Total Maximum Daily Load (TMDL)
For Turbidity

Final Report
May 2004

Fourth Creek (Subbasin 03-07-06)
Yadkin River Basin
North Carolina

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INDEX OF TMDL SUBMITTAL

303(d) List Information

State: North Carolina
Counties: Iredell and Rowan
Basin: Yadkin River Basin

303(D) LISTED WATERS

Name of Stream	Description	Class	Index #	Subbasin	Miles
Fourth Creek	From SR 2308 Iredell Co 1.5 mile upstream.	C	12-108-20-(1)b	30706	9.5

14 digit HUC or Cataloging Unit(s): 3040102030010 and 3040102030020
Area of Impairment: 9.5 miles
WQS Violated: Turbidity
Pollutant of Concern: Turbidity
Applicable Water Quality Standards for Class C Waters: Turbidity not to exceed 50 NTU
Sources of Impairment: Nonpoint sources throughout watershed

Public Notice Information

A draft of the TMDL was publicly noticed through various means, including notification in a local newspaper, the *Statesville Record and Landmark* on February 24, 2004. The TMDL was also available from the Division of Water Quality's website during the comment period at: http://h2o.enr.state.nc.us/tmdl/TMDL_list.htm.
The public comment period began February 24 and was held for 30 days. A public meeting was held on March 26 at the Old City Hall Building, Council Chambers, 301 South Center Street, in Statesville, North Carolina.

Did notification contain specific mention of TMDL proposal? Yes
Were comments received from the public? No
Was a responsiveness summary prepared? No

TMDL Information

Critical conditions: Hydrologically high flow conditions during all seasons but particularly during late winter and early spring.

Seasonality: TMDL is based on meeting the target standard during all seasons and is applied on an annual basis.

Development tools: Load duration curves based on cumulative frequency distribution of flow conditions in the watershed. Allowable loads are average loads over the recurrence interval between the 95th and 10th percent flow exceeded (excludes extreme drought (>95th percentile) and floods (<10th percentile). Percent reductions expressed as the average value between existing loads (calculated using an equation to fit a curve through actual water quality violations) and the allowable load at each percent flow exceeded.

Supporting documents: Total Maximum Daily Load (TMDL) For Turbidity in Fourth Creek, NC Division of Water Quality (2004)

TMDL Allocations	**TSS Load (lbs/day)**
Existing	**19,703**
WLA - NC0031836 (4 MGD, 30 mg TSS/L limit)	**1,001**
WLA - NC0082821 (0.114 MGD, 30 mg TSS/L limit)	**29**
Sum of WLAs	*1,030*
LA – Urban	**1,044**
LA – Rural (Non-Urban)	**8,445**
Sum of LAs	*9,489*
MOS	**Explicit 10%**
TMDL	**10,519**
TMDL – Percent Reduction Required	**47%**

WLA = wasteload allocation, LA = load allocation, MOS = margin of safety

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1.0 Introduction

The 2002 North Carolina Water Quality Assessment and Impaired Waters List (also known as the Integrated 305(b) and 303(d) Report) identified Fourth Creek in the Yadkin River Basin as impaired by elevated turbidity. Based on this report, the impaired segment (assessment unit 12-108-20-(1)b) includes a 9.5-mile segment located in subbasin 03-07-06 between State Route 2308 in Iredell County downstream to 1.5 miles upstream of Rowan County State Road 1985 in Rowan County. Subsequent to the 2002 listing, additional monitoring has been conducted and suggests that the area of impairment includes the Fourth Creek from its source to SR 1972 (Figure 1). This report will establish a Total Maximum Daily Load (TMDL) for turbidity for the entire Fourth Creek watershed. This report will serve as a management approach or restoration plan aimed toward reducing loadings of sediment from various sources in order to attain applicable surface water quality standards for turbidity.

In accordance with Section 305(b) of the Federal Clean Water Act (CWA) (33 U.S.C. 1315(B)), the State of North Carolina is required to biennially prepare and submit to the USEPA a report addressing the overall water quality of the State's waters. This report is commonly referred to as the 305(b) Report or the Water Quality Inventory Report. In accordance with Section 303(d) of the Clean Water Act (CWA), the State is also required to biennially prepare and submit to USEPA a report that identifies waters that do not meet or are not expected to meet surface water quality standards (SWQS) after implementation of technology-based effluent limitations or other required controls. This report is commonly referred to as the 303(d) List. The 303(d) process requires that a TMDL be developed for each of the waters appearing on Category 5 of North Carolina's Water Quality Assessment and Impaired Waters List (formerly Part 1 of North Carolina's 303(d) list). The objective of a TMDL is to quantify the amount of a pollutant a water body can assimilate without violating a state's water quality standards and allocate that load capacity to point and nonpoint sources in the form of wasteload allocations (WLAs), load allocations (LAs), and a margin of safety (MOS) (USEPA, 1991). Generally, the primary components of a TMDL, as identified by EPA (1991, 2000) and the Federal Advisory Committee (USEPA FACA, 1998) are as follows:

Target identification or selection of pollutant(s) and end-point(s) for consideration. The pollutant and end-point are generally associated with measurable water quality related characteristics that indicate compliance with water quality standards. North Carolina indicates known pollutants on the 303(d) list.

Source assessment. All sources that contribute to the impairment should be identified and loads quantified, where sufficient data exist.

Reduction target. Estimation or level of pollutant reduction needed to achieve water quality goal. The level of pollution should be characterized for the waterbody, highlighting how current conditions deviate from the target end-point. Generally, this component is identified through water quality modeling.

Allocation of pollutant loads. Allocating pollutant control responsibility to the sources of impairment. The wasteload allocation portion of the TMDL accounts for the loads associated with existing and future point sources. Similarly, the load allocation portion of the TMDL accounts for the loads associated with existing and future non-point sources, stormwater, and natural background.

Margin of Safety. The margin of safety addresses uncertainties associated with pollutant loads, modeling techniques, and data collection. Per EPA (2000), the margin of safety may be expressed explicitly as unallocated assimilative capacity or implicitly due to conservative assumptions.

Seasonal variation. The TMDL should consider seasonal variation in the pollutant loads and end-point. Variability can arise due to stream flows, temperatures, and exceptional events (e.g., droughts, hurricanes).

Critical Conditions. Critical conditions indicate the combination of environmental factors that result in just meeting the water quality criterion and have an acceptably low frequency of occurrence.

Section 303(d) of the CWA and the Water Quality Planning and Management regulation (USEPA, 2000) require EPA to review all TMDLs for approval or disapproval. Once EPA approves a TMDL, then the waterbody may be moved to Category 4a of the Integrated 305(b) and 303(d) Report. Waterbodies remain in Category 4a until compliance with water quality standards is achieved. Where conditions are not appropriate for the development of a TMDL, management strategies may still result in the restoration of water quality.

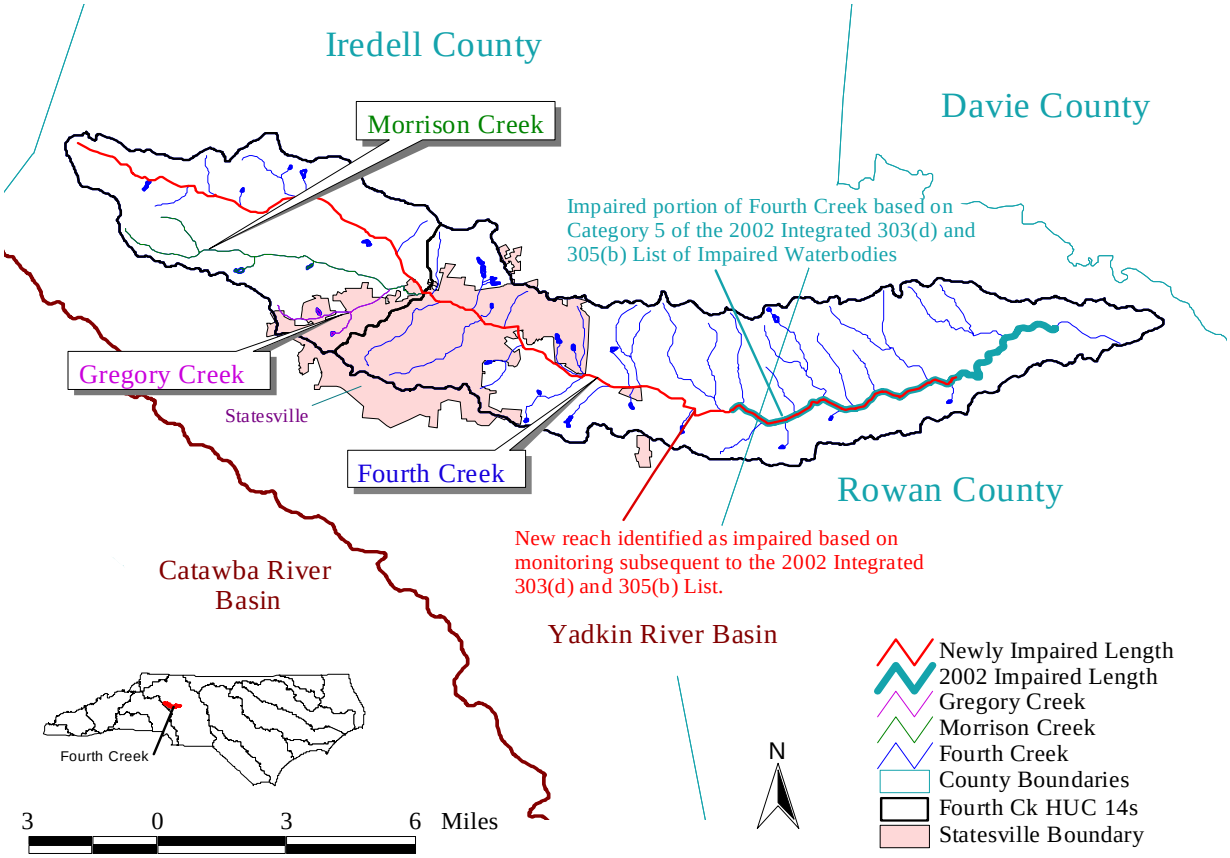
The goal of the TMDL program is to restore designated uses to water bodies. Thus, the implementation of sediment controls throughout the watershed will be necessary to restore uses in the most downstream portion of Fourth Creek. Although a site specific implementation plan is not included as part of this TMDL, reduction strategies are needed. The involvement of local governments and agencies will be critical in order to develop implementation plans and reduction strategies. Implementation discussion will begin during public review of the TMDL.

1.1 Watershed Description

Fourth Creek is located within the Inner Piedmont region of the Yadkin-Pee Dee River Basin and flows in a southeasterly direction from near the town of Stony Point in Iredell County through Statesville to its confluence with Third Creek in rural Rowan County (see Figure 1). The majority of the impaired stream segment is located in the downstream portion in Rowan County, however, this TMDL will address the entire watershed of Fourth Creek (approximately 83 square miles) which includes approximately 116 river miles (approximately 30 miles in the mainstem Fourth Creek and 86 miles of tributaries to Fourth Creek) upstream of its confluence with Third Creek. Two named tributaries, Morrison Creek and Gregory Creek, are located in the watershed and are located in the southwest portion of the watershed, west of the city of Statesville. Fourth Creek consists

of two USGS 14-digit hydrologic unit codes (HUCs); units 3040102030010 and 3040102030020.

Figure 1. Fourth Creek watershed and surrounding area. Impaired stream lengths are based on the Impaired Waters List (2002 Integrated 305(b) and 303(d) Report) and monitoring conducted subsequent to the 2002 listing.



1.1.1 Land use/ Land cover

The land use/land cover characteristics of the watershed were determined using 1996 land cover data that were developed from 1993-94 LANDSAT satellite imagery. The North Carolina Center for Geographic Information and Analysis, in cooperation with the NC Department of Transportation and the United States Environmental Protection Agency Region IV Wetlands Division, contracted Earth Satellite Corporation of Rockville, Maryland to generate comprehensive land cover data for the entire state of North Carolina. Land cover/land use data for the Fourth Creek watershed are identified in Figures 2 and 3. During the formation of this geographic dataset, the proportion of synthetic cover was used to identify developed land as either low density developed (50-80% synthetic cover) or high density developed (80-100% synthetic cover) (Earth Satellite Corporation, 1997). Assuming that synthetic cover is impervious, and that all non-developed land cover classes have 1% impervious cover, the Lower Fourth Creek watershed is estimated to have 4.9-6.5% impervious surface.

Figure 2. Land use/ land cover distribution within the Fourth Creek watershed.

