria
Sediment/ Siltation	Aquatic Life Support	Waters shall be free from materials attributable to municipal, industrial, agricultural, or other dischargers producing color, odor, taste, total suspended solids, or other conditions in such degree as to create a nuisance, render the waters injurious to public health, recreation, or to aquatic life and wildlife, or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated uses.

Table iii. Total Maximum Daily Load

Segment	WLA	LA	MOS	TMDL
MS151FE	6.9E-04 to 4.2E-03	6.9E-04 to 4.2E-03	implicit	6.9E-04 to 4.2E-03
MS151FM2	6.9E-04 to 4.2E-03	6.9E-04 to 4.2E-03	implicit	6.9E-04 to 4.2E-03
MS151FM1	6.9E-04 to 4.2E-03	6.9E-04 to 4.2E-03	implicit	6.9E-04 to 4.2E-03

*tons per acre per day at the effective discharge

EXECUTIVE SUMMARY

Fannegusha Creek (MS151FE), Red Cane Creek (MS151FM2), and Hurricane Creek (MS151FM1) are on the Mississippi 2002 Section 303(d) List of Water Bodies for biological impairment. These water bodies were all sampled during the winter of 2001. Benthic macroinvertebrate data collected from Fannegusha Creek and Red Cane Creek summarized as metrics were scored and combined into the regionally calibrated Mississippi Benthic Index of Stream Quality (M-BISQ). Based on the M-BISQ scores, Fannegusha Creek and Red Cane Creek were determined to be impaired. No benthic macroinvertebrate data could be collected from Hurricane Creek during the winter of 2001 due to numerous beaver dams within the creek which essentially made the creek a series of ponds. Therefore, no M-BISQ score could be determined. Screening level biology data for Hurricane Creek from earlier sampling events in 1993 indicated impairment and thus were the basis of its original listing on the 1996 303(d) List of Waterbodies.

A stressor identification study was completed for the Fannegusha Creek watershed. This analysis identified sediment as the most probable stressor of the water body. This TMDL is being completed for clean sediment. Certain contaminants may be associated with sediment such as pesticides and nutrients. These contaminants are not being addressed directly within this TMDL. However, these contaminants would also be controlled by the same best management practices (BMPs) that control the sediment coming from fields.

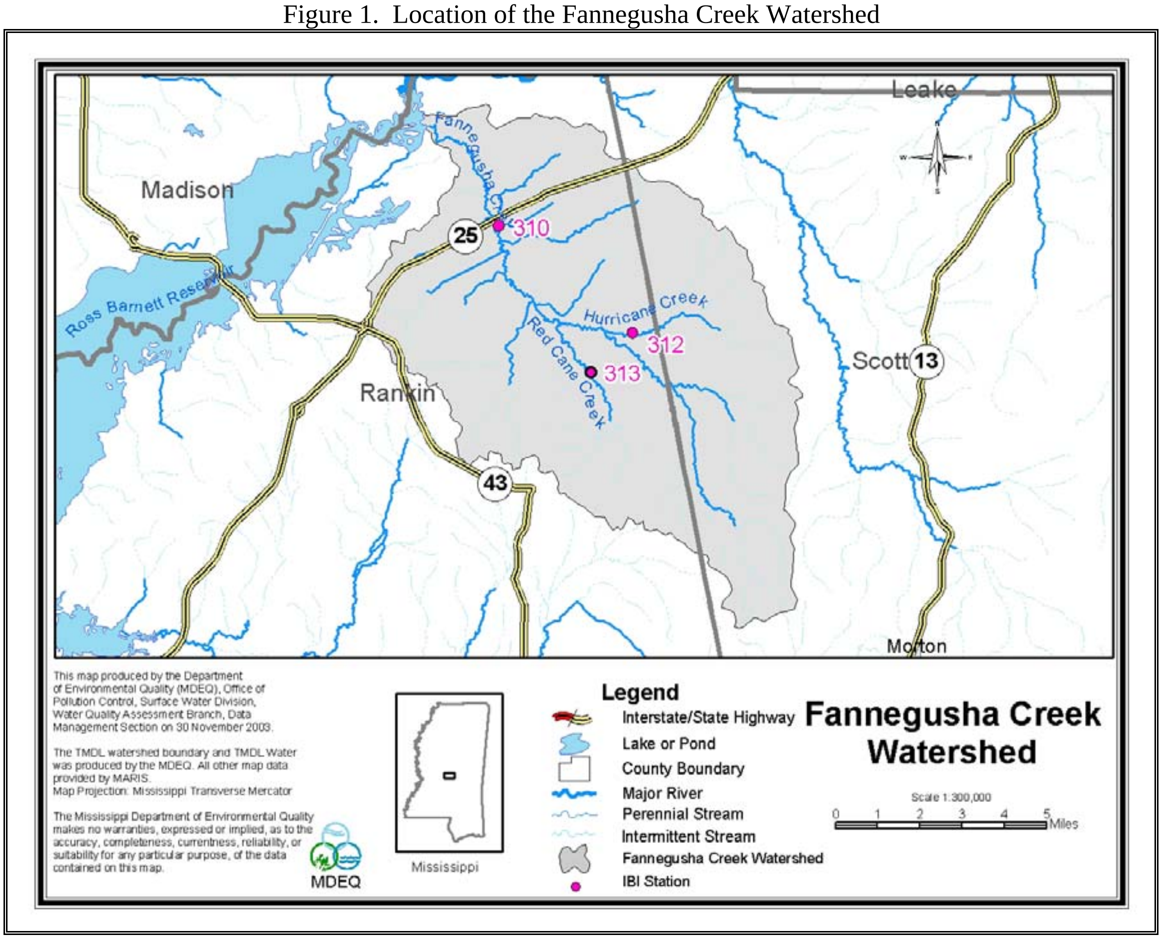
The State of Mississippi *Water Quality Criteria for Intrastate, Interstate and Coastal Waters* (2002) regulation does not include a numerical water quality standard for aquatic life protection due to sediment. The narrative standard for the protection of aquatic life is sufficient for justification of TMDL development, but does not provide a quantifiable TMDL target. The target for this TMDL was developed by the Channel and Watershed Processes Research Unit (CWPRU) at the National Sedimentation Laboratory (NSL). CWPRU was contracted by the Mississippi Department of Environmental Quality (MDEQ) and EPA Region 4 to develop reference sediment yields, or targets, for each ecoregion within Mississippi and Region 4. The reference load, or TMDL target, was derived from the empirical analysis of historical flow and sediment-transport data for stable streams in the appropriate ecoregion for the Fannegusha Creek watershed, the Southeastern Plains Ecoregion (65).

According to 40 CFR §130.2 (i), TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measure. This TMDL is expressed as the tons of sediment that can be discharged from an acre of a subwatershed during a day (tons/acre/day) at the effective discharge and still attain the applicable water quality standard. This results in a range of acceptable reference yields of 6.9E-04 to 4.2E-03 tons per acre per day at the effective discharge. The methods used to develop the acceptable yields are described in detail in the reports titled, *"Reference" and "Impacted" Rates of Suspended-Sediment Transport for Use in Developing Clean Sediment TMDLs: Mississippi and the Southeastern United States* (Simon, et al., 2002b) and *Actual and Reference Sediment Yields for the James Creek Watershed – Mississippi* (Simon, et al., 2002a).

It is expected that all values within this range will result in attainment of water quality standards. The TMDL is expressed at the effective discharge. The effective discharge is the channel forming flow or the flow that moves the most sediment. The effective discharge is obtained by combining flow frequency data with sediment transport relationships. This TMDL is not applicable on an annual basis, because the effective discharge only occurs statistically once every one and a half years, not on a daily basis. However, because the effective discharge is the critical condition, compliance with the TMDL at effective discharge will result in the attainment of the water quality standards at all times.

For many 303(d) listed streams in the Pearl River Basin, including Fannegusha Creek, Red Cane Creek, and Hurricane Creek, suspended sediment data were either not available or were insufficient to calibrate a water quality model for prediction of existing sediment loads within these water bodies. Therefore, this TMDL does not provide an existing load specific to each water body. However, a source assessment is included. In addition, the CWPRU estimated the typical range for unstable streams in this ecoregion is 1.4E-03 to 6.9E-02 tons per acre per day at the effective discharge. This range is representative of the load that would be expected from the Fannegusha Creek watershed. The unstable yield range is an order of magnitude larger than the target yield range, which indicates a reduction plan is necessary for the Fannegusha Creek watershed.

