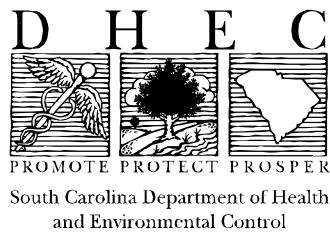


South Carolina Department of Health and Environmental Control
Total Maximum Daily Load Development for
Unnamed Tributary to Catawba River CW-221
Fecal Coliform

August 17, 1999
Bureau of Water



**Unnamed Tributary to the Catawba River
03050103-010**

BASIS FOR 303(d) LISTING

Introduction:

Levels of fecal coliform can be elevated in water bodies as the result of both point and nonpoint sources of pollution. Section 303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop total maximum daily loads (TMDLs) for their water bodies that are not meeting designated uses under technology-based controls for pollution. The TMDL process establishes the allowable loadings of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and instream water quality conditions, so that states can establish water-quality based controls to reduce pollution from both point and nonpoint sources and restore and maintain the quality of their water resources (USEPA, 1991).

Problem Definition:

Waterbody Impaired: Unnamed Tributary to the Catawba River (York County)

Water Quality Standards Being Violated: Fecal Coliform

Pollutant of Concern: Fecal Coliform

Water Classification: Freshwaters

The impaired stream segment, Unnamed Tributary to the Catawba River, is classified Class Freshwater. Waters of this class are to be:

A Freshwaters suitable for primary and secondary contact recreation and as a source for drinking water supply after conventional treatment in accordance with the requirements of the Department. Suitable for fishing and the survival and propagation of a balanced indigenous aquatic community of fauna and flora. Suitable also for industrial and agricultural uses.@ (R.61-68)

Fecal Coliform Criteria:

A Not to exceed a geometric mean of 200/100 ml, based on five consecutive samples during any 30 day period; nor shall more than 10% of the total samples during any 30 day period exceed 400/100 ml.@ (R.61-68)

The water quality assessment published in the South Carolina Watershed Water Quality Management Strategy: Catawba Santee Basin (1996) was used for determining the stream segment impairment and for listing the water on the South Carolina 1998 303(d) list. Waters in which less than or equal to 10 percent of the samples collected over a five year period are greater

than 400 colonies/100 ml are considered to comply with South Carolina water quality standard for fecal coliform bacteria. Waters with greater than 10 percent of samples greater than 400 colonies/100 ml are considered impaired and listed for fecal coliform bacteria on South Carolina's 303(d) List. DHEC has data from one ambient monitoring station, CW-221, on Unnamed Tributary to the Catawba River at SC highway 161, 0.4 miles west of I-77. This station shows recreational uses are not supported due to fecal coliform violations of the 400/100 ml standard. Forty-three percent of the samples in a five year period do not meet the fecal coliform standard.

TMDL TECHNICAL BASIS

Target Identification:

The target levels are the fecal coliform levels established in South Carolina's Water Quality Standards, Regulation 61-68. This TMDL will use criteria >not to exceed a geometric mean of 175/100 ml=, to allow an explicit margin of safety of 25/100 ml to ensure that the 200/100 ml standard will be met. This target of 175/100 ml as a geometric mean is expected also to satisfy the criterion, >nor shall more than 10% of the total samples during any 30 day period exceed 400/100 ml.=

Based on a review of water quality assessments in South Carolina, over 75% of waters having a fecal coliform geometric mean of 175/100ml also meet the criterion "not more that 10% of samples exceed 400/100ml" (SCDHEC unpublished data). Most of the data in those assessments, however, reflect fecal coliform concentrations in areas that do not have sufficient best management practices (BMPs) in place. Thus, implementation of BMPs as described in this TMDL will likely achieve an even greater rate of compliance with the latter criterion since the BMPs are generally focused on reducing fecal loadings during runoff events, the condition most likely to result in an exceedence of the 400/100ml criterion.