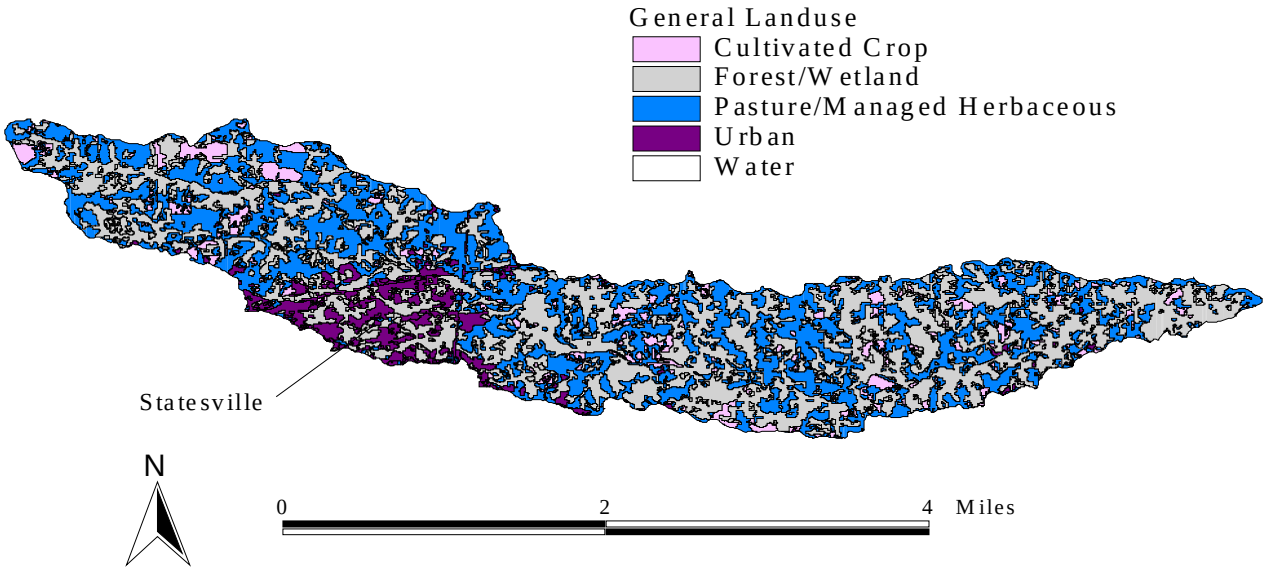
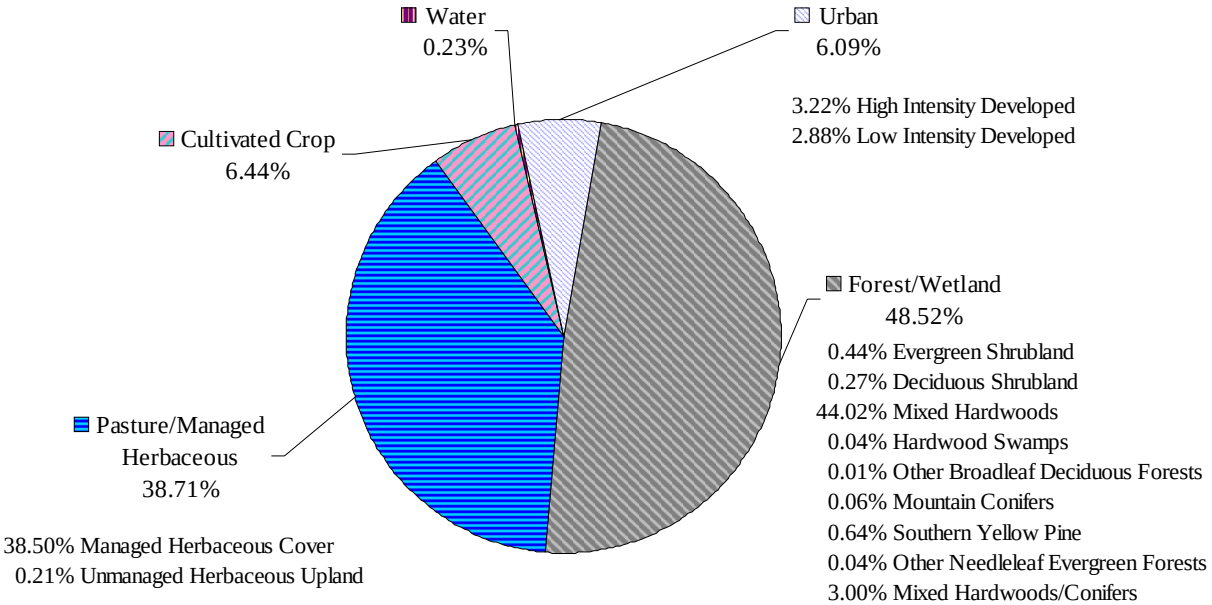


Figure 3. Detailed land use/ land cover distribution within Fourth Ck watershed.



1.1.2 Geology

Iredell County is in the heart of the Piedmont physiographic province. Predominantly, three rock types occur in the Fourth Creek watershed; composite gneiss, hornblende gneiss, and gabbro-diorite (LeGrand, 1954).

1.1.3 Soils

Soils types and characteristics vary throughout the Fourth Creek watershed. In the headwaters portion, west and north of Statesville, predominant soils include Lloyd-Cecil and Lloyd series. In the central portion the watershed, inclusive of the Statesville area downstream to the Iredell-Rowan Counties border, the primary soils include Cecil-Appling, Lloyd, and Iredell-Mecklenburg-Lloyd series. The predominant soils in the lower portion of the watershed, in Rowan County, include Enon, Mecklenburg, Hiwassee, Cecil, and Poindexter soil series. A number of these soil types exhibit above-normal erodeability. A description of the runoff and erosion potential for several soils in the Fourth Creek watershed are presented in Table 1. Soils highlighted bold are the predominant soils of the watershed; non-bold soils listed are present in the Fourth Creek watershed and exhibit highly erosive characteristics. Soils in Rowan County were identified as predominant based on GIS analysis (coverages using 1995 updated soil survey) and, in the case of Iredell County, analysis of soil survey maps (maps updated in 1964). GIS Soils (SSURGO) coverages are currently not available for Iredell County. Surface runoff and hazard of water erosion values were obtained from the NRCS and are defined below in Table 2 (USDA, 1995; USDA, 1964).

"Slow" surface runoff defines soils where surface water flows away so slowly that free water stands on the surface for moderate periods or enters the soil rapidly. Most of the water passes through the soil, is used by plants, or evaporates. The soils are nearly level or very gently sloping, or they are steeper but absorb precipitation very rapidly. "Medium" surface runoff is used to define soils where surface water flows away so rapidly that free water stands on the surface for only short periods. These soils are nearly level or gently sloping and absorb precipitation at a moderate rate, or they are steeper but absorb water rapidly. "Rapid" surface runoff is used to define soils where surface water flows away so rapidly that the period of concentration is brief and free water does not stand on the surface. These soils are mainly moderately steep or steep and have moderate or slow rates of absorption. "Very rapid" is used to define soils where surface water flows away so rapidly that the period of concentration is very brief and free water does not stand on the surface. The soils are mainly steep or very steep and absorb precipitation slowly (USDA, 1995).

The "erosion hazard" is a term developed by the NRCS (USDA, 1995) and is used to describe the potential for future erosion, inherent in the soil itself, in inadequately protected areas. The estimated erosion for each erosion classification is based on estimated annual soil loss in metric tons per hectare. Values were determined using the Universal Soil Loss Equation assuming bare soil conditions and using rainfall and climate factors for North Carolina.

Table 1 Surface runoff and the hazard of water erosion characteristics are presented for predominant soil series (bolded) and less dominant soils series (non-bolded) in the Fourth Creek watershed. Less dominant soil series include only series that displayed a high hazard of water erosion classification (USDA 1995; USDA, 1964).

Soil Map Unit	Soil Series	Surface runoff	Hazard of water erosion*
AsB	**Appling Sandy Loam, 2 to 6 Percent slopes, Eroded**	**Medium to very**	**Moderate**
CeB	**Cecil Sandy Clay Loam, 2 to 6 Percent slopes, Eroded**	**Medium to rapid**	**Severe**
CcC	Cecil Sandy Loam, 8 To 15 Percent Slopes	Medium to rapid	Severe
CeC	Cecil Sandy Clay Loam, 8 To 15 Percent Slopes, Eroded	Rapid	Very severe
CfB	**Cecil-Urban Land complex, 2 to 6 Percent slopes, Eroded**	**Medium to very**	**Severe**
CfC	**Cecil-Urban Land complex, 6 to 10 Percent slopes, Eroded**	**Medium**	**Severe**
EnB	**Enon Fine Sandy Loam, 2 To 6 Percent Slopes**	**Medium**	**Moderate**
EnC	**Enon Fine Sandy Loam, 8 To 15 Percent Slopes**	**Medium to rapid**	**Severe**
HsD	Hiwassee Loam, 15 To 25 Percent Slopes	Rapid	Very severe
HwB	**Hiwassee Loam, 2 to 6 Percent Slopes, Eroded**	**Medium to rapid**	**Severe**
HwC	Hiwassee Clay Loam, 8 To 15 Percent Slopes, Eroded	Rapid	Very severe
IrB	**Iredell loam, 2 to 6 Percent Slopes, Eroded**	**Medium**	**Moderate**
LaD	**Lloyd clay loam, 10 to 15 Percent Slopes, Severely Eroded**	**Rapid**	**Very severe**
LbB	**Lloyd loam, 2 to 6 Percent Slopes, Eroded**	**Medium**	**Moderate**
LbC	**Lloyd loam, 6 to 10 Percent Slopes, Eroded**	**Rapid**	**Severe**
MeB	**Mecklenburg Clay Loam, 2 To 8 Percent Slopes, Eroded**	**Slow or medium**	**Severe**
MeC	**Mecklenburg Clay Loam, 8 To 15 Percent Slopes, Eroded**	**Medium**	**Very severe**
PaC	Pacolet Sandy Loam, 8 To 15 Percent Slopes	Medium to rapid	Severe
PaD	Pacolet Sandy Loam, 15 To 25 Percent Slopes	Rapid	Very severe
PaE	Pacolet Sandy Loam, 25 To 45 Percent Slopes	Rapid	Very severe
PcB	Pacolet Sandy Clay Loam, 2 To 8 Percent Slopes, Eroded	Medium	Severe
PcC	Pacolet Sandy Clay Loam, 8 To 15 Percent Slopes, Eroded	Rapid	Very severe
PxC	Poindexter-Mocksville Complex, 8 To 15 Percent Slopes	Rapid	Severe
PxD	**Poindexter-Mocksville Complex, 15 To 25 Percent Slopes**	**Rapid**	**Very severe**
PxE	Poindexter-Mocksville Complex, 25 To 45 Percent Slopes	Rapid	Very severe
RnC	Rion-Wedowee Complex, 8 To 15 Percent Slopes	Rapid	Severe
VnB	Vance Sandy Clay Loam, 2 To 8 Percent Slopes, Eroded	Medium to rapid	Severe
VnC	Vance Sandy Clay Loam, 8 To 15 Percent Slopes, Eroded	Medium to rapid	Very severe
ZeC	Zion-Enon Complex, 8 To 15 Percent Slopes	Medium	Severe

* A description of each classification is presented in Table 2.

Table 2 "Hazard of water erosion" classifications as defined by the NRCS.

Hazard of Water Erosion Classification	Estimated Annual Erosion
None	0 tons per hectare
Slight	Less than 2.5 tons per hectare
Moderate	2.5 to 10 tons per hectare
Severe	10 to 25 tons per hectare
Very Severe	More than 25 tons per hectare

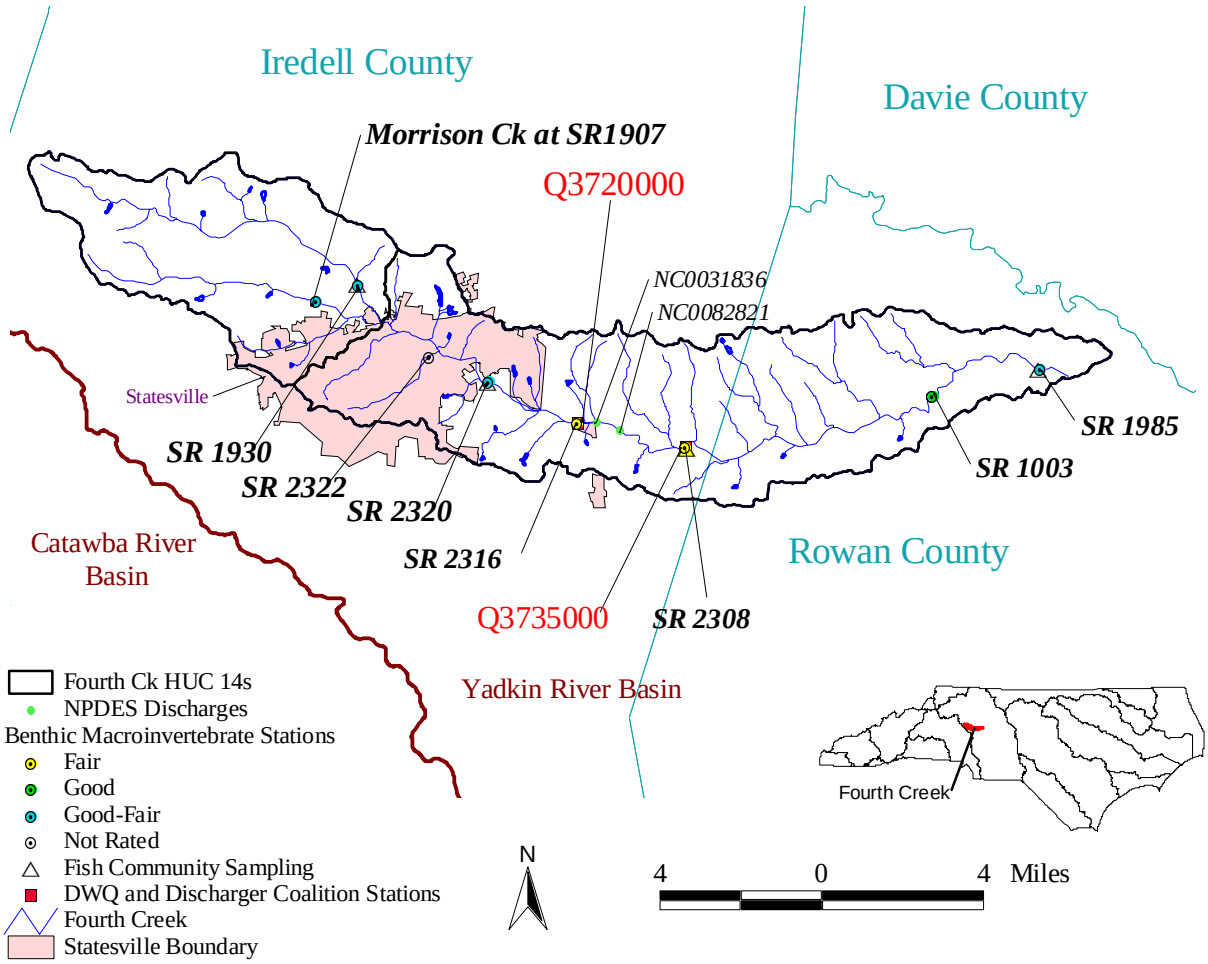
1.2 Water Quality Monitoring Program

Water quality monitoring for turbidity, performed by the NCDENR and Yadkin discharger coalition, has shown occasional violations of the water quality standard (24 out of 135 samples or 18%). As part of this TMDL, chemical and biological assessments were conducted throughout the Fourth Creek watershed to characterize the impact of turbidity impairment. Both chemical and biological assessments suggest significant water quality and habitat impairment and support the inclusion of Fourth Creek on the Impaired Waters List (2002 Integrated 305(b) and 303(d) Report).