Figure 1. Location of the Fannegusha Creek Watershed



1.0 INTRODUCTION

1.1 Background

The identification of water bodies not meeting their designated use and the development of total maximum daily loads (TMDLs) for those water bodies are required by Section 303(d) of the Clean Water Act (CWA) and the Environmental Protection Agency's (EPA) Water Quality Planning and Management Regulations (40 CFR part 130). The TMDL process is designed to restore and maintain the quality of those impaired water bodies through the establishment of pollutant specific allowable loads. The pollutant of concern for this TMDL is sediment from landuse runoff and in-channel sediment processes.

The listed segments of Fannegusha Creek, Red Cane Creek, and Hurricane Creek are within United States Geological Survey (USGS) Hydrologic Unit Code (HUC) 03180002. The Fannegusha Creek watershed is located in Rankin and Scott Counties. The entire watershed is 47,289 acres and contains many landuse types including agricultural land, pastureland, and urban areas. However, the dominant landuses within the watershed are agriculture and forest. The landuse distribution of the Fannegusha Creek watershed is provided in Table 1 and shown in Figure 2 and Figure 4 in Section 3.2. The location of the 303(d) listed segments is shown below in Figure 3. Photos of Fannegusha Creek, Red Cane Creek, and Hurricane Creek are also provided.

Table 1. Fannegusha Creek Watershed Landuse Distribution

	Forest	Urban	Barren	Wetland	Agriculture	Other	Total
Area (acres)	16,854	178	137	8,389	21,700	32	47,290
Percentage	35.6%	0.4%	0.3%	17.7%	45.9%	0.1%	100%

Figure 2. Fannegusha Creek Watershed Landuse Distribution

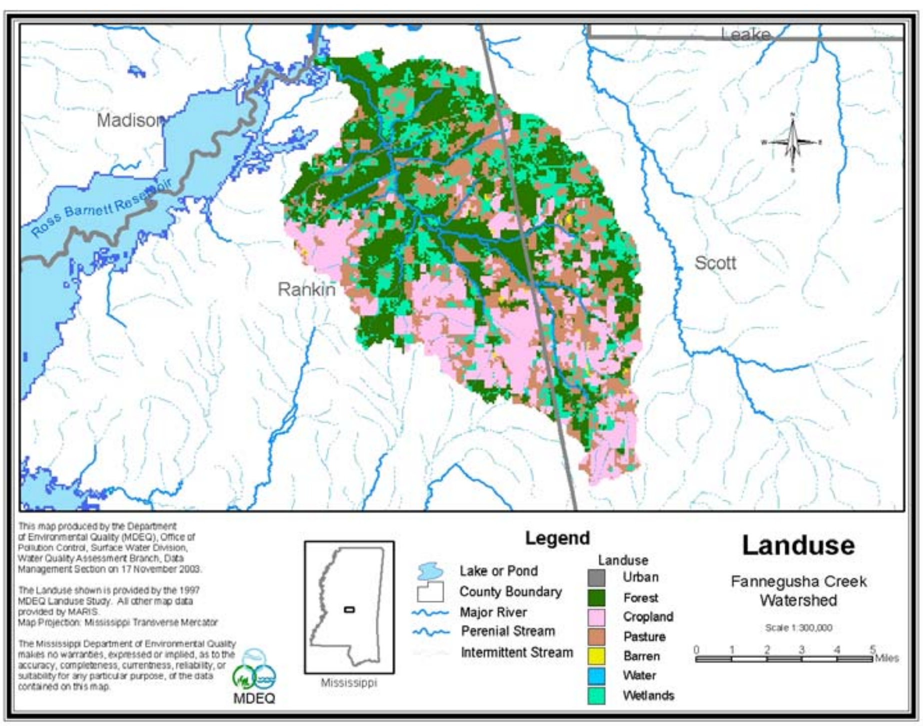


Figure 3. Fannegusha Creek Watershed 303(d) Listed Segments

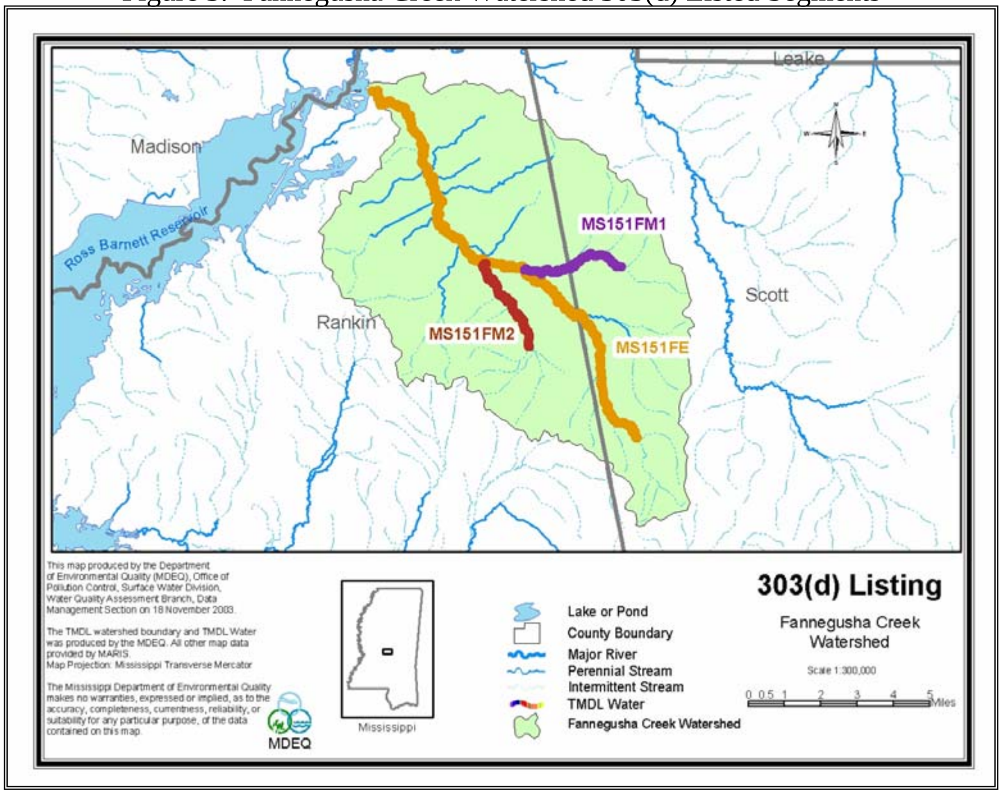


Photo 1. Fannegusha Creek

Photo 2. Hurricane Creek

Photo 3. Red Cane Creek

The Fannegusha Creek watershed is located within the Southeastern Plains Ecoregion (65). Fannegusha Creek, Red Cane Creek, and Hurricane Creek were all sampled as part of the Mississippi Benthic Index of Stream Quality (M-BISQ) during the winter of 2001. Fannegusha Creek and Red Cane Creek were sampled for benthic macroinvertebrates, physical habitat quality, and water quality. Hurricane Creek was sampled for habitat features and water quality, but not for benthic macroinvertebrates or substrate composition. These data were not collected from Hurricane Creek due to numerous beaver dams located within the creek which essentially made the stream a series of ponds.

The taxonomic data were summarized as metrics of the benthic assemblage that are responsive to the predominant stressors in the East Bioregion of Mississippi. The metrics were scored and combined into the regionally calibrated M-BISQ that describes the overall biological impairment. Physical habitat quality was assessed by scoring ten habitat parameters based on visual observations. The scores were combined into an overall habitat score and partial scores for instream, morphologic, and riparian habitat features. M-BISQ scores were determined for Fannegusha Creek and Red Cane Creek. The M-BISQ scores for Fannegusha Creek and Red Cane Creek were 27.41 and 33.20, respectively. The reference M-BISQ score for the East Bioregion is 61.35. Based on these scores, Fannegusha Creek and Red Cane Creek are both impaired.

Since no benthic macroinvertebrate data could be collected from Hurricane Creek during the winter of 2001, no M-BISQ score could be determined. Screening level biology data for Hurricane Creek from earlier sampling events in 1993 indicated potential impairment and thus were the basis of Hurricane Creek's original listing on the 1996 303(d) List of Waterbodies.