Source Assessment:

General Sources of Fecal Coliform:

Both point and nonpoint sources may contribute fecal coliform to a given water body. Potential sources of fecal coliform are numerous, and often occur in combination. Nationwide, poorly treated municipal sewage comprises a major source of fecal coliform, but data presented below suggest this is not the case here. Urban storm water runoff, sanitary sewer overflows, and combined sewer overflows can be sources of fecal coliform. Rural storm water runoff can transport significant loads of fecal coliform from livestock pastures and animal feedlots. Wildlife can also contribute fecal coliform. Most sources of fecal coliform loads can be assigned to two broad classes: point source loads, and nonpoint source loads.

Point Sources in Unnamed Tributary to the Catawba River Watershed:

Permitted Dischargers in Area of Concern:

<u>Permit #</u>	<u>Facility</u>	<u>Receiving Water</u>	<u>Type</u>	<u>Flow (mgd)</u>
SCG645008	City of Rock Hill WTP	Unnamed Trib to Catawba Rr	General Permit	Monitor & Report

This drinking water treatment plant discharges filter backwash water and sedimentation basin washdown water. Fecal coliform is not typically a pollutant found in backwash water and sedimentation basin washdown water; it is not addressed in the NPDES permit. Therefore this facility will not be considered in this TMDL.

The City of Rock Hill operates a waste water treatment facility (WWTF), permit number SC0020443. The service area of this facility includes the urban area in the Unnamed Tributary to the Catawba River watershed. The City of Rock Hill's WWTF discharges to the Catawba River outside the watershed to be addressed in this TMDL.

Nonpoint Sources in Unnamed Tributary to the Catawba River Watershed:

Due to the absence of point sources with fecal coliform in their discharge, nonpoint sources are believed to be the source of fecal coliform in this watershed. The land use in this watershed is 100% urban (the City of Rock Hill).

Fecal coliform bacteria have been detected in storm water runoff from urban areas at densities high enough to suggest a potential health risk (Novotny, 1994). Fecal coliform concentrations in urban storm water may be higher than concentrations in treatment plant effluent (Novotny, 1994; Metcalf, 1979). The origins of urban bacterial loads are diverse, and may include leakage or overflows from sanitary sewers, failing septic tanks and direct loading of human fecal matter, as well as bacteria derived from dog and cat feces and other domestic and non-domestic animals.

Linkage Between Numeric Targets and Sources:

Due to the land use in this small watershed, the major source of fecal coliform is urban runoff. Urban land will be the land use targeted for reductions in loading.

Data Availability and Analysis:

Watershed Characteristics:

Unnamed Tributary to the Catawba River is located in the Catawba River Basin in watershed unit 03050103-010. Unnamed Tributary to the Catawba River watershed is located in York County. It flows through the City of Rock Hill. The watershed considered for TMDL development is 450 acres in the Piedmont region.

Landuse		
Landuse	Acres	Percentage
Urban	450	100%

Existing Data:

Fecal Coliform: South Carolina Department of Health and Environmental Control monitors water chemistry on Unnamed Tributary to the Catawba River at secondary ambient monitoring station CW-221 once a month from May through October. Existing data from this monitoring station is available through STORET and included in the appendix. The geometric mean of fecal coliform using the most current data available (1994-1998) is 217 colonies/100ml (for these warm weather months).

Flow data: Flow information for Unnamed Tributary to the Catawba River was estimated using flow data from USGS gaging station 02153780 on Clarks Fork Creek near Smyrna, SC for water years 1981-1997. A warm weather generation coefficient was established by dividing the average flow from May - October at the USGS station by the drainage area for the station. The warm weather generation coefficient (Gc) is established as follows:

$$Gc = \frac{\text{Mean flow from May-Oct in cfs}}{\text{Drainage area in square miles}}$$
$$Gc = 13.3/24.1 \text{ cfs/square mile} = 0.552 \text{ cfs/square miles}$$

The warm weather generation coefficient is multiplied by the Unnamed Tributary drainage area (0.703 square miles) to obtain the average warm weather flow for Unnamed Tributary to the Catawba River of 0.388 cfs.