1.2.1 Chemical Monitoring

Fourth Creek was listed as impaired on North Carolina's 2002 Integrated 303(d) and 305(b) based on monthly data collected between 1992 and 1996 at ambient monitoring station Q3735000 located at SR 2308 near the town of Elmwood. Two Yadkin-Pee Dee River Basin Association discharger coalition monitoring stations are located in the Fourth Creek watershed; one at station Q3735000 and one at an unnamed tributary of Fourth Creek at SR 2316 (Q3720000). The discharger coalition has been monitoring turbidity at these locations since 1998. Water quality monitoring performed by NCDENR for turbidity has shown occasional violations of the water quality standard. Similarly, monitoring by the Yadkin discharger coalition indicates occasional violations and supports the decision to list Fourth Creek based on turbidity impairment. Figure 4 shows the locations of the monitoring stations in the Fourth Creek watershed. Data from each of these monitoring stations during 1997-2003 are presented in Appendix A.

Figure 4. Fourth Creek watershed including areas of benthic macroinvertebrate and fish monitoring, ambient chemical monitoring, and wastewater treatment discharges.



The turbidity concentrations of the samples collected at the DWQ ambient monitoring station ranged from 3.7 NTU to 500 NTU with an average of 48 NTU, a median value of 14 NTU, and mode value of 10 NTU. The turbidity concentrations for the samples collected by the Yadkin discharger coalition at station Q3735000 ranged between 4 and 600 NTU with an average of 51 NTU and a median value of 15 NTU. The turbidity concentrations for the samples collected by the discharger coalition at station Q3720000 ranged between 4.3 and 880 with an average value of 54 NTU and a median value of 15 NTU.

1.2.2 Biological Monitoring

The DWQ maintains an extensive biological monitoring network of ambient stations. In the Fourth Creek watershed recent monitoring conducted by DWQs Environmental Sciences Branch has included assessment for basin wide monitoring plans (1996 and 2001), site specific biological studies below a WWTP point source discharge (1987, 1989, 2001, and 2003), and monitoring for biological stressors (2003). Most recently, in June and July 2003, an intensive monitoring effort was conducted that included benthic

macroinvertebrate populations, fish populations, physical and water chemistry characteristics, and site descriptions and instream and riparian habitats at six locations in the Fourth Creek watershed. These locations are shown in Figure 4. A summary of fish and benthic invertebrate results from this study are presented in Table 3.

Table 3 Biological and habitat ratings at the six monitoring stations in the Fourth Creek watershed.

Site/Assessment Location (see below descriptions)	Benthic macroinvertebrate	Fish	Habitat (1-100 scale)	Overall rating
1. At SR 1930	Good-Fair	Poor	42/41	Fair
2. At SR 2320	Good-Fair	Good-Fair	46/34	Good-Fair
3. At SR 2308	Fair	Poor	50/46	Fair
4. At ST 1985	Good-Fair	Poor	43/41	Fair
5. UT Fourth Creek	Not rated	---	72	Not rated
6. Morrison Creek	Good-Fair	---	37	Good-Fair

1. Fourth Creek Site No. 1 at SR 1930, north of Interstate 40 and above Statesville.
2. Fourth Creek Site No. 2 at SR 2320, east of Statesville. This site is upstream of the city's WWTP, but still receives urban runoff. The SR 2320 site replaced the historically sampled site above the WWTP (SR 2316) The new site is about three miles upstream of the SR 2316 site.
3. Fourth Creek Site No. 3 at SR 2308, southeast of Statesville and approximately three miles below the city's WWTP.
4. Fourth Creek Site No. 4 at SR 1985 in Rowan County, east of Statesville, approximately 15 miles below the city's WWTP, and one mile above its confluence with Third Creek. This site is intended to measure any potential recovery from the WWTP discharges and urban runoff from Statesville.
5. UT Fourth Creek at SR 2322. Most small streams draining the urbanized area were too small to sample. The largest of the tributaries (UT Fourth Creek at SR 2322) drained a highly urbanized section of Statesville.
6. Morrison Creek at SR 1907, above Statesville.

Most notable in this study was the widespread finding of stream bank erosion and habitat degradation. Instream and riparian habitats at all sites except the UT Fourth Creek were of low quality; the habitat scores were generally less than 50 (1 and 100 scale). Instream habitats were identified as severely degraded and were characterized as having bottom substrates of primarily sand, shallow and sand-filled pools, a general lack of gravel or cobble riffles, and very unstable, easily eroded banks. At all locations along Fourth Creek there remained repercussions of extremely high 2003 winter flows, including large woody debris and obstructions, sloughing and exposed banks with minimal stabilizing vegetation, recent bank erosion, and tires, plastics, lumber, and other domestic items in the stream and along the shoreline. Bank erosion was noted as a large contributor of sediment and habitat degradation. The study concludes by identifying a number of sources (including poor landuse practices, urbanization, and wastewater treatment discharges), all contributors to hydromodification that, in connection with highly erodable soils, has resulted in the current state of habitat degradation.

While this biological information is not used directly in calculation the TMDL, it will be a primary information source when implementing the load and wasteload reductions set forward in this TMDL.

1.3 Water Quality Target

Turbidity is a unit of measurement quantifying the degree to which light traveling through a water column is scattered by the suspended organic and inorganic particles. The scattering of light increases with a greater suspended load. Turbidity is commonly

measured in Nephelometric Turbidity Units (NTU), but may also be measured in Jackson Turbidity Units (JTU).

The NC DWQ has classified Fourth Creek and its tributaries as Class C waters. Class C waters are defined as "Waters protected for secondary recreation, fishing, wildlife, fish and aquatic life propagation and survival, agriculture and other uses suitable for Class C. Secondary recreation includes wading, boating, and other uses involving human body contact with water where such activities take place in an infrequent, unorganized, or incidental manner." The North Carolina fresh water quality standard for turbidity in Class C waters (T15A: NCAC 2B.0211 (3)k) states:

> *The turbidity in the receiving water shall not exceed 50 Nephelometric Turbidity Units (NTU) in streams not designated as trout waters and 10 NTU in streams, lakes or reservoirs designated as trout waters; for lakes and reservoirs not designated as trout waters, the turbidity shall not exceed 25 NTU; if turbidity exceeds these levels due to natural background conditions, the existing turbidity level cannot be increased. Compliance with this turbidity standard can be met when land management activities employ Best Management Practices (BMPs) [as defined by Rule .0202 of this Section] recommended by the Designated Nonpoint Source Agency [as defined by Rule .0202 of this Section]. BMPs must be in full compliance with all specifications governing the proper design, installation, operation and maintenance of such BMPs;*

The in-stream numeric target is the restoration objective that is expected to be reached by implementing the specified load reductions in this TMDL. The target allows for evaluation of progress toward the goal of reaching water quality standards for the impaired stream by comparing the in-stream data to the target. In the Fourth Creek watershed, the applicable water quality target is the 50 NTU standard.

2.0 Source Assessment

A source assessment is used to identify and characterize the known and suspected sources of turbidity in the Fourth Creek watershed. This section outlines the assessment completed for the purpose of developing this TMDL.

2.1 Assessment of Point Sources

Two categories are included under this discussion; NPDES-regulated municipal and industrial wastewater treatment facilities and NPDES general permitted facilities.

2.1.1 NPDES-Regulated Municipal and Industrial Wastewater Treatment Facilities

Discharges from wastewater treatment facilities may contribute sediment to receiving waters as total suspended solids (TSS) and/or turbidity. Municipal treatment plants and industrial treatment plants are required to meet surface water quality criteria for turbidity in their effluent. Since these facilities are routinely achieving surface water quality criteria, this TMDL will not impose additional limits to current practices or existing effluent limits for POTWs and industrial treatment plants. When effluent turbidity

concentrations exceed surface water quality criteria, and result in permit violations, action will be taken through the NPDES unit of North Carolina's Division of Water Quality.

Currently, there are two NPDES permitted wastewater treatment plant dischargers located in the Fourth Creek watershed. The Statesville WWTP (NC0031836) has a 4.0 MGD flow limit and a TSS effluent limit of 30 mg/l on a monthly average and 45 mg/L on a weekly average. Southern States Cooperative (NC0082821) has a 0.114 MGD flow limit and a TSS effluent limit of 30 mg/l on a monthly average and 45 mg/L as a daily maximum. Average monthly TSS values for both facilities are available in Appendix B.

2.1.2 NPDES General Permits

Twenty-six general permitted facilities are located in the Fourth Creek watershed. A list of these facilities is presented in Appendix C. General permitted facilities are not subject to effluent TSS or turbidity limitations nor are they required to monitor for TSS or turbidity. Thus, this TMDL will not allocate a load reduction for general permitted facilities.

A number of manufacturing facilities are located in the Fourth Creek watershed. Included are operations involving granite mining, metal processing, paper milling, textile, paperboard and rubber processing, food and tobacco processing, paint processing, auto junk yards, landfills, asphalt paving, furniture production, and homebuilding construction. Sediment loading from NPDES-regulated construction activities are considered point sources of sediments to surface waters. Discharges from regulated mining activities may also contribute sediment to surface waters as TSS. Discharges from active mines may result from dewatering operations and/or in response to storm events. Discharges from permitted inactive mines are only in response to storm events. Inactive sites with successful surface reclamation contribute relatively little solids loading. Sediment loading in the Fourth Creek watershed that is a result of mining activity is not specifically addressed as part of this TMDL.

2.2 Assessment of Nonpoint and Stormwater Sources

Nonpoint and stormwater sources include various erosional processes, including sheetwash, gully and rill erosion, wind, landslides, dry ravel, and human excavation that contribute sediment during storm or runoff events. Sediments are also often produced as a result of stream channel and bank erosion and channel disturbance (EPA, 1999).

Nonpoint sources account for the vast majority of sediment loading to surface waters. A few of these sources include:

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

- Erosion from agricultural activities. This erosion can be 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 streambank damage and erosion.

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

- Erosion from unpaved roadways can be a significant source of sediment to rivers and streams. Exposed soils, high runoff velocities and volumes and poor road compaction all increase the potential for erosion.

- Runoff from active or abandoned mines may be a significant source of solids loading. Mining activities typically involve 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 erosion.

- Streambank and streambed erosion processes often contribute a significant portion of the overall sediment budget. The consequence of increased streambank erosion is both water quality degradation as well as increased stream channel instability and accelerated sediment yields. Streambank erosion can be traced to two major factors: stream bank characteristics (erodibility potential) and hydraulic/gravitational forces (Rosgen, online). The predominant processes of stream bank erosion include: surface erosion, mass failure (planar and rotational), fluvial entrainment (particle detachment by flowing water, generally at the bank toe), freeze-thaw, dry ravel, ice scour, liquifaction/collapse, positive pore water pressure, both saturated and unsaturated failures and soil piping.

2.2.1 Stormwater Discharges in the Fourth Creek Basin

Urban runoff can contribute significant amounts of turbidity, however, much of this runoff is designed to be regulated under the Storm Water Phase II Final Rule (EPA, 2000). Amendments were made to the Clean Water Act in 1990 and most recently in 1999 pertaining to permit requirements for stormwater dischargers associated with industrial activities and municipal separate storm sewer systems (MS4s). MS4s can discharge sediment to waterbodies in response to storm events through road drainage systems, curb and gutter systems, ditches, and storm drains. This rule applies to a cities or counties which own or operate a municipal separate storm sewer system (MS4). As a result of the Phase II Rule, MS4 owners are required to obtain a National Point Source Discharge Elimination System (NPDES) permit for their stormwater discharges to surface waters. Currently, the City of Statesville does not fall under the Phase II Rule, however, it is clear that Statesville causes and contributes to impairment in Fourth Creek and should initiate a storm water management program.