A stressor identification study was completed for the Fannegusha Creek watershed. This analysis identified sediment as the most probable stressor of the water body. This TMDL is being completed for clean sediment. Certain contaminants may be associated with sediment such as pesticides and nutrients. These contaminants are not being addressed directly within this TMDL. However, these contaminants would also be controlled by the same best management practices (BMPs) that control the sediment coming from fields.

1.2 Applicable Water Body Segment Use

The water use classification for Fannegusha Creek, Red Cane Creek, and Hurricane Creek, as established by the State of Mississippi in the *Water Quality Criteria for Intrastate, Interstate and Coastal Waters* regulation, is Fish and Wildlife Support. Waters with this classification are intended for fishing and propagation of fish, aquatic life, and wildlife. Waters that meet the Fish and Wildlife Support criteria should also be suitable for secondary contact, which is defined as incidental contact with water including wading and occasional swimming.

1.3 Applicable Water Body Segment Standard

The *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters* do not include a water quality standard applicable to aquatic life protection due to sediment (2002). However, a narrative standard for the protection of aquatic life was interpreted to determine an applicable target for this TMDL. The narrative standard is that waters shall be free from materials attributable to municipal, industrial, agricultural, or other dischargers producing color, odor, taste, total suspended solids, or other conditions in such degree as to create a nuisance, render the waters injurious to public health, recreation, or to aquatic life and wildlife, or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated uses.

2.0 TMDL ENDPOINT AND WATER QUALITY ASSESSMENT

2.1 Selection of a TMDL Endpoint and Critical Condition

One of the major components of a TMDL is the establishment of target endpoints, which are used to evaluate the attainment of acceptable water quality. Target endpoints, therefore, represent the water quality goals that are to be achieved by meeting the load and wasteload allocations specified in the TMDL. The endpoints allow for a comparison between observed conditions and conditions that are expected to restore designated uses.

This sediment TMDL is expressed as an acceptable range of sediment loadings at the effective discharge. The range was developed from data measured at stable streams in the same ecoregion. The target range for the Fannegusha Creek watershed is a sediment yield in the range from 6.9E-04 to 4.2E-03 tons of sediment per acre per day at the effective discharge. The discharge, which moves the most sediment or is the "channel forming flow", is known as the effective discharge. This discharge has been selected as the critical condition for this TMDL (Simon, et al., 2002b). If the sediment target applicable for sediment in Fannegusha Creek, Red Cane Creek, and Hurricane Creek is maintained during critical conditions, then the health of the streams should improve.

3.0 SOURCE ASSESSMENT and LOAD ESTIMATION

An important part of the TMDL analysis is the identification of individual sources, source categories, or source subcategories of sedimentation in the watershed and the amount of pollutant loading contributed by each of these sources. Under the CWA, 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 plants (WWTPs) and 2) NPDES regulated industrial activities (which include construction activities) and municipal storm water discharges (Municipal Separate Storm Sewer Systems [MS4s]). For the purposes of this TMDL, all sources of sediment loading not regulated by NPDES are considered nonpoint sources.

3.1 Assessment of Point Sources

The pollutant of concern for this TMDL is sediment from landuse runoff and in-channel processes. There are no municipal, industrial, or domestic facilities in the Fannegusha Creek watershed with the total suspended solids (TSS) component of a NPDES permit. The TSS component of a NPDES permitted facility is different from the pollutant addressed within this TMDL because the TSS component of the permitted 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.

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 and are included in the WLA of this TMDL. As of March 2003, discharge of storm water from construction activities disturbing between one and five acres must also be controlled by an NPDES permit. The purpose of these NPDES permits is to eliminate or minimize the discharge of pollutants (sediment) 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 varies. The target for these areas is the same range as the TMDL target of 6.9E-04 to 4.2E-03 tons per acre per day at the effective discharge. The WLAs provided to the NPDES regulated construction activities and MS4s will be implemented as BMPs as specified in Mississippi's General Stormwater Permits for Small Construction, Construction, and Phase I & II MS4 permits. Properly designed and well-maintained BMPs are expected to provide attainment of WLAs.

3.2 Assessment of Nonpoint Sources

Nonpoint loading of sediment in a water body results from the transport of the material into receiving waters by the processes of mass wasting, head cutting, gullying, and sheet and rill erosion. Sources of sediment include:

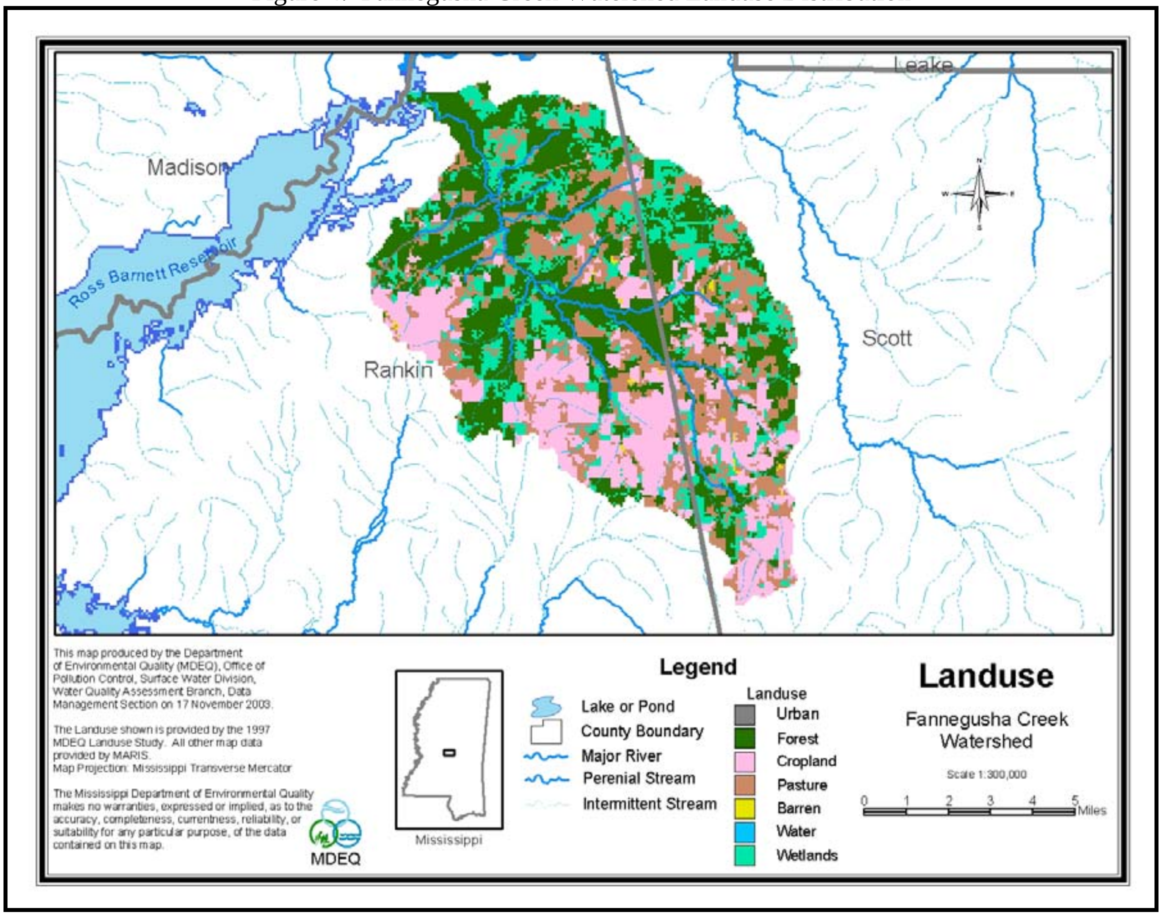
- Agriculture
- Silviculture
- Rangeland
- Construction sites
- Roads
- Urban areas
- Mass wasting areas
- Gullies
- Surface mining
- In-channel and in-stream sources
- Historical landuse activities and channel alterations

The 47,290 acre drainage area of the Fannegusha Creek watershed contains many different landuse types, including forest, cropland, pasture, barren, and wetlands as shown in Table 2 and Figure 4. The landuse information for the watershed is based on the State of Mississippi's Automated Resource Information System (MARIS), 1997. This data set is based on Landsat Thematic Mapper digital images taken between 1992 and 1993. The MARIS data are classified on a modified Anderson level one and two system with additional level two wetland classifications.