Critical Conditions:

Novotny & Olem (1994) find statistically lower fecal coliform counts in cold weather urban runoff samples than in warmer weather urban runoff. To substantiate this, winter and summer fecal coliform values were compared at ambient water quality monitoring stations in the Piedmont Region in South Carolina thought to be impacted by nonpoint sources. This analysis reveals similar or higher values in the summer than the winter. Therefore, summer months (May-October) are considered critical conditions. This can be explained by the nature of storm events in the summer versus the winter. Thunderstorms are typical in the summer months. This pattern of rainfall allows for the accumulation and washing off of fecal coliforms into the streams resulting in spikes of fecal coliform concentrations. In the winter, long slow rain events are the norm. This pattern of rainfall does not allow for the high build-up of coliform that characterizes the summer. Rather, coliform are washed into the stream at a more even rate. This, coupled with the increased winter flows that provide more dilution, results in lower fecal coliform concentrations.

Load Calculations:

Using the observed geometric mean of 217 colonies/100 ml and the average warm weather flow calculated above, the current loading at CW-221 is 2.06E+09 colonies/day:

$$\text{Fecal Coliform} * Qa * \text{Factor} = \text{Loading}$$

Where fecal coliform = # colonies/100ml
Qa = average warm weather flow in cfs
factor = conversion factor = 24468984
Loading = # colonies fecal coliform/day

The allowable load (geometric mean of 200 colonies/100 ml) during average warm weather flow is 1.9E+09.

TMDL Development:

Total maximum daily loads (TMDLs) comprise the sum of individual wasteload allocations (WLAs) for point sources, and load allocations (LAs) for both nonpoint sources and natural background levels for a given watershed. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relation between pollutant loads and the quality of the receiving water body. Conceptually, this definition is denoted by the equation:

$$\text{TMDL} = 3 \text{ WLAs} + 3 \text{ LAs} + \text{MOS}$$

The TMDL is the total amount of pollutant that can be assimilated by the receiving water body while achieving water quality standards. TMDLs establish allowable water body loadings that are less than or equal to the TMDL and thereby provide the basis to establish water-quality-based controls.

For some pollutants, TMDLs are expressed on a mass loading basis (e.g., pounds per day). For bacteria, however, TMDLs can be expressed in terms of organism counts (or resulting concentration), in accordance with 40 CFR 130.2(l).

Margin of Safety:

There are two basic methods for incorporating the MOS (USEPA, 1991): 1) implicitly incorporate the MOS using conservative model assumptions to develop allocations, or 2) explicitly specify a portion of the total TMDL as the MOS; use the remainder for allocations.

The MOS is implicit in this TMDL process through the use of a critical period and explicit by establishing a target TMDL level of 175 colonies/ 100 ml. This level is below the state standard of 200 colonies/ 100 ml.

Since there are no contributing point sources and the MOS is included, this TMDL comprises solely the load allocations from nonpoint sources and natural conditions.

TMDL

Allocation of Load:

The existing load of 2.06E+09 colonies/day must be reduced by 19% to obtain the TMDL of 1.66E+09 colonies/day (loading at 175 colonies/ 100 ml).

An allocation strategy that will allow the target TMDL of 175 colonies/100ml to be maintained is as follows:

19% reduction in fecal coliform loading and/or resultant instream concentrations from urban land uses.

Implementation Strategy:

As discussed in the Implementation Plan for Achieving Total Maximum Daily Load Reductions From Nonpoint Sources for the State of South Carolina, South Carolina has several tools available for implementing this nonpoint source TMDL. Specifically, SCDHEC's Catawba Environmental Quality Control District and the Bureau of Water Enforcement Section will address collection system, overflowing manhole and/or leaky sewer line problems as necessary in the watershed. The State Revolving Fund offers low interest rate loans for improvements to waste water treatment facilities including sewer line and pump station maintenance. It is available to local governments. The city of Rock Hill falls within the guidelines to be issued a Phase II Municipal Separate Storm Sewer System (MS4) Permit. The regulations for Phase II MS4 permits are to be published in November 1999 in the Federal Register. This permit will require Rock Hill to develop and implement a plan for detecting and addressing any illicit discharges to the storm sewer system. Also as part of the MS4 permit, the city will conduct public education about storm water impacts on water bodies and how citizens can reduce storm water pollution.