2.2.2 Load Duration Curve

When streamflow gage information is available, a load duration curve (LDC) is useful in identifying and differentiating between storm-driven and steady-input sources. Turbidity is measured in NTUs, not a concentration, so another parameter that is measured as a concentration must be used to represent turbidity loadings in the watershed. To accomplish this, correlation coefficients were determined for all parameters at the Fourth Creek ambient station # Q3735000. Highest correlations for turbidity are shown below in Table 4.

Table 4 Correlation coefficients for turbidity at DWQ ambient station # Q3735000.

Parameter and Units	Correlation Coefficient
Total Precipitation (inches per day)	0.85
Total Suspended Solids (mg/L)	**0.92**
Total Chromium (ug/L as Cr)	0.67
Total Copper (ug/L as Cu)	0.83
Total Iron (ug/L as Fe)	0.88
Total Nickel (ug/L as Ni)	0.61
Total Zinc (ug/L as Zn)	0.60
Total Aluminum (ug/L as Al)	0.84

Correlation coefficients were determined using the below formula:

$$\rho_{xy} = \frac{\frac{1}{n}\sum_{i=1}^{n}(x_i - \mu_x)(y_i - \mu_y)}{\sigma_x \cdot \sigma_y}$$

where:

$-1 \le \rho_{xy} \le 1$

Of the available parameters, the strongest correlation is present between turbidity and TSS. High correlations between turbidity and precipitation, and turbidity and iron support the turbidity –TSS correlation and suggest a strong relationship between storm driven TSS inputs that correspond to elevated turbidity measurements. Given this information, a linear regression was developed between turbidity and TSS to allow for the use of TSS values in developing a LDC. This correlation is shown in Figure 5. An example LDC using the 50 NTU criterion is presented in Figure 6. Steps used to develop the LDC are presented in Appendix D.

Figure 5. Linear regression for TSS-Turbidity at Fourth Creek at SR 2308 near Elmwood, NC (USGS station #02120780) using data collected during years 1997-2003.

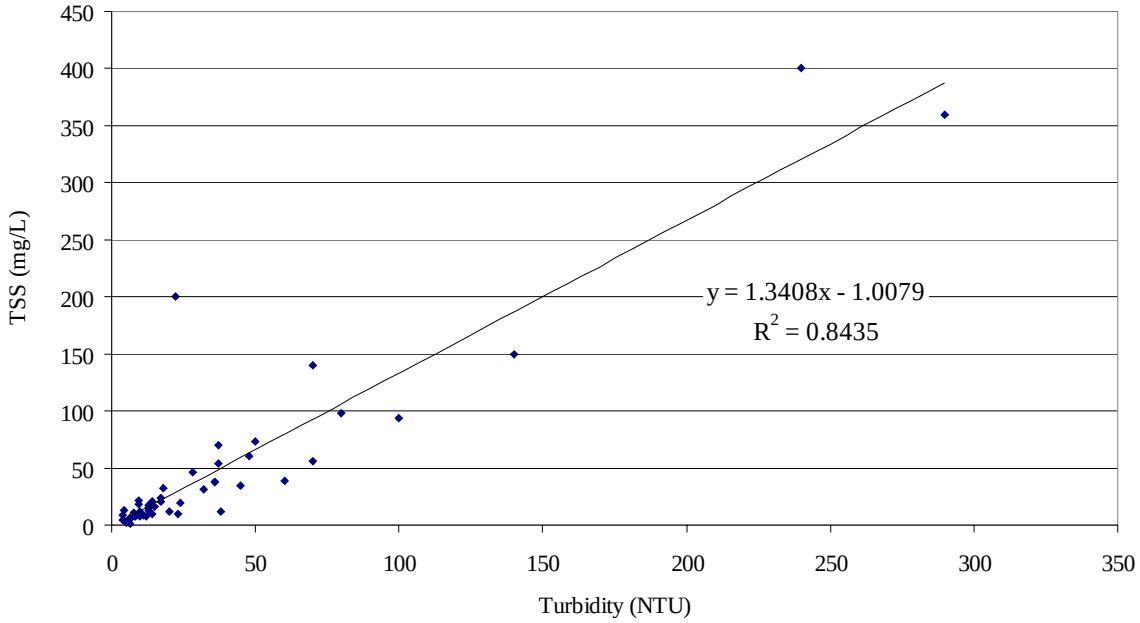
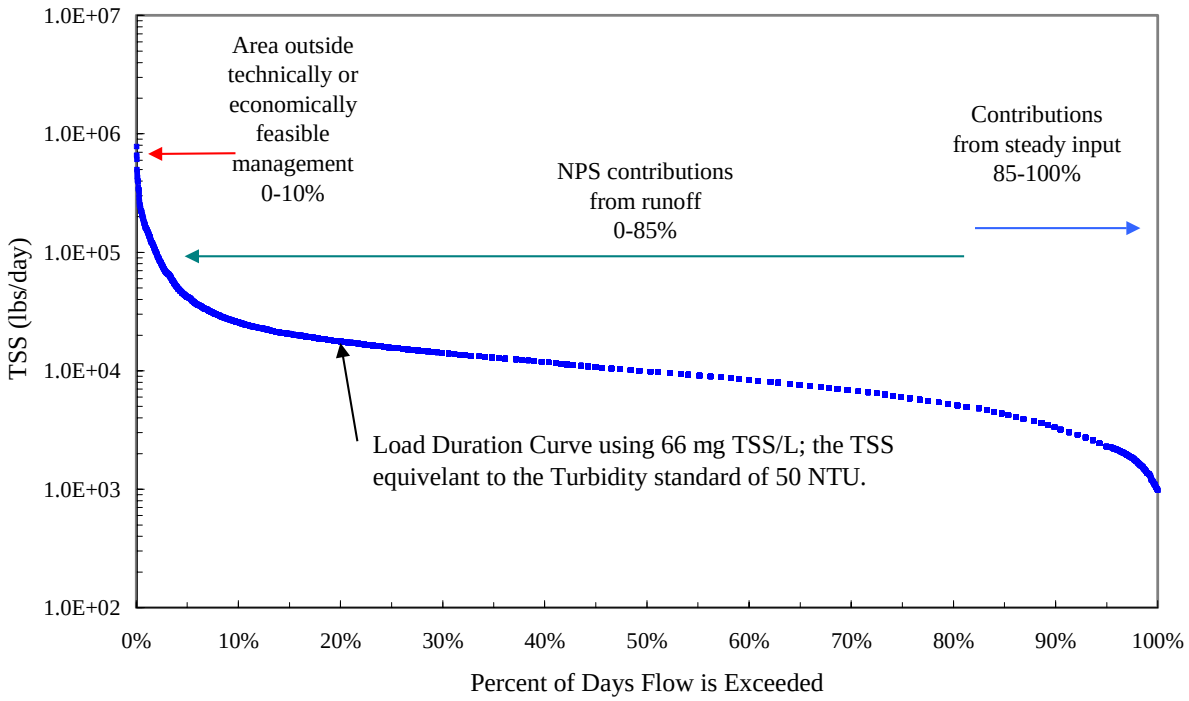


Figure 6. Example load duration curve.



Values that plot below the LDC represent samples below the concentration threshold whereas values that plot above represent samples that exceed the concentration threshold. Loads that plot above the curve and in the region between 85 and 100 percent of days in

which flow is exceeded indicate a steady-input source contribution. Loads that plot in the region between 10 and 70 percent suggest the presence of storm-driven source contributions. A combination of both storm-driven and steady-input sources occurs in the transition zone between 70 and 85 percent. Loads that plot above 99 percent or below 10 percent represent values occurring during either extreme low or high flows conditions and are thus considered to be outside the region of technically and economically feasible management.

2.3 Data Sources

The NCDENR's Geographic Information System (GIS) was used extensively to describe the Fourth Creek watershed characteristics. The following is general information regarding the data used to describe the watershed:

- **Ambient chemical monitoring locations**: NC DENR Div of Water Quality, Water Quality Section, 9/30/2000, Ambient Water Quality Monitoring Sites: NC DENR Div of Water Quality, Water Quality Section, Raleigh, North Carolina.
- **Biological monitoring locations**: NC DENR Clean Water Management Trust Fund, NC DENR - Div. of Water Quality, Biological Assessment Unit, 11/15/2000, Benthic monitoring results: NC DENR - Div. of Water Quality, Biological Assessment Unit, Raleigh, North Carolina.
- **City of Statesville Boundary**: NC Department of Transportation-GIS Unit, 7/17/2000, Municipal Boundaries - Powell Bill 1999: NC Department of Transportation, Raleigh, North Carolina.
- **County boundaries**: information NC Center for Geographic Information & Analysis, 12/01/1998, Boundaries - County (1:100,000): NC Center for Geographic Information & Analysis, Raleigh, North Carolina.
- **Detailed stream coverage**: North Carolina Center for Geographic Information and Analysis, 4/19/2001, Hydrography (1:24,000): North Carolina Center for Geographic Information and Analysis, Raleigh, NC.
- **Hydrologic Units**: USDA, Natural Resources Conservation Service, 12/01/1998, Hydrologic Units - North Carolina River Basins: USDA, Natural Resources Conservation Service, Raleigh, North Carolina..
- **Land use/Land cover information**: Earth Satellite Corporation (EarthSat), 6/12/1998, Statewide Land Cover - 1996: EarthSat, Raleigh, North Carolina.
- **NPDES Permitted Facilities**: NC DENR Division of Water Quality, Planning Branch, 10/11/2000, National Pollutant Discharge Elimination System Sites: NC DENR Division of Water Quality, Planning Branch, Raleigh, North Carolina.
- **Roads**: NC Department of Transportation - GIS Unit, 9/21/1999, Transportation - NCDOT Roads (1:24,000): NC Department of Transportation, Raleigh, NC.
- **Stream Gaging Stations**: NC DENR-Division of Water Resources, 12/01/1998, Stream Gaging Stations: NC DENR-Division of Water Resources, Raleigh, North Carolina.
- **Streamflow gage data** was obtained online from the United States Geological Survey (USGS) at: http://nc.water.usgs.gov/ .

3.0 Technical Approach

A LDC and mass-balance approach was chosen to calculate this TMDL for turbidity in Fourth Creek (ASIWPCA, 2002; Kansas, 2002; Sheely, 2002). The load duration curve approach is advantageous because it is applicable in the initial phases of source identification, in water quality assessment to quantifying the magnitude of exceedence during critical conditions, and in implementation planning. Given this, the LDC/mass balance approach was used to identify source types, specify the assimilative capacity of the stream, and quantify the necessary load reduction needed to meet water quality standards

3.1 TMDL Endpoints

Given that the turbidity standard is expressed as NTU, a correlation between TSS and turbidity was necessary in applying the LDC method. A discussion surrounding the selection of TSS as a surrogate for turbidity is presented in Section 2.2.2. As discussed, a correlation of 0.92 exists between the TSS – turbidity data, and in using a linear regression, the following relationship is observed:

TSS = (1.3408 * Turbidity) –1.0079
R^2 = 0.84

Thus, the Surface Water Quality Standard turbidity target of 50 NTU in Class C waters correlates to a TSS value of 66.0 mg/L. The results from this regression are presented in Figure 5.

3.2 Load Duration Curve

A load duration curve is based on comparison of the frequency of a given flow even with its associated water quality load. As previously discussed, flow gage information is not available in the Fourth Creek watershed, thus, daily flow data (during April 1979 through August 2003) from a nearby USGS Station #02120780, Second Creek near Barber, was used to establish the historic flow regimes and define ranges for the high, typical, and low flow conditions. Flows at the Fourth Creek ambient station at SR 2308 were estimated based on a drainage area ratio between USGS station #02120780 and the watershed area upstream of SR 2308. Flows were also adjusted to account for point sources in each watershed by subtracting the average point source flow in Second Ck and adding the flows from the effluent of the Fourth Ck WWTP (NC0031836) and the Southern States Cooperative (NC0082821). Table 5 presents flow statistics for station #02120780 obtained from the USGS and LDC analysis.

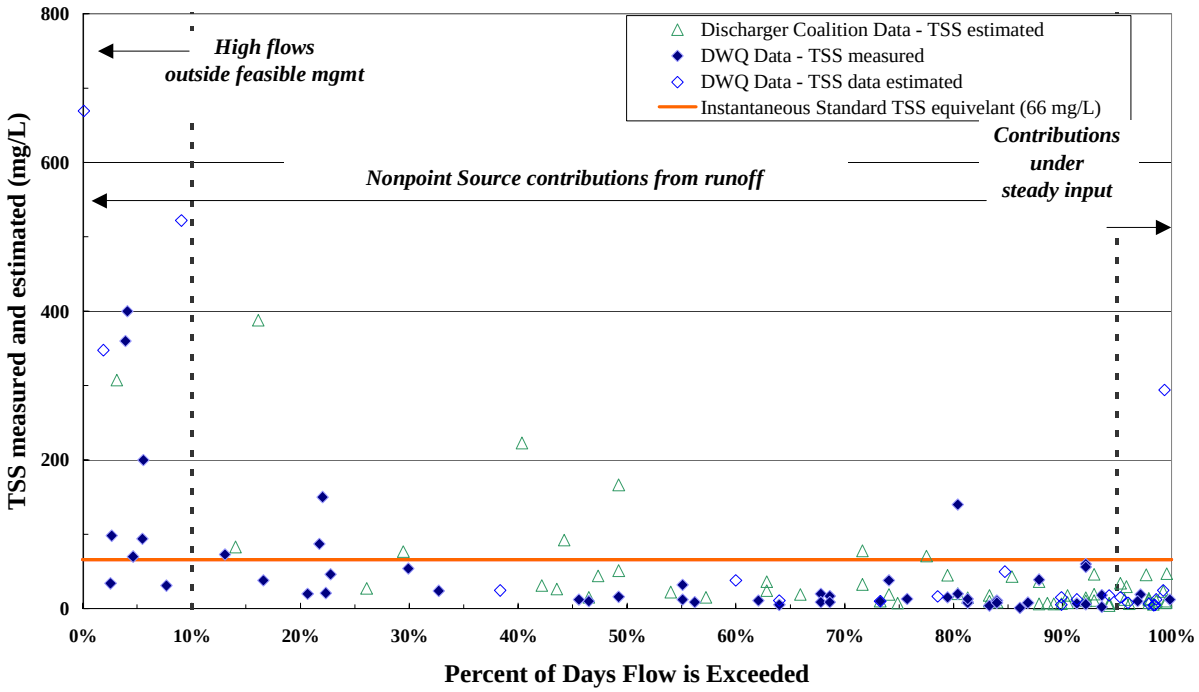
Table 5 Flow statistics for USGS gage station #02120780 during years 1979-2003.