Table 2. Fannegusha Creek Watershed Landuse Distribution

	Forest	Urban	Barren	Wetland	Agriculture	Other	Total
Area (acres)	16,854	178	137	8,389	21,700	32	47,290
Percentage	35.6%	0.4%	0.3%	17.7%	45.9%	0.1%	100%

Figure 4. Fannegusha Creek Watershed Landuse Distribution



3.3 Load Estimation

Due to lack of data for calibration it was determined that a modeling exercise to quantify the load from each source and estimate the total existing load would be inappropriate. However, the range of loads for other unstable streams with sufficient data in this ecoregion is 1.4E-03 to 6.9E-02 tons per acre per day at the effective discharge. Similar sources are present in the unstable watersheds. Therefore the existing load for the Fannegusha Creek watershed is believed to be within this range.

4.0 DETERMINING THE TARGET SEDIMENT LOAD

The information and methodologies described in the following sections are based on research efforts conducted by the CWPRU of the National Sedimentation Laboratory in Oxford, Mississippi. The primary sources of the information presented in this section are:

- *Actual and Reference Sediment Yields for the James Creek Watershed – Mississippi* (Simon, et al., 2002a)

- *"Reference" and Impacted" Rates of Suspended-Sediment Transport for Use in Developing Clean Sediment TMDLs: Mississippi and the Southeastern United States* (Simon, et al., 2002b)

4.1 Selecting a Reference Condition (Simon, et al., 2002a)

> Sediment loads (transport rates) in streams vary by orders of magnitude over time and by location. Controls such as geology and channel-boundary materials, land use, channel stability, and the type and timing of precipitation events make prediction of sediment loads difficult and complex. Still, in order to determine the amount of sediment that impairs a given waterbody (TMDL), one must first be able to determine the sediment load that would be expected in an unimpaired stream of a given type and location. However, baseline conditions of flow, sediment concentrations, and transport rates for streams in the wide variety of physiographic provinces and under a wide variety of land uses are poorly understood.
>
> There is no reason to assume that "natural" or background rates of sediment transport will be consistent from one region to another. Within the context of clean sediment TMDLs, it follows that there is no reason to assume that "target" values should be consistent on a nationwide basis. Similarly, there is no reason to assume that channels within a given region will have consistent rates of sediment transport. For example, unstable channel systems or those draining disturbed watersheds will produce and transport more sediment than stable channel systems in the same region. This reflects differences in the magnitude and perhaps type of erosion processes that dominate a subwatershed or stream reach.
>
> To be useful for TMDL practitioners sediment-transport relations must be placed within a conceptual and analytic framework such that they can be used to address sediment-related problems at sites where no such data exist. To accomplish this, sediment-transport characteristics and relations need to be regionalized according to attributes of channels and drainage basins that are directly related to sediment production, transport, and potential impairment. In a general way, these attributes include among others, physiography, geology, climate and ecology, differentiated collectively as an ecoregion.

In order to identify those sediment-transport conditions that represent impacted or impaired conditions, it is essential to first be able to define a non-disturbed, stable, or "reference" condition for the particular stream reach. In some schemes the "reference" condition simply means "representative" of a given category of classified channel forms or morphologies and as such, may not be analogous with a "stable", "undisturbed", or "background" rate of sediment production and transport.

The Rosgen (1985) stream classification system is widely used to describe channel form. In this classification system, stream types D, F, and G are by definition, unstable (Rosgen, 1996). These stream reaches, therefore, would be expected to produce and transport enhanced amounts of sediment and represent "impacted", if not "impaired" conditions. Thus, although it may be possible to define a "representative" reach of stream types D, F, and G, for the purpose of TMDL development, a "reference" condition transporting "natural" or "background" rates of sediment will be difficult to find.

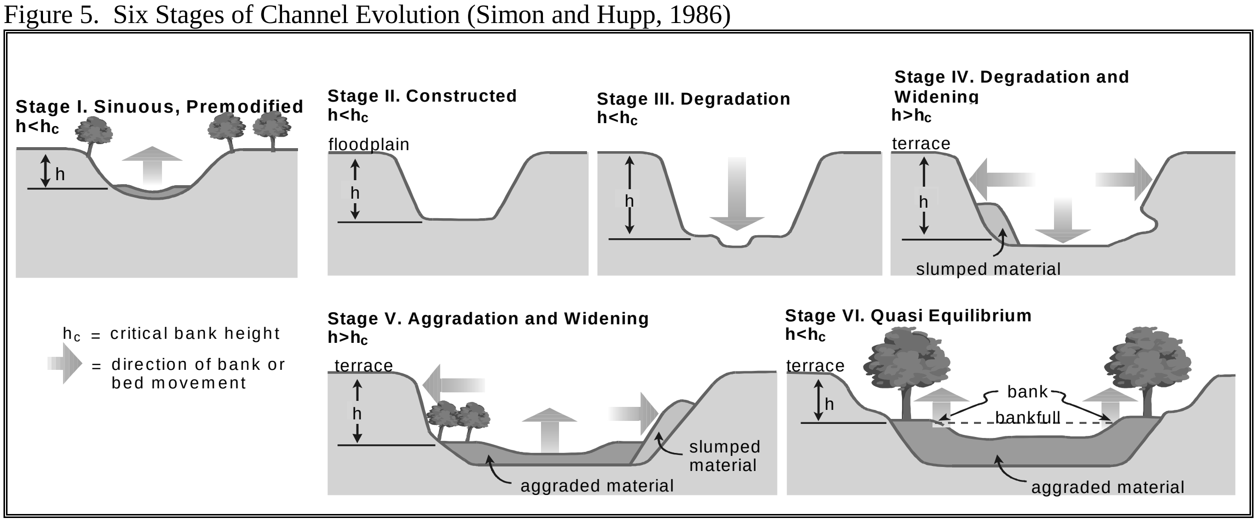
As an alternative scheme for TMDL practitioners, the channel evolution framework set out by Simon and Hupp (1986) is proposed (Figure 5). In most alluvial channels, disruption of the dynamic equilibrium generally results in a certain degree of upstream channel degradation and downstream aggradation. If the predisturbed channel is considered as the initial stage (stage I) of channel evolution and the disrupted channel as an instantaneous condition (stage II), rapid channel degradation can be considered stage III. Degradation flattens channel gradients and consequently reduces the available stream power for given discharges with time. Concurrently, bank heights are increased and bank angles are often steepened by fluvial undercutting and by pore-pressure induced bank failures near the base of the bank. Thus, the degradation stage (stage III) is directly related to destabilization of the channel banks and to channel widening by mass-wasting processes (stage IV) once bank heights and angles exceed the critical conditions of the bank material (as determined by shear-strength characteristics).

As degradation migrates further upstream, aggradation (stage V) becomes the dominant trend in previously degraded downstream sites because the flatter gradient and lower hydraulic radius at the degraded site cannot transport the heightened sediment loads originating from degrading reaches upstream. This secondary aggradation occurs at rates roughly 60% less than the associated degradation rate (Simon and Hupp, 1992). These reduced aggradation rates indicate that bed-level recovery will not be complete and that attainment of a new dynamic equilibrium will take place through (1) further channel widening, (2) the establishment of riparian vegetation that adds roughness elements and reduces the stream power for given discharges, and (3) further gradient reduction by meander extension and elongation.

The lack of complete bed-level recovery often results in a two-tiered channel configuration with the original floodplain surface becoming a terrace. Flood flows are, therefore, constrained within this enlarged channel below the terrace level. Without proliferation of riparian vegetation within the channel, this results in a given flow having greater erosive power than if an equivalent flow could dissipate energy by spreading across the floodplain. Where vegetation does re-establish, the additional roughness limits the erosive power of flood events within the incised channel and constrains shear-stress values to near bankfull levels. Aggrading conditions (stage V) are also common in reaches downstream from the area of maximum disturbance immediately after the disturbance is imposed on the stream channel.

With stages of channel evolution tied to discrete channel processes and not strictly to specific channel shapes, they have been successfully used to describe systematic channel-stability processes over time and space in diverse environments subject to various disturbances such as stream response to: channelization in the Southeast US Coastal Plain; volcanic eruptions in the Cascade Mountains; and dams in Tuscany, Italy (Rinaldi and Simon, 1998). Because the stages of channel evolution represent shifts in dominant channel processes, they are systematically related to suspended-sediment and bed-material discharge (Simon, 1989; Kuhnle and Simon, 2000), fish-community structure, rates of channel widening (Simon and Hupp, 1992), and the density and distribution of woody riparian vegetation (Hupp, 1992).