In addition, SCDHEC will work with the existing agencies in the area to provide nonpoint source education in the Unnamed Tributary to the Catawba River watershed. Local sources of nonpoint source education include Clemson Extension Service, the Natural Resource Conservation Service and the South Carolina Department of Natural Resources. Clemson Extension Service offers a >Home-A-Syst= package to home owners. Home-A-Syst allows the homeowner to evaluate practices at their home and determine the nonpoint source impact they may be having. It recommends best management practices (BMPs) to correct nonpoint source problems at a residence. SCDHEC employs a nonpoint source educator who can also provide BMP information.

DHEC will continue to monitor, according to the basin monitoring schedule, the effectiveness of implementation measures and evaluate stream water quality as the implementation strategy progresses.

References

- Metcalf & Eddy, Inc. 1979. Wastewater Engineering: Treatment Disposal Reuse. McGraw Hill, New York.
- Novotny, Vladimir. Olem, Harvey. 1994. Water Quality Prevention, Identification, and Management of Diffuse Pollution. Van Nostrand Reinhold, New York.
- South Carolina Department of Health and Environmental Control. 1998. Implementation Plan for Achieving Total Maximum Daily Load Reductions From Nonpoint Sources for the State of South Carolina.
- South Carolina Department of Health and Environmental Control. 1997. Watershed Water Quality Management Strategy: Catawba and Santee River Basins. Technical Report No. 002-96.
- United States Environmental Protection Agency. 1991. Guidance for Water Quality-Based Decisions: The TMDL Process, Office of Water, EPA 440/4-91-001.

Public Participation

The public notice on page 12 and 13 was sent to a mailing list of over 300 individuals statewide interested in water quality issues on July 1, 1999. In addition, the notice was sent to local organizations and York county and Rock Hill city officials with a possible interest in this TMDL.

The public notice on page 14 was published in the Anderson Independent Mail, Charleston Post and Courier, State, Greenville News, Rock Hill Herald, and Camden Chronicle newspapers on July 9, 1999.

Comments Received and Responsiveness Summary

Comments were received from the Southern Environmental Law Center (SELC), the South Carolina Department of Natural Resources (SC DNR), the Sierra Club South Carolina Chapter, and the South Carolina Department of Parks, Recreation & Tourism (SC PRT).

The comments are enclosed in Appendix B. A summary of the comments and DHEC=s response are found in the Responsiveness Summary on page 15.

PUBLIC NOTICE

NOTICE OF AVAILABILITY OF PROPOSED TOTAL MAXIMUM DAILY LOADS FOR WATERS AND POLLUTANTS OF CONCERN IN THE STATE OF SOUTH CAROLINA

July 9, 1999

Section 303(d)(1)(C) of the Clean Water Act (CWA), 33 U.S.C. ' 1313(d)(1)(C), and EPA's implementing regulation, 40 C.F.R. ' 130.7(c)(1), require the establishment of total maximum daily loads (TMDLs) for waters identified as impaired pursuant to ' 303(d)(1)(A) of the CWA. Each of these TMDLs is to be established at a level necessary to implement applicable water quality standards with seasonal variations and a margin of safety, accounting for uncertainty concerning the relationship between effluent limitations and water quality. At this time, the South Carolina Department of Health and Environmental Control (SC DHEC) has developed proposed TMDLs for the following ' 303(d)(1)(A) waters:

Unnamed Tributary to Catawba River, York County
Camp Creek, Lancaster County
Beaverdam Creek, Oconee County
Brushy Creek, (in Enoree drainage) Greenville County
Middle Tyger River, Greenville County
Catawba River, Chester and Lancaster Counties
Wateree River, Kershaw County
Saluda River, Lexington County

More information about these TMDLs can be found in the chart on the back of this page. SC DHEC is proposing to establish these as final TMDLs.

Persons wishing to comment on these proposed TMDLs or to offer new data regarding the proposed TMDLs are invited to submit the same in writing no later than August 9, 1999 to the South Carolina Department of Health and Environmental Control, Bureau of Water, 2600 Bull Street, Columbia, South Carolina 29201, ATTENTION: Ms. Ann Lackey. Ms. Lackey's telephone number is 803-898-4213. Her E-Mail address is lackeyae@columb32.dhec.state.sc.us.