Parameter	Value
Drainage Area	118 mi^2
Average flow	104 cfs
Minimum flow	0.5 cfs
Maximum flow	5,280 cfs
High Flow Range (> 10% exceed)	> 1,050 cfs
Nonpoint Source Contributions from runoff (10-85%)	11- 1,050 cfs

Parameter	Value
Low Flow Range (95-100%)	< 4.6 cfs

Using the drainage-area and point source adjusted flow values, flow duration graphs were developed for the Fourth Creek ambient station. Monitoring data was then matched up with the flow duration ranking based on the collection date. Figure 7 shows TSS data as a function of estimated flow duration at the Fourth Creek ambient station. As shown in Figure 7, the majority of Surface Water Quality violations occur under low percent exceedence flows and are likely the result of storm events. Infrequently, exceedences also occur under mid-range and low flow conditions.

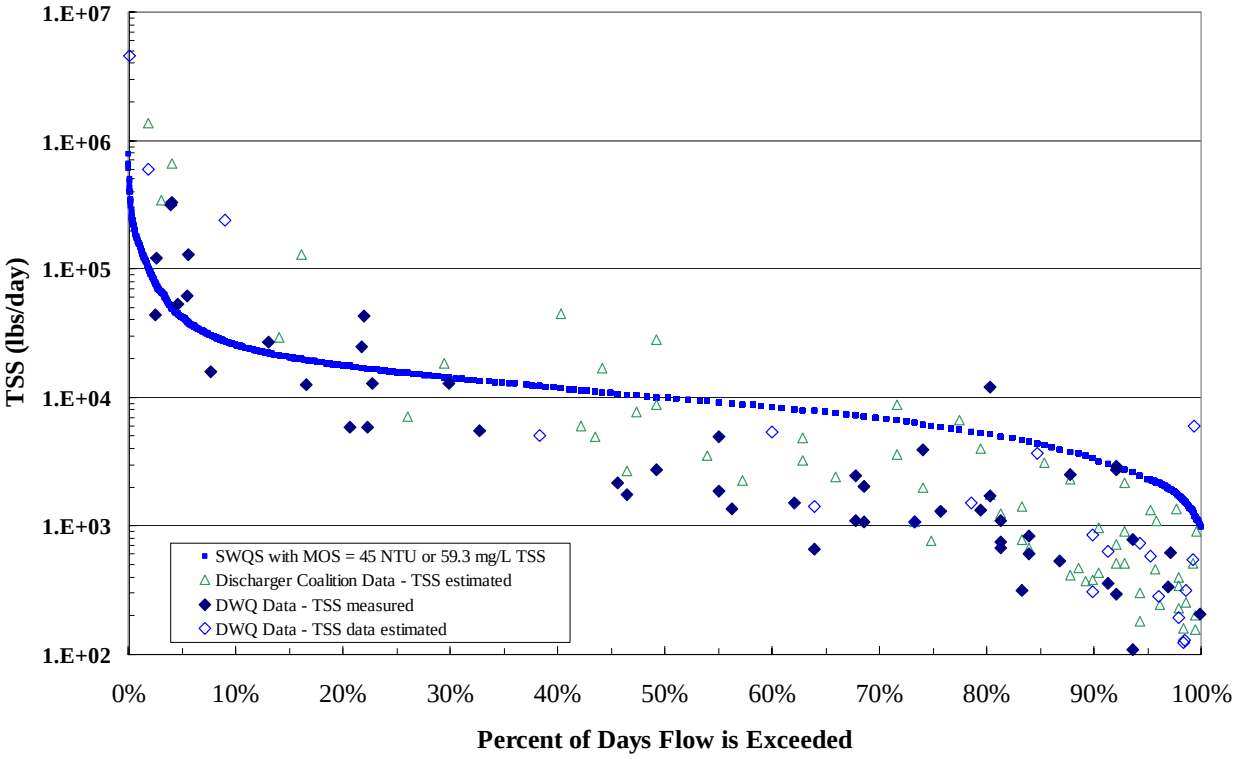
Figure 7. Fourth Creek at USGS station 02120780 (Fourth Creek at SR 2308 near Elmwood); Flow Duration and TSS Concentration during years 1997-2003.



3.3 Assimilative Capacity

The assimilative capacity is the maximum level of pollutant allowable while achieving the water quality goal. As discussed in section 2.2.2, TSS was selected as a surrogate for turbidity in this TMDL. To determine the TSS assimilative capacity, the TSS concentration equivalent to the turbidity standard of 50 NTU (66 mg TSS/L) was multiplied by the full range of measured flow values. The assimilative capacity is shown graphically in the form of a blue line in Figure 8.

Figure 8. Fourth Creek at USGS station 02120780 (Fourth Creek at SR 2308 near Elmwood); Load Duration Curve using water quality data from years 1997-2003.



4.0 TMDL Calculation

A Total Maximum Daily Load (TMDL) represents the assimilative or carrying capacity of a waterbody, taking into consideration point and nonpoint sources of pollutants of concern, natural background and surface water withdrawals. A TMDL quantifies the amount of a pollutant a water body can assimilate without violating a state's water quality standards (in our case, Class C freshwaters) and allocates that load capacity to known point and nonpoint sources in the form of wasteload allocations (WLAs), load allocations (LAs). In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. This definition is expressed by the following equation:

$$\mathbf{TMDL = \Sigma WLAs + \Sigma LAs + MOS}$$

A TMDL is developed as a mechanism for identifying all the contributors to surface water quality impacts and setting goals for load reductions for pollutants of concern as necessary to meet the SWQS. The Code of Federal Regulations (40 CFR §130.2(1)) states that TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measures. This TMDL will be expressed in terms of mass per time and a percent reduction that is calculated based on estimated stream flow and both estimated

and measured instream TSS concentrations. At total of 135 TSS values were used in this TMDL analysis; 74 collected during 1997-2003 by the DWQ and 61 collected by the Yadkin River Discharger Coalition. Of the 74 DWQ TSS values, 53 are actual measurements and 21 are estimated based on the turbidity-TSS linear regression. All of the 61 TSS values in the Discharger Coalition dataset are estimated based on the turbidity-TSS linear regression.

4.1 TMDL Endpoints

TMDL endpoints represent the instream water quality targets used in quantifying TMDLs and their individual components. As discussed in Section 3, turbidity as a measure is not applicable to the estimation of loading to a stream. TSS was selected as a surrogate measure for turbidity. Based on the regression analysis, a TSS limit of 66 mg/L was determined to be equivalent to a turbidity measure of 50 NTU. As will be discussed in Section 4.4, a 10% explicit margin of safety was applied to the endpoint and resulted in a reduction of the target value from 50 NTU to 45 NTU (66 mg TSS/L to 59.3 mg TSS/L).

4.2 Critical Conditions

Elevated turbidity concentrations occur predominantly during high flow conditions. However, five of the measurements over the 50 NTU standard were taken under flows that occur no less than 50 % of the time.

4.3 Seasonal Variation

Exceedences to the 50 NTU turbidity standard during 1997-2003 have occurred during all months of the year with the exception of December. During 1997-2003, the majority of violations occurred during the late winter and spring months. Table 6 shows the number of violations in each month during the 1997-2003 period. Seasonal variation is considered in this TMDL by applying the load reduction to all seasons.

Table 6 Number of violations to the 50 NTU standard for each month during the 1997-2003 period.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Violations (#)	3	4	4	5	2	2	2	1	1	1	1	0

4.4 Margin of Safety

A Margin of Safety (MOS) is provided to account for "lack of knowledge concerning the relationship between effluent limitations and water quality" (40 CFR 130.7(c)). The MOS may be incorporated into a TMDL either implicitly, through the use of conservative assumptions to develop the allocations, or explicitly through a reduction in the TMDL target. For this TMDL, an explicit margin of safety was incorporated in the analysis by setting the TMDL target at 45 NTU, or equivalent 59.3 mg TSS/L, which is 10% lower than the water quality target of 50 NTU or equivalent 66 mg TSS/L.

4.5 Reserve Capacity

Reserve capacity is an optional means of reserving a portion of the loading capacity to allow for future growth. Reserve capacities are not included at this time. The loading capacity of each stream is expressed as a function of the current load (Section 4.0), and

both WLAs and LAs are expressed as reductions for the entire Fourth Creek watershed. Therefore, the reductions from current levels, outlined in this TMDL, must be attained in consideration of any new sources that may accompany future development. Strategies for source reduction will apply equally to new development as to existing development.

4.6 TMDL Calculation

As presented in Section 3.0, loading curves were used to identify the target and reduction necessary for turbidity in Fourth Creek. The load duration curve presents a maximum allowable concentration of 59.3 mg TSS/L (value includes a 10% MOS and is equivalent to 45 NTU) and identifies a maximum allowable load under any given flow experienced in Fourth Creek. The TMDL calculation focuses on measurements observed under a range of normal or expected flow conditions and excludes data collected under extremely high flows (occurring less than 10% of the time) and low flows (occurring more than 95% of the time). While data obtained under extreme flow conditions are not used to develop the TMDL, they may be appropriate for decision making during TMDL implementation.

Data collected under flows that occur between 10% and 95% of the time that exceeded either the 50 NTU or 66 mg TSS/L were used to calculate the TMDL. An exponential regression line was fit to these values and was used to estimate the corresponding TSS load at each percent between 10% and 95%. Allowable loading was also calculated at each percentage between 10% and 95% based on the MOS-adjusted target concentration. An overall load reduction of 47% was determined by calculating the average load reduction and comparing it to the average target load at all flows between 10% and 95%. The target and regression curves are shown in Figure 9. The average existing and target loadings estimated at each flow interval are presented in Appendix E and summarized in Table 7. The average existing TSS load of 19,703 lbs TSS/day, identified in Table 7, is equivalent to an average turbidity value of 75.7 NTU.

Figure 9. Fourth Creek at USGS station 02120780 (Fourth Creek at SR 2308 near Elmwood); Load Duration Curve with Regression line using water quality from years 1997-2003.

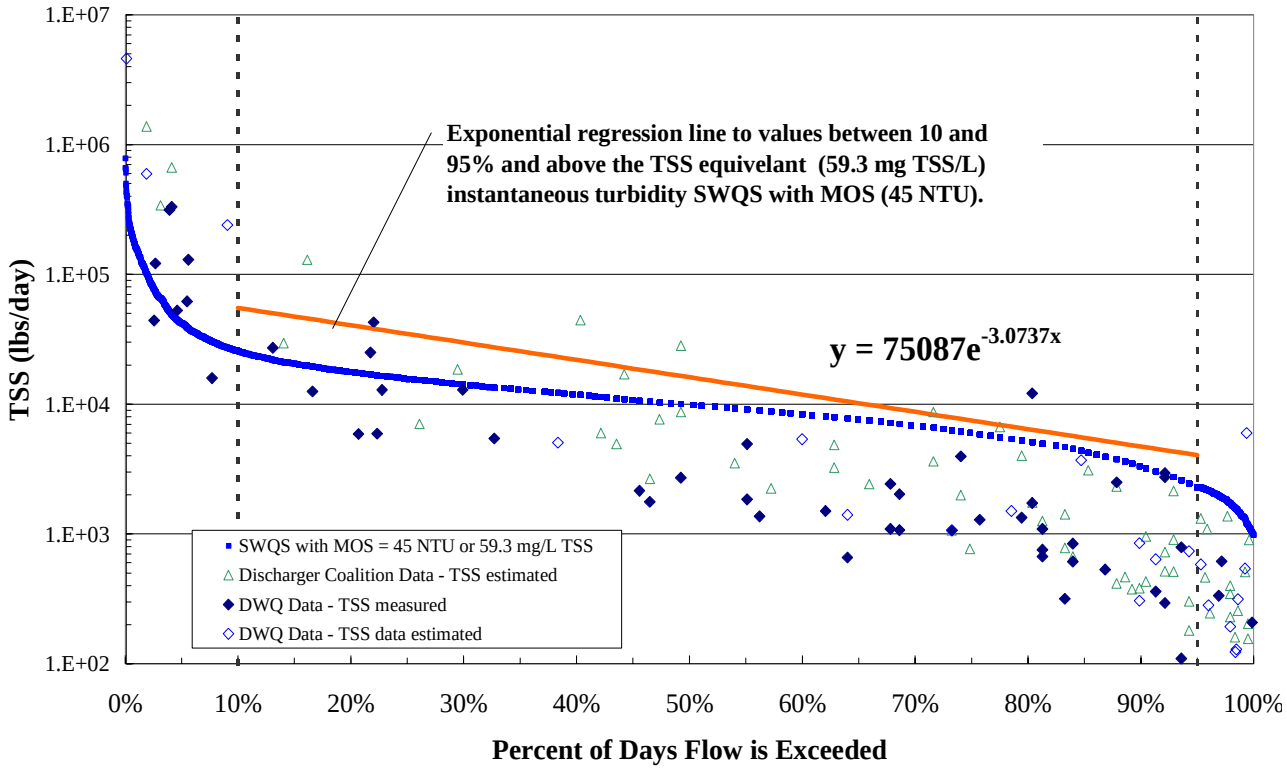


Table 7 Unallocated TMDL load and associated percent reduction

Target Concentration with MOS (mg/L TSS)	Existing Load (Average, lbs/day)	Target Load (Average, lbs/day)	Reduction Required (Percent)
59.3	19,703	10,519	47%

4.7 Wasteload and Load Allocations

Additional analysis is required to address the TMDL reduction by identifying point and nonpoint contributors of turbidity and calculating wasteload and load allocations. WLAs are hereby established for all NPDES-regulated point sources, while LAs are established for all stormwater sources that are not subject to NPDES regulation, and for all nonpoint sources.