Figure 5. Six Stages of Channel Evolution (Simon and Hupp, 1986)



An advantage of a process-based channel-evolution scheme for use in TMDL development is that Stages I and VI represent two true "reference" conditions. In some cases, channels are unlikely to recover to Stage I, pre-modified conditions. Stage VI, re-stabilized conditions are a more likely target under the present regional landuse and altered hydrologic regimes and can be used as a "reference" condition. However, in pristine areas where disturbances have not occurred or where they are far less severe, Stage I conditions can be used as a "reference" condition.

4.2 Analysis of Available Suspended Sediment Data (Simon, et al., 2002a)

Analysis of suspended sediment transport data involves establishing a relation between flow and sediment concentration or load. Instantaneous concentration data combined with either an instantaneous flow value or flow data representing the value obtained from the stage-discharge relation at 15-minute intervals are best. Mean daily values of both flow and sediment loads, which are readily available from the USGS, tend to be biased towards lower flows, particularly in flashy basins. For establishing sediment-transport rating relations, instantaneous concentration and 15-minute flow data were used from USGS and ARS gauging station records.

Because the "effective discharge" is that discharge or range of discharges that shape channels and perform the most geomorphic work (transport the most sediment) over the long term, it can serve as a useful indicator of regional suspended sediment transport conditions for "reference" and impacted sites. The effective discharge is obtained by combining flow frequency data with sediment transport relationships. In many parts of the United States, the effective discharge is approximately equal to the peak flow that occurs about every 1.5 years ($Q_{1.5}$) and may be analogous to the bankfull discharge in stable streams.

The recurrence interval for the effective discharge was calculated for 10 streams in Mississippi. Calculating the effective discharge is a matter of integrating a flow-frequency curve with a sediment-transport rating to obtain the discharge (range of discharges) that transports the most sediment. This was accomplished at 10 sites where the complete 15-minute flow record was easily obtainable. For the 10 streams analyzed in Mississippi, the $Q_{1.5}$ is on average, a good approximation (Table 5). Therefore, the $Q_{1.5}$ was used as a measure of establishing the effective discharge at all sites.

The effective discharge ($Q_{1.5}$) was determined for all sites where the instantaneous sediment concentration data were available. This discharge was then applied to the sediment transport relation to obtain the sediment load at the effective discharge. To normalize the data for differences in basin size, the sediment load was divided by drainage area to obtain sediment yield (in $T/D/km^2$).

4.3 "Reference" or "Target" Sediment Yields

"Reference" or "Target" values for suspended sediment are based on the concept that stable channel conditions can be represented by channel evolution Stages I and VI. Therefore, the effective discharge sediment yields for Stage I and VI in a given ecoregion represent background or natural transport rates (Simon, et al., 2002b). The targeted sediment yield for an ecoregion is based on the sediment yield values obtained for Stage I and VI sites within that ecoregion. Based on this information, the targeted sediment yield range for Ecoregion 65 is 6.9E-04 to 4.2E-03 tons per acre per day at the effective discharge. Figure 6 provides a median of all of the data in each ecoregion, not the range of the central 50 percent of the distribution for the stable streams only, which is the way the target yield for this TMDL is provided. Figure 6 shows the wide range of sediment yields among the 84 ecoregions of the continental United States.

Figure 6. Comparison of national median suspended-sediment yields at the Q1.5 for 84 ecoregions of the continental United States (Simon et al., 2002c)

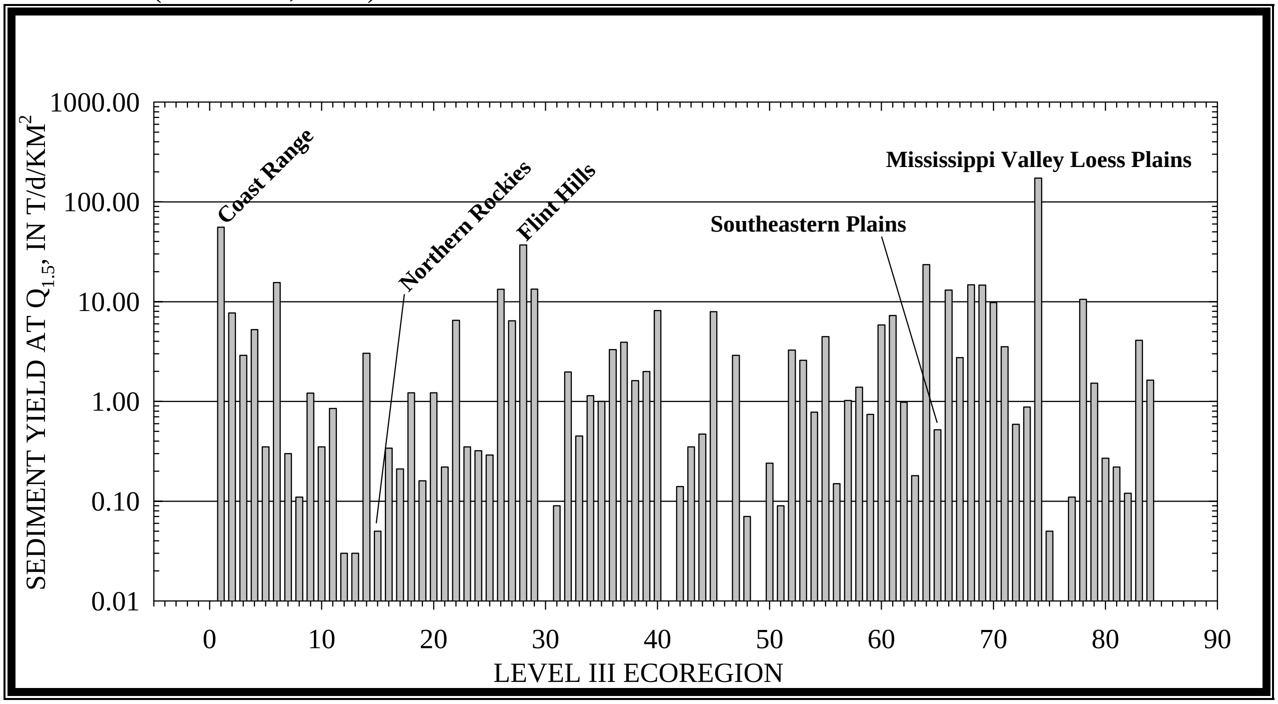
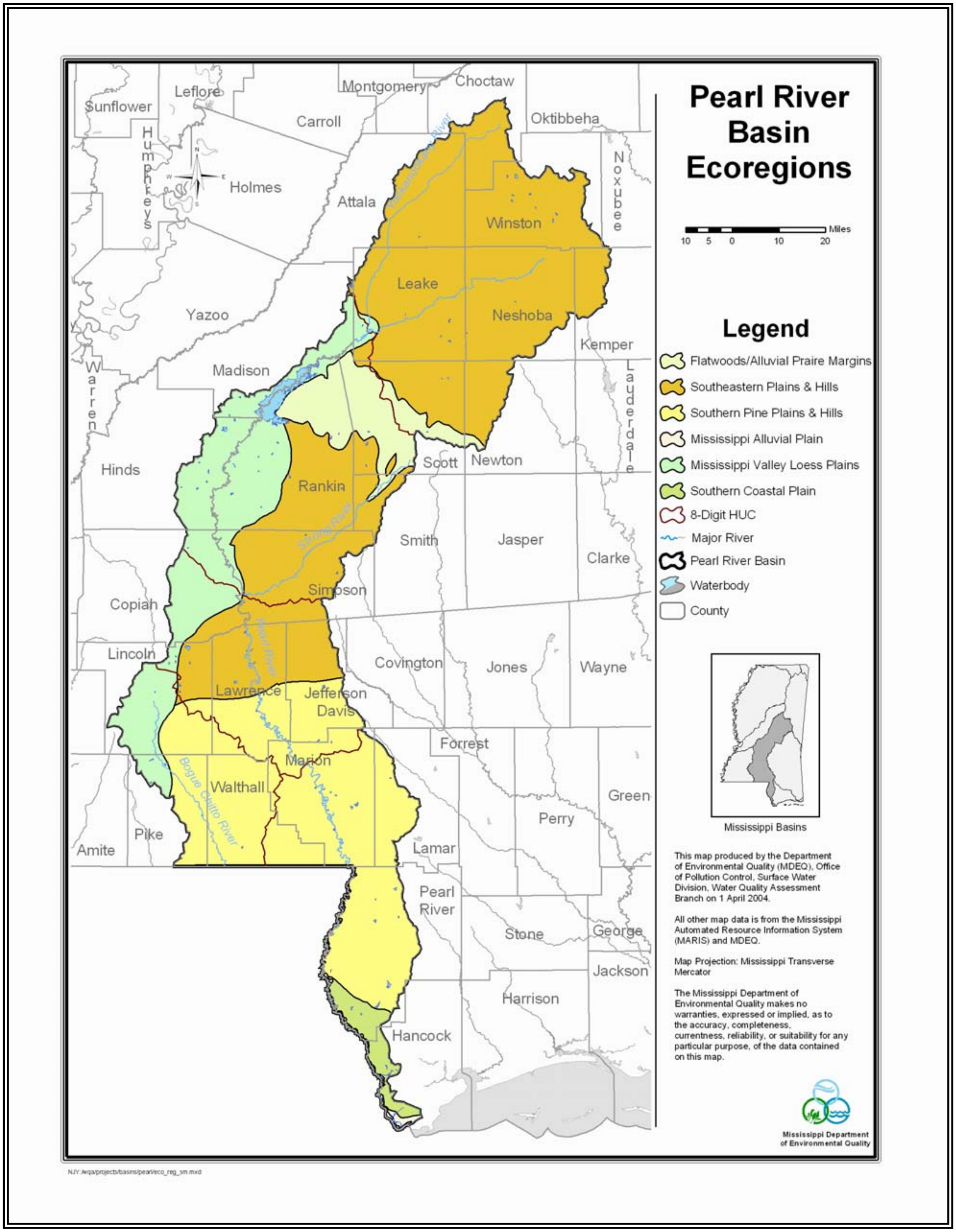