The proposed TMDLs and the administrative record, including technical information, data, and analyses supporting the proposed TMDLs, may be reviewed and copied at 2600 Bull Street, Columbia, South Carolina between the hours of 8:00 a.m. and 4:30 p.m., Monday through Friday, or are available by writing, calling, or e-mailing Ms. Lackey at the address above.

After review of comments, the proposed TMDLs will be sent to EPA for approval shortly after

August 9, 1999.

Please bring the foregoing to the attention of persons whom you believe will be interested in this matter.

July 9, 1999

Notice of availability of proposed TMDLs for the following waters and pollutants of concern:

Waterbody	Upstream of Station	Pollutant of Concern	County	Watershed Unit	Action Necessary for Waterbody to Meet Applicable Water Quality Standards
Unnamed Trib to Catawba River at SC highway 161	CW-221	fecal coliform	York	03050103-010	19% reduction in fecal coliform from urban land
Camp Creek	CW-235	fecal coliform	Lancaster	03050103-080	44% reduction in fecal coliform from agricultural/grass lands
Beaverdam Creek	SV-345	fecal coliform	Oconee	03060102-150	55% reduction in fecal coliform from agricultural/grass lands
Brushy Creek	BE-009	fecal coliform	Greenville	03050108-010	73% reduction in fecal coliform from urban land
Middle Tyger River	B-148	fecal coliform	Greenville	03050107-040	68% reduction in fecal coliform from agricultural/grass lands
Catawba River (downstream of Great Falls Reservoir Dam)	CW-174	dissolved oxygen	Chester/ Lancaster	03050103-010	Increase dissolved oxygen concentration in discharge from facility to meet applicable standard
Wateree River	CW-019, CW-214	dissolved oxygen	Kershaw	03050104-030	Increase dissolved oxygen concentration in discharge from facility to meet applicable standard

(downstream of Lake Wateree Dam)					
Saluda River (downstream of Lake Murray Dam)	S-152	dissolved oxygen	Lexington	03050109-210	Increase dissolved oxygen concentration in discharge from facility to meet applicable standard

**NOTICE OF AVAILABILITY OF PROPOSED TMDLS
FOR WATERS AND POLLUTANTS OF CONCERN IN SC**

The South Carolina Department of Health and Environmental Control (DHEC) has developed a proposed total maximum daily load (TMDL) for fecal coliform bacteria for each of the following waterbodies: Unnamed tributary to Catawba River (York County), Camp Creek (Lancaster County), Beaverdam Creek (Oconee County), Brushy Creek (Greenville County), and Middle Tyger River (Greenville County). DHEC has also developed a proposed TMDL for dissolved oxygen downstream of dams for each of the following waterbodies: Cawtaba River (downstream of Great Falls Reservoir Dam), Wateree River (Lake Wateree Dam), and Saluda River (Lake Murray Dam). These TMDLs have been developed in accordance with Section 303(d) of the Clean Water Act, and SCDHEC is now proposing to establish them as final TMDLs.

Persons wishing to offer comments or new data regarding these proposed TMDLs may submit data and comments in writing no later than August 9, 1999 to Anne Runge, DHEC, Bureau of Water, 2600 Bull Street, Columbia, SC 29201. For more information, please contact Ms. Runge at (803) 898-3701 or visit our website at www.state.sc.us/dhec/eqpubnot.htm.
July 9, 1999

Responses to comments on Fecal TMDLs
(Summarized comments are in italics, respondent is in parentheses)

Middle Tyger River, Camp Creek, Beaverdam Creek TMDLs:

1) *Respondent questions the assumption that no fecal coliform contamination originates from forested land. Forestry activities, including land clearing, cultivating, and harvesting, can generate non-point source pollution, particularly if carried out without using Best Management Practices.* (SELC)

Estimates of fecal coliform bacteria loading from forested lands were made using SC DHEC water quality monitoring data from forested areas. As stated in the TMDLs, the estimates used are consistent with the typical values of loadings from forested areas seen in the literature and in other studies.