As previously discussed, two NPDES-permitted facilities are located in the Fourth Creek watershed. Both facilities are subject to monthly TSS effluent limitations of 30 mg TSS/L. As such, this TMDL will not result in changes to these limits. For the purposes of this TMDL, a wasteload allocation will be apportioned based on the maximum permitted load allowable at each NPDES facility.

To apportion the TMDL to WLAs and LAs, additional analysis beyond the LDC method is necessary. As earlier noted, Fourth Creek is primarily composed of agricultural and forested land uses. Given this, urban stormwater flows from the city of Statesville are known to have a significant impact on instream turbidity concentrations. Percent land use in association with relative loading rates associated with that land use have been applied previously in identifying wasteload and load allocations (NCDWQ, 2003) and a similar method will be used to determine appropriate WLAs and LAs for this TMDL.

A number of studies have attempted to quantify pollutant loading relative to land use. One such study, conducted by the USGS, estimated pollutant loads from nine subwatersheds in the Charlotte area (USGS, 1999). Streamflow and water-quality data were collected at nine sites in the city of Charlotte and Mecklenburg County, North Carolina, during 1993-97. Six of the basins drained areas having relatively homogeneous land use and were less than 0.3 square mile in size; the other three basins had mixed land use. Sediment yields at the nine sites ranged from 77 tons per square mile per year in a residential basin to 4,700 tons per square mile per year at the developing basin. The application of the USGS results of this report is appropriate given the close proximity of the two study sites and the common landuses involved in each. Relative pollutant contributions from different landuses in the USGS report are presented in Appendix F.

For this TMDL, landuse-specific sediment loading estimates from the USGS (1999) study were categorized as either urban or rural, and the relative percent TSS contribution was determined for both land use types. The resulting relative percent TSS contributions were combined with the Fourth Creek landuse distribution to estimate the overall relative loading ratios for urban and rural areas. These results are presented in Table 8. The city of Statesville constitutes nearly all of the urban land use in the Fourth Creek watershed. While the boundary of the city of Statesville constitutes over 16.4% of the Fourth Creek watershed, the 1993-94 land use/land cover classification identifies 6.9% of the total area as "urban" because of the presence of parks, vegetation, and other mixed land uses in the boundary of Statesville. For the purposes of this TMDL, the Statesville boundary (16.4%) was used to calculate the urban area and the remainder of the watershed is characterized as rural.

Table 8 Relative Pollutant concentrations using USGS (1999) study and Fourth Creek landuse.

Landuse	TSS load (tons/mi^2/yr) USGS (1999) study	Landuse Percent from Fourth Creek	TSS Loading Ratio for Fourth Creek
Urban	1071	16.4%	11%
Rural	1688	83.6%	89%

Wasteload allocations for NC0031836 and NC0082821 are based on permitted flow and effluent TSS limits and do not result in additional reductions for these facilities. Load allocations for urban and rural landuses were determined by first subtracting the WWTP

point source loads (combined 1030 lbs/day) from the overall TMDL load (10,519 lbs/day) and multiplying the resulting TMDL load (9,489 lbs/day) by the associated TSS loading ratio (11% for urban, 89% for rural). The resulting load and wasteload allocations are presented in Table 9.

Table 9 Fourth Creek TMDL Wasteload and Load Allocations for Turbidity expressed as lbs/day TSS.

TMDL Allocations	TSS Load (lbs/day)
Existing	**19,703**
WLA - NC0031836 (4 MGD, 30 mg TSS/L limit)	**1,001**
WLA - NC0082821 (0.114 MGD, 30 mg TSS/L limit)	**29**
Sum of WLAs	*1,030*
LA – Urban	**1,044**
LA – Rural (Non-Urban)	**8,445**
Sum of LAs	*9,489*
MOS	**Explicit 10%**
TMDL	**10,519**
TMDL – Percent Reduction Required	**47%**

5.0 Follow – up Monitoring

Turbidity monitoring will continue on a monthly interval at the ambient monitoring station at SR2308 near Elmwood and will allow for the evaluation of progress towards the goal of reaching water quality standards. Short-term flow monitoring at the Fourth Creek at SR2308 near Elmwood is currently underway for the purpose of increasing the accuracy of estimating flows in Fourth Creek to assist in verifying an appropriate near-by station for future flow estimation. Additional monitoring could focus on identifying critical areas of streambank erosion and turbidity source assessment in the watershed. This would further aid in the evaluation of the progress towards meeting the water quality standard.

6.0 Implementation

Turbidity impairments in the Fourth Creek watershed are primarily due to excessive stream channel and bank erosion. This erosion is, in part, a result of higher flows and volumes associated with increased urbanization and impervious surface in the Fourth Creek watershed. Enforcement of stormwater BMP requirements for construction sites, education on farm practices, and consideration of urban stormwater controls for sediment are potential management options for improving turbidity levels. Other TSS sources include runoff from disturbed landuses, such as agriculture and construction areas where conversion from rural to urban uses is occurring. While stormwater controls are required on construction sites, significant loadings can occur due to initial periods of land

disturbance before controls are in place or during high rainfall periods during which the controls are inadequate. North Carolina Phase II rules require development, implementation, and enforcement of an erosion and sediment control program for construction activities that disturb one or more acres of land. In addition, Phase II rules require the development, implementation, and enforcement of a program to address discharges of post-construction storm water runoff from new development and redevelopment areas.

Implementation of conservation management plans and best management practices are the best means of controlling agricultural sources of suspended solids. Several programs are available to assist farmers in the development and implementation of conservation management plans and best management practices. The Natural Resource Conservation Service is the primary source of assistance for landowners in the development of resource management pertaining to soil conservation, water quality improvement, wildlife habitat enhancement, and irrigation water management. The USDA Farm Services Agency performs most of the funding assistance. All agricultural technical assistance is coordinated through the locally led Naturally Resource Conservation Service offices (Soil Conservation Districts). The funding programs include:

- **The Environmental Quality Incentive Program (EQIP)** is designed to provide technical, financial, and educational assistance to farmers/producers for conservation practices that address natural resource concerns, such as water quality. Practices under this program include integrated crop management, grazing land management, well sealing, erosion control systems, agri-chemical handling facilities, vegetative filter strips/riparian buffers, animal waste management facilities and irrigation systems.

- **The Conservation Reserve Program (CRP)** is designed to provide technical and financial assistance to farmers/producers to address the agricultural impacts on water quality and to maintain and improve wildlife habitat. CRP practices include the establishment of filter strips, riparian buffers and permanent wildlife habitats. This program provides the basis for the Conservation Reserve Enhancement Program (CREP). In 1999 The North Carolina DENR Departments of Environmental Protection and Agriculture, in partnership with Commodity Credit Corporation (CCC), submitted a proposal to the USDA to offer financial incentives for agricultural landowners to voluntarily implement conservation practices on agricultural lands through CREP. The goals for this program are to significantly reduce the amount of nutrients entering estuaries from agricultural sources through a voluntary, incentive-based program; to assist North Carolina in achieving the nutrient reduction goals for agriculture in the area; to significantly reduce the amount of sediment entering water courses; to enhance habitat for a range of threatened and endangered species dependent on riparian areas; and to decrease excess pulses of freshwater in primary nursery areas. NC CREP will be part of the USDA's Conservation Reserve Program (CRP). The enrollment of farmland into CREP in North Carolina is expected to improve stream health

through the installation of water quality conservation practices on North Carolina farmland.

- **The Soil & Water Conservation Cost-Sharing Program** is available to participants in a Farmland Preservation Program pursuant to the Agriculture Retention and Development Act. A Farmland Preservation Program (FPP) means any voluntary FPP or municipally approved FPP, the duration of which is at least 8 years, which has as its principal purpose as long-term preservation of significant masses of reasonably contiguous agricultural land within agricultural development areas. The maintenance and support of increased agricultural production must be the first priority use of the land. Eligible practices include erosion control, animal waste control facilities, and water management practices. Cost sharing is provided for up to 50% of the cost to establish eligible practices.

Management Strategies

Management measures are "economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint and stormwater sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint and stormwater source pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives" (USEPA, 1993). Development of effective management measures depends on accurate source assessment. A few projects recently completed, underway and planned are identified below.

The Iredell Soil and Water Conservation District (SWCD), located in Statesville, Iredell County, has been active in assessing issues related to sediment loading in Fourth Creek. In 1999 the SWCD conducted a sediment survey to identify sediment sources and provide a description of the landuses and sediment BMPs adjacent to Fourth Ck and in the watershed (Soil and Water Conservation District, 1999). An action plan was also developed and includes recommendations, goals, and estimates of associated financial expenditures needed for remediation to problems in-stream, in adjacent land areas, and in the watershed as a whole. Lastly, barriers and limiting factors toward achieving the recommended goals are identified in the action plan. This report is provided in Appendix G.

The Division of Water Quality, in cooperation with the Iredell SWCD, and USDA, NRCS in Statesville, NC, is supporting a Fourth Creek fecal coliform TMDL implementation project aimed at meeting the objectives for fecal coliform reduction as outlined in the 2001 TMDL report on fecal coliform in Fourth Creek (DWQ, 2001). The main goal of this project is to reduce fecal coliform loading to Fourth Creek from agricultural sources by providing alternative water sources and excluding grazing cattle from the stream. While not specifically addressing turbidity or TSS, management measures taken to reduce bacterial loads will likely have the direct effect of reducing sediment erosion and resuspension. A few of such actions in the implementation plan include: construction of fencing along 30,000 feet of stream bank, reestablishing 2,000

feet of riparian vegetation in the buffer zone to reduce erosion, 2 acres of tree planting, 3 acres of critical area seeding/treatment, and construction of 12 stream crossings.

Fourth Creek and the lower South Yadkin River watersheds (HUCs 3040102030010 and 3040102030020) are two of 55 watersheds in the Yadkin-Pee Dee River basin that have been identified by the NC Wetlands Restoration Program (NCWRP) as areas with the greatest need and opportunity for stream and wetland restoration efforts. This watershed will be given higher priority than a non-targeted watershed for the implementation of NCWRP restoration projects.

7.0 Public Participation

The City of Statesville in Iredell County and Rowan County has been notified of the Fourth Creek turbidity TMDL. The county extension service and soil and water conservation districts will be involved in the implementation portion of the TMDL. A public meeting will be held in the watershed on March 26, 2004 to discuss the TMDL. The TMDL has been publicly noticed and comments on the TMDL will be accepted over a period of at least thirty days.

8.0 Additional Information

Further information concerning North Carolina's TMDL program can be found on the Internet at the Division of Water Quality website:
http://h2o.enr.state.nc.us/tmdl/index.htm

Technical questions regarding this TMDL should be directed to the following members of the DWQ Modeling/TMDL Unit:

Brian Jacobson, Modeler
e-mail: Brian.Jacobson@ncmail.net

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Establishing TMDL Waste Load Allocations for stormwater sources and NDPES permit requirements based on those allocations.