Figure 7. Ecoregions of the Pearl River Basin



5.0 ALLOCATION

The allocation for this TMDL involves a wasteload allocation (WLA) for permitted sources, a load allocation (LA) for unpermitted nonpoint sources, and an implicit margin of safety (MOS), which should result in attainment of water quality standards in the Fannegusha Creek watershed. According to 40 CFR §130.2 (i), TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measure. This TMDL is expressed as the tons of sediment that can be discharged from an acre of a subwatershed during a day (tons/acre/day) at the effective discharge and still attain the applicable water quality standard. It is appropriate to apply the same target yield to permitted (WLA) and unpermitted (LA) watershed areas. For load TMDLs the WLA and LA are summed to calculate the TMDL. Because this TMDL is expressed as a yield, as long as all activities, permitted or unpermitted, meet the same yield, the TMDL yield will be met, regardless of the relative load contribution. The methods used to develop these values are described in detail in the reports titled, *"Reference" and "Impacted" Rates of Suspended-Sediment Transport for Use in Developing Clean Sediment TMDLs: Mississippi and the Southeastern United States* (Simon, et al., 2002b) and *Actual and Reference Sediment Yields for the James Creek Watershed – Mississippi* (Simon, et al., 2002a).

5.1 Wasteload Allocations

There are no NPDES permitted facilities in the Fannegusha Creek watershed. The pollutant of concern for this TMDL is sediment from landuse runoff and in-channel processes. Sediment loadings from NPDES regulated construction activities and MS4s are considered point sources of sediment to surface waters. These discharges occur in response to storm events and are included in the WLA of this TMDL as the same target yield as the TMDL of 6.9E-04 to 4.2E-03 tons per acre per day at the effective discharge.

5.2 Load Allocations

The LA developed for this TMDL is an estimation of the acceptable contribution of all nonpoint sources in the watershed. Channel processes and upland sources both contribute to the sediment loading of the river. Forested areas that are subject to silviculture activities may exhibit elevated sediment contributions if voluntary BMPs for forestry in Mississippi are not implemented. BMPs, as outlined in "Mississippi's BMPs: Best Management Practices for Forestry in Mississippi" (MFC, 2000), "Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater" (MDEQ, et. al, 1994), and "Field Office Technical Guide" (NRCS, 2000), would be the most effective means of reducing the load from the upland sources.

The calculated range of allowable loads of sediment for the impaired segments of the Fannegusha Creek watershed without exceeding the applicable narrative water quality standard, as interpreted by MDEQ, is also a range of 6.9E-04 to 4.2E-03 tons per acre per day at the effective discharge.

5.3 Incorporation of a Margin of Safety (MOS)

The two types of MOS development are to implicitly incorporate the MOS using conservative assumptions or to explicitly specify a portion of the total TMDL as the MOS. The MOS selected for this TMDL is implicit. The use of conservative procedures provides a sufficient implicit MOS. These conservative procedures include the use of a stable stream as the target and the use of the effective discharge flow, the flow that produces the most sediment transport.

5.4 Calculation of the TMDL

As stated above, the pollutant of concern for this TMDL is sediment from landuse runoff and in-channel processes. The LA includes the contributions from the channel and surface runoff from the watershed. The MOS for this TMDL is implicit and derived from the conservative assumptions incorporated into this methodology. This TMDL, expressed as an acceptable range of sediment yields, is the same for the WLA, LA, and TMDL. For load TMDLs the WLA and LA are summed to calculate the TMDL. Because this TMDL is expressed as a yield, as long as all activities, permitted or unpermitted, meet the same yield as shown in Table 3, the TMDL yield will be met, regardless of the relative load contribution.

WLA= 6.9E-04 to 4.2E-03 tons of sediment per acre per day at the effective discharge

LA = 6.9E-04 to 4.2E-03 tons of sediment per acre per day at the effective discharge

MOS = Implicit

Table 3. TMDL Yields

Parameter	WLA	LA	MOS	TMDL
Sediment (tons/acre/day)*	6.9E-04 to 4.2E-03	6.9E-04 to 4.2E-03	Implicit	6.9E-04 to 4.2E-03

*at the effective discharge

5.5 Seasonality

The use of a data collected throughout the year at many stations in the ecoregion to set the target addresses seasonal variation. Instantaneous flow and suspended sediment data were used to develop the TMDL targets for each ecoregion. These data were collected throughout the year and would account for all seasons of the calendar year, changing atmospheric conditions (including rainy and dry seasons and high and low temperatures), and the periods representative of critical conditions.

5.6 Reasonable Assurance

This component of TMDL development does not apply to this TMDL Report. There are no point sources (WLA) requesting a reduction based on promised LA components and reductions.

6.0 CONCLUSION

The acceptable range of sediment yields was estimated to be 6.9E-04 to 4.2E-03 tons per acre per day at the effective discharge. The estimated range of yields for unstable streams in the same ecoregion is 1.4E-03 to 6.9E-02 tons per acre per day at the effective discharge. Because the existing range for the Fannegusha Creek watershed is estimated to be similar to that of other unstable streams in its ecoregion, there is a deviation of approximately one order of magnitude in the estimated existing range and the TMDL range. Therefore, it is recommended that the Fannegusha Creek watershed be considered a priority for streambank and riparian buffer zone restoration and any sediment reduction BMPs, especially for the road crossings, agricultural activities, and construction activities. The implementation of these BMP activities should reduce the sediment load entering Fannegusha Creek, Red Cane Creek, and Hurricane Creek. The reduction of the sediment load in the Fannegusha Creek watershed to equal that of a relatively stable stream will allow the streams to approach stable conditions. This will provide improved habitat for the support of aquatic life in the river and will result in the attainment of the applicable water quality standards.

6.1 Current and Future Activities

Groundwater is used by most of Mississippi's community and non-community water supply systems. However, the City of Jackson's water supply is mostly dependent on surface waters. Specifically, the City of Jackson has a water intake structure on the Ross Barnett Reservoir and another downstream on the Pearl River. The mouth of Fannegusha Creek is located directly above the Ross Barnett Reservoir. Therefore, the Fannegusha Creek watershed would also be an important part of source water protection for the area.