2) *Agricultural land is treated as a single source of fecal loadings, without assessing individual contributions from intensive livestock operations. Monitoring data pinpointing the locations of major contribution areas or sources within the watershed are not provided. These data are necessary to develop an adequate implementation strategy.* (SELC)

The implementation of these TMDLs will include education about and installation of best management practices that reduce fecal coliform loadings from agricultural lands. These BMPs, to be implemented to the extent possible under voluntary programs such as the Section 319 program and agricultural cost-sharing programs, will be focused on lands that are likely sources of fecal coliform loadings, including the intensive livestock operations and land application sites mentioned by the respondent. As any livestock operation or land application site that does not have adequate BMPs in place is a probable source of fecal coliform bacteria, such implementation measures will reduce fecal loadings to the waterbodies.

3) *The TMDLs do not provide @reasonable assurance@ that nonpoint sources of fecals will be adequately addressed by the measures identified, as required by EPA guidance. No statement specifying when implementation actions by DHEC or other agencies will occur is provided. No information or commitments are provided regarding future monitoring and steps to be taken if impairment is not resolved.* (SELC)

EPA guidance acknowledges that in watersheds impaired solely by nonpoint sources, the primary implementation mechanism will be the Section 319 program and other state or federal assistance programs such as cost-sharing and incentive programs (Robert Perciasepe memo, 1997). As these are all voluntary programs, they involve a process of landowners, agencies, or organizations submitting and receiving approval for project proposals to implement appropriate practices. This project development and evaluation process, which will target fecal sources in these watersheds,

will take place after TMDL approval by EPA has been granted. According to EPA guidance (1991), implementation of the TMDL is to take place after the state has obtained EPA approval. Commitment and funding for implementing these BMPs will thus be arranged after TMDLs have been approved.

As is stated in the TMDLs, DHEC will continue to monitor water quality in these waters according to the basin monitoring schedule in order to evaluate use support and the effectiveness of implementation measures.

Brushy Creek and Unnamed tributary to Catawba River TMDLs:

1) *The TMDLs do not adequately identify the location of the causes of the impairment. Respondent submits that TMDLs should specifically describe additional monitoring work to pinpoint the primary sources of the contamination.* (SELC)

Fecal coliform is present in all sources of urban runoff including streets, lawns, parking lots, commercial and residential rooftops, and storm water drains (Schueler, Thomas R., ed. 1999. *Microbes and Urban Watersheds: Concentrations, Sources, and Pathways. Watershed Protection Techniques.* April 1999:3-1). It is difficult if not impossible to isolate all the contributing sources of fecal coliform in urban watersheds. However, the Municipal Separate Storm Sewer System (MS4) permit for Greenville County (to be public noticed in September 1999) and the MS4 Phase II permit for Rock Hill (Phase II regulations to be published in the Federal Register in November 1999) will require the identification of illicit discharges to the storm sewer system, a potential major contributor of fecal coliform. Language has been added to the Unnamed Tributary to the Catawba River TMDL discussing the MS4 permit for Rock Hill.

2) *The TMDLs do not provide @reasonable assurance@ that nonpoint sources of fecals will be adequately addressed by the measures identified, as required by EPA guidance. No statement specifying when implementation actions by DHEC will occur is provided. No information or commitments are provided regarding future monitoring and steps to be taken if impairment is not resolved.* (SELC)

EPA guidance acknowledges that in watersheds impaired solely by nonpoint sources, the primary implementation mechanism will be the Section 319 program and other state or federal assistance programs such as cost-sharing and incentive programs (Robert Perciasepe memo, 1997). As these are all voluntary programs, they involve a process of landowners, agencies, or organizations submitting and receiving approval for project proposals to implement appropriate practices. This project development and evaluation process, which will target fecal sources in these watersheds, will take place after TMDL approval by EPA has been granted. According to EPA guidance (1991), implementation of the TMDL is to take place after the state has obtained EPA approval.

Commitment and funding for implementing these BMPs will thus be arranged after TMDLs have been approved.

In addition to voluntary measures, both of the watersheds will be subject to (MS4) permits. These permits for Greenville County and Rock Hill will require the identification and removal of illicit discharges to the storm sewer system, a potential major contributor of fecal coliform. MS4 permits will also require the development and implementation of a public education program about storm water and how citizens can reduce storm water pollution. Language has been added to the Unnamed Tributary to the Catawba River TMDL discussing the MS4 permitting program.