Appendix A. DWQ Ambient Monitoring and Discharger Coalition Data

Ambient Monitoring Results for TSS and Turbidity at Station Q3735000

DATE	RESIDUE TOTAL NONFILTRABLE (MG/L) (method 00530)	TURBIDITY LAB NEPHELOMETRIC TURBIDITY UNITS NTU (method 82079)
01/29/97	31	32
02/24/97	24	17
03/20/97	98	80
04/22/97	87	
05/12/97	20	14
07/15/97	32	18
08/12/97	20	14
09/10/97	38	36
10/20/97	10	23
11/05/97	5	6.4
12/19/97	9	3.7
01/15/98	400	240
02/23/98	200	22
03/30/98	21	9.2
04/21/98	70	37
05/28/98	46	28
06/11/98	73	50
07/20/98	20	17
08/31/98	1	6.2
09/10/98	9	11
10/06/98	11	10
11/17/98	13	13
12/10/98	8	10
01/13/99	9	8.5
02/17/99	11	7.6
03/16/99	16	15
04/26/99		13
05/18/99	15	13
06/14/99	7	12
07/12/99	140	70
08/09/99	60	48
09/09/99	12	10
10/12/99	38	36
11/08/99	4	3.9
12/15/99	12	20
01/04/00	17	13
02/14/00	360	290
03/14/00	9	7.9
04/19/00	54	37
05/16/00	13	4.3
06/15/00	18	9.4
07/17/00	19	24
08/09/00	10	9.6

DATE	RESIDUE TOTAL NONFILTRABLE (MG/L) (method 00530)	TURBIDITY LAB NEPHELOMETRIC TURBIDITY UNITS NTU (method 82079)
09/07/00		12
10/16/00		4.2
11/16/00	6	6.2
12/06/00		4.8
01/08/01		38
02/05/01	8	8
04/19/01		8.2
05/10/01	8	8.1
06/11/01		14
08/14/01	56	70
09/10/01		5.7
10/03/01		4.4
11/08/01	2.5	5.3
12/04/01		6.5
01/10/02		12
02/13/02	10	14
03/20/02		29
04/24/02		10
05/14/02	39	60
06/10/02		10
07/08/02		19
08/27/02	12	38
09/18/02		220
10/16/02		390
11/13/02	94	100
12/18/02		19
01/29/03		8.7
02/20/03	150	140
03/20/03		500
04/07/03		260
05/07/03	34	45

Discharger Coalition Monitoring Results at Station Q3735000

DATE	TURBIDITY (NTU)
06/04/1998	39
07/14/1998	53.6
08/03/1998	14.1
09/02/1998	6.4
10/15/1998	11.8
11/11/1998	15.8
12/11/1998	11.9
01/08/1999	18.8
02/05/1999	20.5
03/10/1999	17.5
04/06/1999	27.8
05/11/1999	25
06/02/1999	27.8
07/06/1999	34.3
08/10/1999	15.3
09/07/1999	33
10/13/1999	33.6
11/08/1999	8.1
12/10/1999	15
01/12/2000	58
02/03/2000	24
03/23/2000	62.6
04/21/2000	69.4
05/09/2000	58.9
06/13/2000	35.2
07/11/2000	22.8
08/31/2000	34.7
09/07/2000	26.2
10/26/2000	6.2
11/30/2000	5.8
12/21/2000	5.6
01/17/2001	5.5
02/15/2001	6.4
03/05/2001	21
04/12/2001	12
05/15/2001	6.7
06/12/2001	10
07/16/2001	11
08/06/2001	5.2
09/10/2001	9.6
10/08/2001	6.6
11/12/2001	4
12/03/2001	5.8
01/14/2002	9
02/11/2002	15
03/04/2002	12
04/08/2002	8.2
05/06/2002	14

DATE	TURBIDITY (NTU)
06/10/2002	8.3
07/08/2002	18
08/05/2002	8.4
09/23/2002	36
10/07/2002	6.6
11/04/2002	8.6
12/02/2002	7.3
01/06/2003	167
02/10/2003	125
03/17/2003	600
04/07/2003	600
05/12/2003	290
06/09/2003	230

Discharger Coalition Monitoring Results at Station Q3720000 (this information was not used in calculating the TMDL).

DATE	Turbidity (NTU)
06/04/1998	37
07/14/1998	49.2
08/03/1998	14.7
09/02/1998	7.9
10/15/1998	12.9
11/11/1998	18.4
12/11/1998	10.8
01/08/1999	18.1
02/05/1999	18.3
03/10/1999	15.1
04/06/1999	21.5
05/11/1999	26
06/02/1999	51.2
07/06/1999	37
08/10/1999	15
09/07/1999	28
10/13/1999	54.3
11/08/1999	8.4
12/10/1999	13.8
01/12/2000	47
02/03/2000	15.3
03/23/2000	46.6
04/21/2000	65.6
05/09/2000	46.5
06/13/2000	34.5
07/11/2000	23.7
08/31/2000	136
09/07/2000	26.7
10/26/2000	4.85
11/30/2000	5.8
12/21/2000	5.6
01/17/2001	6.2
02/15/2001	12
03/05/2001	24
04/12/2001	7.1
05/15/2001	7
06/12/2001	12
07/16/2001	11
08/06/2001	5.4
09/10/2001	8.7
10/08/2001	6.4
11/12/2001	4.3
12/03/2001	5.3
01/14/2002	14
02/11/2002	17
03/04/2002	14
04/08/2002	5.1

DATE	Turbidity (NTU)
05/06/2002	8.1
06/10/2002	7.5
07/08/2002	10
08/05/2002	17
09/23/2002	29
10/07/2002	7.2
11/04/2002	4.3
12/02/2002	5.8
01/06/2003	230
02/10/2003	84
03/17/2003	880
04/07/2003	420
05/12/2003	350
06/09/2003	165

Appendix B. Monthly average effluent TSS concentrations (mg/L) at the Statesville WWTP (NC0031836) and Southern States Cooperative Facility (NC0082821) during years 1998-2003.

Statesville WWTP (NC0031836)

	1998	1999	2000	2001	2002	2003
January	13.1	10.7	15.2	9.1	8.2	7.1
February	18.4	10.3	12.7	9.3	10.7	8.2
March	15.1	12.0	11.0	13.8	10.5	12.8
April	7.4	15.1	15.3	12.9	10.7	8.6
May	8.1	14.2	8.4	15.3	15.7	6.4
June	4.8	8.8	7.5	12.4	8.8	18.1
July	7.7	11.8	7.1	13.8	< 5.0	4.3
August	8.3	10.4	7.2	19.4	2.3	3.8
September	7.5	7.7	7.3	8.1	3.6	4.9
October	6.4	9.7	7.4	9.0	4.9	
November	7.7	11.0	5.7	9.7	6.4	
December	8.8	14.0	7.5	6.6	5.4	

Southern States Cooperative facility (NC0082821)

	1998	1999	2000	2001	2002
January		26.0	23.7	15.2	
February	23.6	23.9	21.7	18.5	
March	24.2	17.8	17.5	0.03	
April	20.7			14.1	
May	18.0				
June	18.1				
July	26.2				
August	20.9				
September	18.5				
October	18.8				
November	22.5	23.5			
December	22.3	27.1			7.0

Appendix C. General Permitees located within the Fourth Creek watershed.

Permit Number	Coc Number	Facility Name	Receiving Waterbody	DWQ Description
NCS000018	N/A	J. C. Steele & Sons; Inc.	UT Fourth Ck	No description available
NCG020000	NCG020109	Martin Marietta - Statesville		SW-Mining
NCG030000	NCG030052	Hunt Manufacturing Company	Gregory Ck	SW-Metal processing
NCG030000	NCG030255	JC Steele & Sons Inc.	UT To Fourth Ck	SW-Metal processing
NCG030000	NCG030256	Wheeling Corrugating Company	UT To Fourth Ck	SW-Metal processing
NCG030000	NCG030379	MMI Products; Inc.-Merchants Metals	UT Fourth Ck	SW-Metal processing
NCG030000	NCG030442	Commscope, Inc.	Gregory Ck	SW-Metal processing
NCG030000	NCG030445	Dana Spicer Clark - Hurth	UT fourth Ck	SW-Metal processing
NCG040000	NCG040120	Bruce Hardwood Flooring LP	Third Ck & Fourth Ck	SW-Chip mill
NCG040000	NCG040237	Shaver Wood Products; Inc.	UT To Fourth Ck	SW-Chip mill
NCG050000	NCG050029	UNIWOOD	Morrison Ck	SW-Textile, paperboard, rubber (not tires) processing
NCG050000	NCG050098	International Paper; Container Div.	Gregory Ck	SW-Textile, paperboard, rubber (not tires) processing
NCG050000	NCG050108	Rubbermaid-Statesville; Inc.	Gregory Ck	SW-Textile, paperboard, rubber (not tires) processing
NCG050000	NCG050265	Jet Corr	Statesville MS4 to UT Gregory Ck	SW-Textile, paperboard, rubber (not tires) processing
NCG050000	NCG050272	Iredell Fiber; Inc.	UT Fourth Ck	SW-Textile, paperboard, rubber (not tires) processing
NCG060000	NCG060156	Bartlett & Co. D/B/A Bartlett Milling Co.	Fourth Ck	SW-Food, tobacco, cosmetics processing
NCG080000	NCG080016	Ruan Leasing Company	UT To Fourth Ck	SW-Vehicle maintenance areas, fuel storage sites
NCG080000	NCG080360	Ruan Leasing Company- Statesville	UT Fourth Ck	SW-Vehicle maintenance areas, fuel storage sites
NCG080000	NCG080568	NC Army National Guard-Statesville NG Armory	UT Gregory Ck	SW-Vehicle maintenance areas, fuel storage sites
NCG090000	NCG090023	Engineered Polymer Solutions; Inc. D/b/a Valspar Corporation	UT Fourth Ck	SW-Paint processing
NCG100000	NCG100030	Matlocks Used Cars	UT Fourth Ck	SW-Auto junk yards
NCG120000	NCG120042	Iredell County Sanitary Landfill	Fourth Ck	SW-Landfills
NCG140000	NCG140172	Union Concrete	UT of Fourth Ck	SW-Ready-Mix concrete
NCG160000	NCG160067	APAC-Carolina Inc.-North Side Drive Plant	Morrison Ck	SW-Asphalt paving and block processing
NCG170000	NCG170017	John Boyle & Co.; Inc.	UT of Fourth Ck	SW-Textile Mill
NCG170000	NCG170127	Carolina Mills; Inc.-Plant 12	Fourth Ck	SW-Textile Mill
NCG210000	NCG210003	Intercraft Industries; L. P.	Fourth Ck	SW-Wood processing

Appendix D. Methodology for developing the Load Duration Curve

The load duration curve method is based on comparison of the frequency of a given flow event with its associated water quality load. In the case of applying the NTU criteria, a correlation is necessary between NTU and TSS to allow for calculation of a load in mass per time units. Data from the Fourth Creek ambient station (Station Q3735000) was used in this this TMDL resulted in the below equation:

TSS concentration (mg/L) = (1.341* Turbidity (NTU)) – 1.008
$R^2 = 0.8435$

A LDC can be developed using the following steps:

1. Plot the Flow Duration Curve, Flow vs. % of days flow exceeded.
2. Develop TSS-turbidity correlation.
3. Translate turbidity values to equivalent TSS values using the linear regression equation from the correlation.
4. Translate the flow-duration curve into a LDC by multiplying the water quality standard (as equivalent TSS concentration), the flow and a units conversion factor; the result of this multiplication is the maximum allowable load associated with each flow.
5. Graph the LDC, maximum allowable load vs. percent of time flow is equaled or exceeded.
6. Water quality samples, expressed as estimated TSS values, are converted to loads (sample water quality data multiplied by daily flow on the date of sample).
7. Plot the measured loads on the LDC

Appendix E. Load Reduction Estimates for Turbidity in Fourth Creek.

Percent of Days flow is exceeded	TSS Load based on Regression Line (mg TSS/L)	TSS Load based on SWQS with MOS (mg TSS/L)	Load Reduction Required at each flow (mg TSS/L)
10%	55,217	25,492	29,725
11%	53,546	24,006	29,540
12%	51,925	22,817	29,108
13%	50,353	22,371	27,983
14%	48,829	21,033	27,796
15%	47,351	20,439	26,913
16%	45,918	19,993	25,925
17%	44,528	19,547	24,981
18%	43,180	18,506	24,674
19%	41,873	18,209	23,664
20%	40,606	17,615	22,991
21%	39,377	17,466	21,911
22%	38,185	16,723	21,462
23%	37,029	16,574	20,455
24%	35,908	16,277	19,631
25%	34,821	15,831	18,990
26%	33,767	15,385	18,382
27%	32,745	15,088	17,657
28%	31,754	14,790	16,963
29%	30,793	14,345	16,448
30%	29,861	14,196	15,665
31%	28,957	13,899	15,058
32%	28,080	13,750	14,330
33%	27,230	13,453	13,777
34%	26,406	13,155	13,250
35%	25,607	13,007	12,600
36%	24,832	12,710	12,122
37%	24,080	12,561	11,519
38%	23,351	12,412	10,939
39%	22,644	12,115	10,529
40%	21,959	11,818	10,141
41%	21,294	11,669	9,625
42%	20,650	11,520	9,129
43%	20,024	11,223	8,801
44%	19,418	11,075	8,344
45%	18,831	10,777	8,053
46%	18,261	10,629	7,632
47%	17,708	10,331	7,376
48%	17,172	10,183	6,989
49%	16,652	10,034	6,618
50%	16,148	9,886	6,263
51%	15,659	9,737	5,922
52%	15,185	9,588	5,597
53%	14,726	9,440	5,286
54%	14,280	9,291	4,989
55%	13,848	9,142	4,705
56%	13,428	8,994	4,435
57%	13,022	8,845	4,177
58%	12,628	8,696	3,931

Percent of Days flow is exceeded	TSS Load based on Regression Line (mg TSS/L)	TSS Load based on SWQS with MOS (mg TSS/L)	Load Reduction Required at each flow (mg TSS/L)
59%	12,246	8,548	3,698
60%	11,875	8,399	3,476
61%	11,515	8,251	3,265
62%	11,167	8,102	3,065
63%	10,829	7,953	2,876
64%	10,501	7,805	2,696
65%	10,183	7,656	2,527
66%	9,875	7,507	2,368
67%	9,576	7,359	2,217
68%	9,286	7,210	2,076
69%	9,005	7,061	1,944
70%	8,733	6,913	1,820
71%	8,468	6,764	1,704
72%	8,212	6,467	1,745
73%	7,963	6,318	1,645
74%	7,722	6,170	1,553
75%	7,489	6,021	1,468
76%	7,262	5,872	1,389
77%	7,042	5,724	1,318
78%	6,829	5,575	1,254
79%	6,622	5,426	1,196
80%	6,422	5,129	1,293
81%	6,227	4,981	1,247
82%	6,039	4,832	1,207
83%	5,856	4,683	1,173
84%	5,679	4,535	1,144
85%	5,507	4,386	1,121
86%	5,340	4,089	1,251
87%	5,179	3,940	1,238
88%	5,022	3,792	1,230
89%	4,870	3,643	1,227
90%	4,722	3,346	1,377
91%	4,579	3,048	1,531
92%	4,441	2,900	1,541
93%	4,306	2,751	1,555
94%	4,176	2,602	1,574
95%	4,050	2,261	1,789
Averages:	**19,703**	**10,519**	**9,184**

Appendix F. Relative Pollutant Contributions from the USGS report "Relation of Land Use to Streamflow and Water Quality at Selected Sites in the City of Charlotte and Mecklenburg County, North Carolina, 1993-98" (USGS, 1999).