MDEQ has adopted the Basin Approach to Water Quality Management, a plan that divides Mississippi's major drainage basins into five groups. During each yearlong cycle, MDEQ resources for water quality monitoring will be focused on one of the basin groups. During the next monitoring phase in the Pearl River Basin, the Fannegusha Creek watershed may receive additional monitoring to identify any changes or improvements in water quality. In 1999 the Mississippi Source Water Assessment Program (SWAP) recognized that MDEQ's Basin Approach to Water Quality Management provided an opportunity to better coordinate the various water-related programs thus resulting in effective management, planning, and enhanced protection of Public Water Systems that use public surface water sources. In this case, basin management upstream of the City of Jackson's Pearl River water intake, including the Ross Barnett Reservoir and the headwaters of the Pearl and Yockanookany Rivers, can efficiently and economically address water quality and source water protection.

In addition, for land disturbing activities in the Fannegusha Creek watershed related to silviculture, construction, and agriculture, it is recommended that practices, as outlined in "Mississippi's BMPs: Best Management Practices for Forestry in Mississippi" (MFC, 2000), "Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater" (MDEQ, et. al, 1994), and "Field Office Technical Guide" (NRCS, 2000), be followed, respectively.

6.2 Public Participation

This TMDL will be published for a 30-day public notice. During this time, the public will be notified by publication in both a statewide and local newspaper. The public will be given an opportunity to review the TMDL and submit comments. MDEQ also distributes all TMDLs at the beginning of the public notice to those members of the public who have requested to be included on a TMDL mailing list. TMDL mailing list members may request to receive the TMDL reports through either, email or the postal service. Anyone wishing to become a member of the TMDL mailing list should contact Greg Jackson at (601) 961-5098 or Greg_Jackson@deq.state.ms.us. At the end of the 30-day period, MDEQ will determine the level of interest in the TMDL and make a decision on the necessity of holding a public meeting.

All comments received during the public notice period and at any public meeting become a part of the record of this TMDL. All comments will be considered in the ultimate completion of this TMDL for submission of this TMDL to EPA Region 4 for final approval.

DEFINITIONS

Aggradation: The raising of the bed of a watercourse by the deposition of sediment.

Allocations: That portion of a receiving water's loading capacity that is attributed to one of its existing or future pollution sources (nonpoint or point) or to natural background sources.

Ambient Stations: A network of fixed monitoring stations established for systematic water quality sampling at regular intervals, and for uniform parametric coverage over a long-term period.

Anthropogenic: Pertains to the [environmental] influence of human activities.

Assimilative Capacity: The amount of contaminant load that can be discharged to a specific stream or river without violating the provisions of the *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters and Water Quality* regulations. Assimilative capacity is the extent to which a body of water can receive wastes without significant deterioration of beneficial uses.

Background: Ambient pollutant concentrations due to natural sources, nearby sources other than the one currently under consideration, and unidentified anthropogenic sources.

Background Levels: Levels representing the chemical, physical, and biological conditions that would result from natural geomorphological processes such as weathering or dissolution.

Bank Full Stage: Stage of flow at which a stream fills its channel up to level of its bank. Recurrence interval averages 1.5 to 2 years.

Bedload Sediment: Portion of sediment load transported downstream by sliding, rolling, bouncing along the channel bottom. Generally consists of particles >1 mm.

Best Management Practices (BMPs): (1) The methods, measures, or practices selected by an agency to meet its nonpoint source control needs. BMPs include but are not limited to structural and nonstructural controls and operation and maintenance procedures. BMPs can be applied before, during, or after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters. (2) Methods have been determined to be the most effective, practical means of preventing or reducing pollution from nonpoint sources.

Calibration: Testing and tuning of a model to a set of field data. Also includes minimization of deviations between measured field conditions and output of a model by selecting appropriate model coefficients.

Channel: (1) A natural stream that conveys water; a ditch or channel excavated for the flow of water. (2) The water-filled groove through which runoff water flows. In a narrow valley the channel may include the entire valley floor, but ordinarily it occupies only a small fraction of the valley.

Channel Improvement: The improvement of the flow characteristics of a channel by clearing, excavation, realignment, lining, or other means in order to increase its capacity. Sometimes used to connote channel stabilization.

Channel Stabilization: Erosion prevention and stabilization of velocity distribution in a channel using jetties, drops, revetments, vegetation, and other measures.

Channelization: Straightening and deepening streams so that water will move faster, a marsh-drainage tactic that can interfere with waste assimilation capacity, disturb fish and wildlife habitats, and aggravate flooding.

Clean Sediment: Sediment that is not contaminated by chemical substances. Pollution caused by clean sediment refers to the quantity of sediment, as opposed to the presence of pollutant-contaminated sediment.

Critical Condition: The critical condition can be thought of as the "worst case" scenario of environmental conditions in the water body in which the loading expressed in the TMDL for the pollutant of concern will continue to meet water quality standards. Critical conditions are the combination of environmental factors (e.g., flow, temperature, etc.) that results in attaining and maintaining the water quality criterion and has an acceptably low frequency of occurrence.

Cross-Sectional Area: Wet area of a waterbody normal to the longitudinal component of the flow.

Daily Discharge: The discharge of a pollutant measured during a 24-hour period that reasonably represents the day for purposes of sampling. For pollutants with limitations expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement, the daily discharge is calculated as the average measurement of the pollutant over the day.

Designated Use: (1) Those uses specified in water quality standards for each water body or segment whether or not they are being attained. (2) Those water uses identified in state water quality standards which must be achieved and maintained as required under the Clean Water Act.

Discharge Monitoring Report: Report of effluent characteristics submitted by a NPDES permitted facility.

Dissolved Solids: (1) The total amount of dissolved materials, organic and inorganic, contained in water or wastes. Excessive dissolved solids can make water unsuitable for industrial uses, unpalatable for drinking, and even cathartic. Potable water supplies must have dissolved solid content from 20 to 1000 mg/l, but sources which have more than 500 mg/l are not recommended by the U.S. Public Health Service. (2) Disintegrated organic and inorganic material in water. Excessive amounts make water unfit to drink or use in industrial processes.

Diurnal: Recurring daily. Diurnal indicates variations following a distinctive pattern and recurring from day to day.

Dynamic Model: A mathematical formulation describing and simulating the physical behavior of a system or a process and its temporal variability.

Ecoregion: A physical region that is defined by its ecology, which includes meteorological factors, elevation, plant and animal speciation, landscape position, and soils.

Effective Discharge: The "channel forming discharge" or discharge which moves the most sediment. This value is obtained by combining flow frequency data with sediment transport data.

Effluent: (1) Any solid, liquid, or gas which enters the environment as a by-product of a man-oriented process. The substances that flow out of a designated source. Effluent, effluence, and efflux have the same meaning. (2) Wastewater – treated or untreated – that flows out of a treatment plant, sewer, or industrial outfall. Generally refers to wastes discharged into surface waters.

Effluent Standards and Limitations: All State or Federal effluent standards and limitations on quantities, rates, and concentrations of chemical, physical, biological, and other constituents to which a waste or wastewater discharge may be subject under the Federal Act or the State law. This includes, but is not limited to, effluent limitations, standards of performance, toxic effluent standards and prohibitions, pretreatment standards, and schedules of compliance.

Flood Plain: (1) The lowland and relatively flat areas adjoining inland and coastal waters and other floodprone areas such as offshore islands, including at a minimum, the area subject to a one percent or greater chance of flooding in any given year. The base floodplain shall be used to designate the 100-year floodplain (one percent chance floodplain). The critical action floodplain is defined as the 500-year floodplain (0.2 percent chance floodplain). (2) The portion of a river valley that becomes covered with water when the river overflows its banks at flood stage. (3) The flat or nearly flat land along a river or stream or in a tidal area that is covered by water during a flood.

Fluvial Geomorphology: The study of landforms and processes associated with rivers.

Geomorphology: The study of the Earth's landscapes and landforms, the processes by which the landforms originated, their age, and the nature of the materials underlying them.

Gully Erosion: (1) Severe erosion in which trenches are cut to a depth greater than 30 centimeters (1 ft). Generally, ditches deep enough to cross with farm equipment are considered gullies. (2) The widening, deepening, and cutting back of small channels and waterways due to erosion.

Impaired Water body: Any water body that does not attain water quality standards due to an individual pollutant, multiple pollutants, pollution, or an unknown cause of impairment.