As is stated in the TMDLs, DHEC will continue to monitor water quality in these waters according to the basin monitoring schedule in order to evaluate use support and the effectiveness of implementation measures.

Other Comments on all five Fecal TMDLs

1) *Respondent commends DHEC on TMDLs and believes implementation of the strategies will make waters safe for recreation. (SC DNR)*

No response necessary.

2) *Respondent has reviewed TMDLs and administrative record and has no questions, comments, or additional information to offer. (Sierra Club - SC Chapter)*

No response necessary.

3) *Respondent supports DHEC=s effort to establish TMDLs and believes they are consisted with recommendations in Lower Saluda River Corridor Plan and the Catawba River Corridor Plan. (SC PRT)*

No response necessary.

Appendix A

Data

CW-221 (Unnamed Trib to Catawba River) drainage

acres square mi
 450 0.001562 0.7029

Clarks Fork Ck near Smyrna, SC USGS02153780

average annual flow water yrs 1981-1997	22.1
drainage area in sq miles	24.1
Generation coefficient 22.1/24.1	0.917012
average may-Oct	13.315
warm months generation coefficient	0.55249
warm months generation coefficient *unnamed trib drainage	0.388345 Unnamed trib to Cat Rr mean for 1

geo mean	factor	flow cfs	#/day	geo mean	factor	flow cfs	#/day
217	24468984	0.388345	2.06E+09	217	24468984	0.388345	2.06E+09
200	24468984	0.388345	1.9E+09	175	24468984	0.388345	1.66E+09
difference			1.62E+08	difference			3.99E+08
% difference			0.078341	% difference			0.193548

STATION	DATE	TIME	DEPTH	31616 FEC COLI MFM-FCBR /100ML	REMARK CODE
CW-221	890518	1352			85 J
CW-221	890619	1549			190 J
CW-221	890727	1355			220 @
CW-221	890823	1015			440 @

remark codes
@ no
code
J estimated
L greater than

CW-221	890919	1441	120 J
CW-221	891023	1042	110 J
CW-221	900509	1423	370 @
CW-221	900618	1453	70 J
CW-221	900717	1020	480 @
CW-221	900823	1349	6600 L
CW-221	900920	1030	790 @
CW-221	901004	1000	60 J
CW-221	910513	1400	20 J
CW-221	910610	1310	1 K
CW-221	910710	1300	1 K
CW-221	910806	1420	1 K
CW-221	910904	1125	1 @
CW-221	911010	1000	1 K
CW-221	920506	1020	200 @
CW-221	920602	1235	100 L
CW-221	920708	1005	100 L
CW-221	920804	1050	550 @
CW-221	920908	1005	7600 J
CW-221	921008	1025	510 @
CW-221	930519	1010	2000 @
CW-221	930622	1140	1600 @
CW-221	930715	1015	3000 @
CW-221	930803	1350	1100 @
CW-221	930902	1110	2000 @
CW-221	931006	1415	480 @
CW-221	940601	1040	920 @
CW-221	940616	1127	620 @
CW-221	940803	1145	1500 @
CW-221	940929	1005	960 @
CW-221	941103	1030	180 @
CW-221	950502	1058	5600 J
CW-221	950627	1040	3300 J
CW-221	950720	1051	480 @
CW-221	950823	946	3300 J
CW-221	950926	1338	1000 @
CW-221	951026	1115	1000 @
CW-221	960522	1010	30 J
CW-221	960627	1140	10 J
CW-221	960807	1100	5 K
CW-221	960924	1115	1 J
CW-221	970506	1023	200 @

* entered as zero@ in STORET
 Considered as 1 J in order to
 calculate a geometric mean

* 0@

CW-221	970617	1040	200 L
CW-221	970721	1025	200 L
CW-221	970917	1250	200 L

CW-221	971021	1345	96 @
CW-221	980601	1025	200 L
CW-221	980715	1105	10 J
CW-221	980803	1150	560 @
CW-221	980914	1445	450 @
CW-221	981022	1430	50 J

geomean	174.0814071
geo mean 89-93	145.002077
geo mean 94-98	216.7734986

Appendix B
Public Comments Received