Landuse Type	TSS Concentration (ton/mi^2/yr)
Mixed forest/pasture/ low density residential	2,400
Mixed forest, pasture, medium-and low-density residential	2,100
Mixed forest, pasture, medium-and low-density residential	564
Average Rural	**1,688**
Industrial	122
Industrial	300
Medium-density residential	225
Medium-density residential	77
High-density residential	1,000
Developing	4,700
Average Urban	**1,071**

Appendix G. Agriculture Sediment Survey/Action Plan for Fourth Creek – Iredell County conducted by the Soil and Water Conservation District, Iredell County in 1999.

DISTRICT AG SEDIMENT SURVEY/ACTION PLAN

Name and Description of Stream as Identified in DENR-DWQ 303(d) List: FOURTH CREEK – IREDELL COUNTY
(name)
SOURCE TO COUNTY LINE
(description)

I. In Stream at the Impaired Stream Segment (This area includes the stream bed and stream banks throughout the named impaired stream segment)

1. Is the identified stream segment (a) a natural stream X, or (b) a stream modified by human activity X?
2. Is there an apparent sediment problem in the streambed of the impaired stream segment? yes X no_____ (If the answer to question number 2 is no, go to question number 5.)
3. If yes, is the excessive sedimentation coming from (a) stream banks X, (b) adjacent land area_____, or (c) other sources within the watershed upstream of the identified stream segment.
4. If the sediment source is in a tributary feeding into the identified stream segment, what is its name? GREGORY CREEK, MORRISON CREEK AND UN-NAMED TRIBS
5. Are there any in-stream projects ongoing in the identified stream segment or upstream to the identified segment that are contributing sediment to the identified stream segment? yes_____ no X
6. If the answer to question 5 is yes, is the project temporary_____or long term_____in its stream disturbing effect relative to sediment.
7. Additional Information. (Add any additional information here that helps describe the current sediment situation within the identified stream segment. SEDIMENT LOADING OCCURRING FROM STREAMBANK EROSION DUE TO EXCESSIVE STORM WATER – FLOWS GENERATED BY URBAN DEVELOPMENT.

1

II. Adjacent Land Area (This area includes land beginning at the top of the streambank along the entire length of the identified impaired stream segment and extending away from the stream 1/2 mile or to the watershed boundary, whichever is the least distance from the stream segment.)

1. Land use (expressed as percent of total adjacent land area - estimated from FSA or other aerial photography)

	1990	Current (1999)
a. Cropland	11 %	11 %
b. Pasture/Hayland	20 %	20 %
c. Forestland	43 %	43 %
d. Non-Ag Use	26 %	26 %

2. Are there sources of excessive sediment delivery into the identified stream segment from the adjacent land area? yes X no

3. If the answer to question #2 is yes, what are the sources? (check all that applies)

a. Cropland	X
b. Pasture/Hayland	X
c. Forestland	X
d. Road Construction	X
e. Construction other than road	X
f. Mining	
g. Other (List Sources)	Developments

4. What percent of the adjacent agricultural land area has a conservation plan for erosion control?

a. 0 to 20% _____
b. 20 to 40% _____
c. 40 to 60% X
d. 60 to 80% _____
e. 80 to 100% _____

2

5. What percent of the adjacent agricultural land area under conservation plan has all planned practices for erosion control applied on the land?

a. 0 to 20% _____ d. 60 to 80% _____

b. 20 to 40% X e. 80 to 100% _____

c. 40 to 60% _____

6. What percent of the applied practices are being adequately maintained?

a. 0 to 20% X d. 60 to 80% _____

b. 20 to 40% _____ e. 80 to 100% _____

c. 40 to 60% _____

7. What are the primary BMP's used for erosion and/or sediment control on the adjacent agricultural land area? (Show purpose(s) for which BMP was used.)

Name of BMP	Purpose: Erosion	Purpose: Sediment
a. PASTURE MANAGEMENT	X	X
b. NO TILL	X	X
c.		
d.		
e.		
f.		
g.		
h.		

8. Additional information (add any information here that helps describe the current sediment situation within the adjacent land area along the identified stream segment). THIS STREAM SEGMENT IS MORE HEAVILY URBAN COMPARED TO AG USE.

3

III. Remaining Land Area within the Watershed that drains into the identified Impaired Stream Segment. (This area includes all of the tributaries and the main stream upstream of the identified stream segment outside of the Adjacent Land Area.

1. Land use in the watershed outside of the adjacent land area upstream of the identified stream segment.

	1990	Current (1999)
a. Cropland	11 %	10 %
b. Pasture/Hayland	20 %	16 %
c. Forestland	43 %	46 %
d. Non-Ag Use	26 %	28 %

2. Are there sources of excessive sediment delivery into the identified stream segment from the watershed outside of the adjacent land area? yes X no

3. If the answer to question #2 is yes, what are the sources? (check all that applies)

a. Cropland	X
b. Pasture/Hayland	X
c. Forestland	X
d. Road Construction	X
e. Construction other than roads	X
f. Mining	
g. Other (List Sources)	Development (single home)

4, What percent of the remaining agricultural land area in the watershed upstream of the impaired stream segment has a conservation plan for erosion control?

a. 0 to 20%		d. 60 to 80%	
b. 20 to 40%		e. 80 to 100%	
c. 40 to 60%	X		

5. What percent of the remaining agricultural land area under conservation plan has all planned practices for erosion control applied on the land?

a. 0 to 20% _____ d. 60 to 80% _____

b. 20 to 40% X e. 80 to 100% _____

c. 40 to 60% _____

6. What percent of the applied practices are being adequately maintained?

a. 0 to 20% X d. 60 to 80% _____

b. 20 to 40% _____ e. 80 to 100% _____

c. 40 to 60% _____

7. What are the primary BMP's used for erosion and/or sediment control on the remaining agricultural land area? (Show purpose(s) for which BMP was used.)

	Name of BMP	Purpose: Erosion	Purpose: Sediment
a.	PASTURE MANAGEMENT	X	X
b.	NO TILL	X	X
c.			
d.			
e.			
f.			
g.			
h.			

8. Additional information (add any information here that helps describe the current sediment situation within the remaining land area along the identified stream segment). REMAINDER OF AREA IS MORE HEAVILY URBAN.

5

IV. Soil and Water Conservation District Action Plan for this Stream Segment

1. Recommended actions of the District in response to In-Stream problems.

a. STREAMBANK STABILIZATION
b. BUFFER (WILDLIFE, RIPARIAN)
c.
d.
e.
f.

2. Recommended actions of the District in response to adjacent land area problems.

a. STREAMBANK STABILIZATION (BOTH AG & URBAN)
b. BUFFERS (WILDLIFE, RIPARIAN)
c. NO TILL FARMING
d. FORESTRY BMP's
e. CRITICAL AREA TREATMENT
f. STORM WATER MANAGEMENT IN URBAN AREA
g. LIVESTOCK EXCLUSION

3. Recommended actions of the District in response to remaining watershed area problems.

a. STREAMBANK STABILIZATION (BOTH AG & URBAN)
b. BUFFERS (WILDLIFE, RIPARIAN)
c. NO TILL FARMING
d. FORESTRY BMP's
e. CRITICAL AREA TREATMENT
f. STORM WATER MANAGEMENT IN URBAN AREA
g. LIVESTOCK EXCLUSION

4. Goals for BMP's and other items to be implemented on this stream segment:

	Item	Goal (Acres, Ft, etc)	Estimated Cost ($)
a.	STREAMBANK STABILIZATION	52,272 feet	$6,534,000.00
b.	RIPARIAN FOREST BUFFERS	52,272 feet	$2,613,600.00
c.	LIVESTOCK EXCLUSION	20,000 feet	$18,000.00
d.	WATERING TROUGHS	100	$4,000.00
e.	UPLAND FOREST DEVELOPMENT	1,116 acres	$164,400.00
f.	PASTURE MANAGEMENT/WILDLIFE	990 acres	$235,000.00
g.			
h.			

6

i. _____ _____ _____

j. _____ _____ _____

5. Barriers/Limiting factors to solving problems listed in the IV 1, 2, and 3 above are:

a. DISTRUST OF GOVERNMENT

b. LAND OWNERSHIP CHANGING

c. LACK OF FUNDING

d. LACK OF MANPOWER

e. NON-PRODUCER OWNERSHIP

f. ENVIRONMNETAL APATHY

g.

h.

6. Resources needed to solve problems found and listed in Districts Action Plan in IV 1, 2, and 3 above: (show resources for staff, equipment, BMP cost-share, etc)

	Item	Units Needed	Estimated Cost ($)
a.	PUBLIC RELATION POSITION	1	$30,000.00
b.	GIS SOFTWARE & HARDWARE	1	$25,000.00
c.	STREAM RESTORATION FUNDING (NCCWMTF)	52,272	$7,893,072.00
d.			
e.			
f.			
g.			
h.			
i.			
j.			

V. General

1. The Clean Water Act, Section 303(d), requires the state to develop a list of waters not meeting water quality standards or which have impaired uses. This stream segment appears on that list as being impaired by sediment. Based on your survey findings, which of the following actions do you recommend relative to this stream segment:

a. Retain agricultural sediment as a problem parameter for this stream segment _____

b. Remove agricultural sediment as a problem parameter for this stream segment X

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Appendix H. Public Notification of Public Review Draft of Fourth Creek Turbidity TMDL.

Fourth Creek, Yadkin River Basin

Now Available Upon Request

Fourth Creek Turbidity Total Maximum Daily Load

Is now available upon request from the North Carolina Division of Water Quality. This TMDL study was prepared as a requirement of the Federal Water Pollution Control Act, Section 303(d). The study identifies the sources of pollution, determines allowable loads to the surface waters, and suggests allocations for turbidity.

TO OBTAIN A FREE COPY OF THE TMDL REPORT:

Please contact Mr. Brian Jacobson (919) 733-5083, extension 552 or write to:

Mr. Brian Jacobson
Water Quality Planning Branch
NC Division of Water Quality
1617 Mail Service Center
Raleigh, NC 27699-1617

Interested parties are invited to comment on the draft TMDL study by April 12, 2004. Comments concerning the reports should be directed to Mr. Brian Jacobson at the above address. The draft TMDL is also located on the following website: http://h2o.enr.state.nc.us/tmdl

Public Meetings Notice

A public meeting to discuss the
Fourth Creek Turbidity TMDL
will be held on **Friday, March 26th** at 10:00am
at the following address:

The Old City Hall Building
Council Chambers
301 South Center Street
Statesville, North Carolina

NORTH CAROLINA
IREDELL COUNTY

AFFIDAVIT OF PUBLICATION

Before the undersigned, a Notary Public of said County and State, duly commissioned, qualified, and authorized by law to administer oaths, personally appeared **Kimberly P. Ownbey** who being first duly sworn, deposes and says: that she is an employee authorized to make this statement by **Media General Newspapers, Inc.** engaged in the publication of a newspaper known as the **Statesville Record & Landmark** published, issued, and entered as second class mail in the city of Statesville in said County adn State, that she is authorized to make this affidavit and sworn statement; that the notice or other legal advertisement, a true copy of which is attached hereto, was published in the **Statesville Record & Landmark** on the following dates:

2/24/04

PUBLIC NOTICE
State of North Carolina
Division of Water Quality

Availability of the Fourth Creek Fecal Coliform Total Maximum Daily Load (TMDL)

Copies of the TMDL may be obtained by calling Mr. Brian Jacobson at (919) 733-9083, ext. 552, or on the Internet at http://h2o.enr.state.nc.us/tmdl. A public meeting will be held at 10:00 am, March 24, 2004 at the Old City Hall Building on South Center Street in Statesville, NC. Written comments regarding the TMDL will be accepted until April 25, 2004. Please mail comments to Mr. Brian Jacobson, Water Quality Planning Branch, NC Division of Water Quality, 1617 Mail Service Center, Raleigh, NC 27699-1617.

and that the said newspaper in which such notice, paper, document, or legal advertisement was published was at the time of each and every such publication, a newspaper meeting all of the requirements and qualifications of Section 1-597 of the General Statues of North Carolina and was a qualified newspaper within the meaning of Section 1-597 of the Greater Statues of North Carolina.

This 24th day February, 2004

Kimberly P Ownbey
(Signature of person making affidavit)

Sworn to and subscribed before me, this 24th day of February 2004

Lori A. Gray
Notary Public

Commission expires: 5-12-2004

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