Surface Runoff: Precipitation, snow melt, or irrigation in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter or nonpoint source pollutants.

Load Allocation (LA): The portion of a receiving water's loading capacity attributed either to one of its existing or future nonpoint sources of pollution or to natural background sources. Load allocations are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. Wherever possible, natural and nonpoint source loads should be distinguished.

Loading: The portion of a receiving water's loading capacity attributed either to one of its existing or future nonpoint sources of pollution or to natural background sources. Load allocations are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. Wherever possible, natural and nonpoint source loads should be distinguished.

Mass Wasting: Downslope transport of soil and rocks due to gravitational stress.

NPDES Permit: An individual or general permit issued by the MDEQ Permit Board pursuant to regulations adopted by the Commission under Mississippi Code Annotated (as amended) § 49-17-17 and § 49-17-29 for discharges into State waters.

Narrative Criteria: Nonquantitative guidelines that describe the desired water quality goals.

Natural Waters: Flowing water within a physical system that has developed without human intervention, in which natural processes continue to take place.

Nonpoint Source: The pollution from sources which generally are not controlled by establishing effluent limitations under sections 301, 302, and 402. Nonpoint source pollutants are not traceable to a discrete identifiable origin, but generally result from land runoff, precipitation, drainage, or seepage. This water may contain pollutants that come from land use activities such as agriculture, construction, silviculture, surface mining, disposal of wastewater, hydrologic modifications, and urban development.

Numeric Target: A measurable value determined for the pollutant of concern which, if achieved, is expected to result in the attainment of water quality standards in the listed water body.

Phased Approach: Under the phased approach to TMDL development, load allocations and wasteload allocations are calculated using the best available data and information recognizing the need for additional monitoring data to accurately characterize sources and loadings. The phased approach is typically employed when nonpoint sources dominate. It provides for the implementation of load reduction strategies while collecting additional data.

Point Source: Pollution from a stationary location or fixed facility from which pollutants are discharged or emitted. Pollution from any single identifiable source, e.g., a pipe, ditch, ship, ore pit, or factory smokestack.

Pollutant: Includes, but not limited to, any element, substance, compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may be reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformations, in such organisms or their offspring; except that the term pollutant or contaminant shall not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under subparagraphs (A) through (F) of paragraph (14) and shall not include natural gas, liquefied natural gas, or synthetic gas of pipeline quality (or mixtures of natural gas and such synthetic gas).

Pollution: Generally, the presence of matter or energy whose nature, location, or quantity produces undesired environmental effects. Under the Clean Water Act, for example, the term is defined as man-made or man-induced alteration of the physical, biological, and radiological integrity of water. Other pollution related terms include: agricultural pollution, air pollution, indoor air pollution, industrial waste pollution, manmade air pollution, natural pollution, noise pollution, oil pollution, sewage pollution, soil pollution, thermal pollution, water pollution, and wood burning stove pollution.

Reference Sites: Water bodies that are representative of the characteristics of the region and subject to minimal human disturbance.

Scouring: The removal of earth or rock by the action of running water or of a glacier.

Sediment: (1) The unconsolidated inorganic and organic material that is suspended in and being transported by surface water, or has settled out and deposited into beds. (2) Soil, sand, and minerals washed from land into water, usually after rain. They pile up in reservoirs, rivers, and harbors, destroying fish and wildlife habitat, and clouding the water so that sunlight cannot reach aquatic plants. Careless farming, mining, and building activities will expose sediment materials, allowing them to wash off the land after rainfall.

Sediment Delivery: Contribution of transported sediment to a particular location or part of a landscape.

Sediment Production: Delivery of colluvium or bedrock from hillslope to stream channel. The production rate is evaluated as the sum of the rates of colluvial bank erosion and sediment transport across channel banks.

Sediment Yield: The quantity of sediment arriving at a specific location.

Sedimentation: Process of deposition of waterborne or windborne sediment or other material; also refers to the infilling of bottom substrate in a waterbody by sediment (siltation).

Sheet Erosion: Also Sheetwash. Erosion of the ground surface by unconcentrated (i.e. not in rills) overland flow.

Sheetwash: Also Sheet Erosion. Erosion of the ground surface by unconcentrated (i.e. not in rills) overland flow.

Stage: The height of a water surface above an established datum plane.

Stream Restoration: Various techniques used to replicate the hydrological, morphological, and ecological features that have been lost in a stream due to urbanization, farming, or other disturbance.

Surface Runoff: Precipitation, snow melt, or irrigation in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter or nonpoint source pollutants.

Suspended Solids: Organic and inorganic particles (sediment) suspended in and carried by a fluid (water). The suspension is governed by the upward components of turbulence, currents, or colloidal suspension. Suspended sediment usually consists of particles <0.1 mm, although size may vary according to current hydrological conditions. Particles between 0.1 mm and 1 mm may move as suspended or be deposited (bedload).

Thalweg: Deepest part of a stream channel.

Topography: The physical features of a geographic surface area including relative elevations and the positions of natural and man-made features.

Total Maximum Daily Load or TMDL: (1) The total allowable pollutant load to a receiving water such that any additional loading will produce a violation of water quality standards. (2) The sum of the individual waste load allocations and load allocations. A margin of safety is included with the two types of allocations so that any additional loading, regardless of source, would not produce a violation of water quality standards.

Turbidity: (1) A measure of opacity of a substance; the degree to which light is scattered or absorbed by a fluid. (2) A cloudy condition in water due to suspended silt or organic matter.

Waste: Useless, unwanted, or discarded material resulting from (agricultural, commercial, community, and industrial) activities. Wastes include solids, liquids, and gases.

Wasteload Allocation (WLA): (1) The portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality based effluent limitation. (2) The portion of a receiving water's total maximum daily load that is allocated to one of its existing or future point sources of pollution. (3) The maximum load of pollutants each discharger of waste is allowed to release into a particular waterway. Discharge limits are usually required for each specific water quality criterion being, or expected to be, violated. The portion of a stream's total assimilative capacity assigned to an individual discharge.

Water Quality Criteria: Specific levels of water quality which, if reached, are expected to render a body of water suitable for its designated use. The criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, fish production, or industrial processes. Water quality criteria are comprised of numeric and narrative criteria. Numeric criteria are scientifically derived ambient concentrations developed by EPA or States for various pollutants of concern to protect human health and aquatic life. Narrative criteria are statements that describe the desired water quality goal.

Water Quality Standards: (1) Provisions of State or Federal law which consist of a designated use or uses for the water quality criteria for such waters based upon such uses. Water quality standards are to protect the public health or welfare, enhance the quality of water, and serve the purposes of the Clean Water Act. (2) A law or regulation that consists of the beneficial designated use or uses of a water body, the numeric and narrative water quality criteria that are necessary to protect the use or uses of that particular water body, and an antidegradation statement. (3) State-adopted and EPA-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.

Waters of the State: All waters within the jurisdiction of this State, including all streams, lakes, ponds, wetlands, impounding reservoirs, marshes, watercourses, waterways, wells, springs, irrigation systems, drainage systems, and all other bodies or accumulations of water, surface and underground, natural or artificial, situated wholly or partly within or bordering upon the State, and such coastal waters as are within the jurisdiction of the State, except lakes, ponds, or other surface waters which are wholly landlocked and privately owned, and which are not regulated under the Federal Clean Water Act (33 U.S.C.1251 et seq.).

Watershed: (1) The land area that drains (contributes runoff) into a stream. (2) The land area that drains into a stream; the watershed for a major river may encompass a number of smaller watersheds that ultimately combine at a common delivery point.

ABBREVIATIONS

ARS .... Agricultural Research Service

BMP .... Best Management Practice

CWA .... Clean Water Act

CWPRU .... Channel and Watershed Processes Research Unit

EPA .... Environmental Protection Agency

HUC .... Hydrologic Unit Code

LA .... Load Allocation

MARIS .... Mississippi Automated Resource Information Service

MDEQ .... Mississippi Department of Environmental Quality

MFC .... Mississippi Forestry Commission

MOS .... Margin of Safety

NPDES .... National Pollution Discharge Elimination System

NRCS .... Natural Resource Conservation Service

NSL .... National Sedimentation Laboratory

SWAP .... Source Water Assessment Program

TSS .... Total Suspended Solids

USGS .... United States Geological Survey

USLE .... Universal Soil Loss Equation

WLA .... Wasteload Allocation

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