Total Maximum Daily Load Document

Ninety Six Creek Watershed

(Hydrologic Unit Codes 030501090701, 030501090702, 030501090703 030501090704)

Fecal Coliform Bacteria

Indicator for Pathogens

March 2010

SCDHEC Technical Document Number: 04A-10

Prepared for:

Bureau of Water

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Abstract

§303(d) of the Clean Water Act (CWA) and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop total maximum daily loads (TMDLs) for water bodies that are not meeting designated uses under technology-based pollution controls. A TMDL is the maximum amount of pollutant a waterbody can assimilate while meeting water quality standards for the pollutant of concern. All TMDLs include a wasteload allocation (WLA) for all National Pollutant Discharge Elimination System (NPDES)-permitted discharges, a load allocation (LA) for all nonpoint sources, and an explicit and/or implicit margin of safety (MOS). A fecal coliform (FC) TMDL was developed for several impaired stations within the Ninety Six Creek watershed located in Greenwood County, SC. Five stations along Ninety Six Creek and tributaries are included as impaired on the State's 2008 §303(d) list due to excessive FC numbers documented during the 2002-2006 assessment period. In addition, ten percent of the samples collected between 1999 and 2006 at the impaired monitoring stations exceeded the water quality standards.

The watershed is divided into two distinct sub-basins: The Upper Wilson Creek watershed and the lower Ninety Six Creek watershed. The upper watershed is more developed whereas the lower watershed is predominately forest or agriculture lands. There are currently three active NPDES permitted sanitary waste dischargers within the watershed. Probable sources of fecal contamination include wildlife, agricultural runoff, failing septic systems, illicit connections, leaking sewers, sanitary sewer overflows and urban runoff. The load-duration curve methodology was used to calculate existing and TMDL loads for each impaired segment. Existing pollutant loadings and proposed TMDL reductions for critical hydrologic conditions are presented in Table Ab-1. Critical hydrologic conditions were defined as either moist, mid-range, or dry depending on which condition demonstrated the highest load reductions necessary to meet water quality standards. In order to achieve the target load (slightly below water quality standards) for Ninety Six Creek and tributaries, reductions in the existing loads of up to 79% will be necessary at some stations. Compliance with terms and conditions of existing and future NPDES sanitary and stormwater permits (including all construction, industrial and MS4) may effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL. For SCDOT, compliance with terms and conditions of its NPDES MS4 permit is effective implementation of the WLA to the Maximum Extent Practicable (MEP). Required load reductions in the LA portion of this TMDL can be implemented through voluntary measures and are eligible for CWA §319 grants.

The Department recognizes that adaptive management/implementation of this TMDL might be needed to achieve the water quality standard and we are committed towards targeting the load reductions to improve water quality in the Ninety Six Creek Watershed. As additional data and/or information become available, it may become necessary to revise and/or modify the TMDL target accordingly.

Table Ab-1. Total Maximum Daily Loads for the Ninety Six Creek Watershed. Loads are expressed as colony forming units (cfu) per day.

				Wasteload Allocation (WLA)		Load Allocation (LA)	
Station	Existing Load (cfu/day)	TMDL (cfu/day)	Margin of Safety (MOS) (cfu/day)	Continuous Sources[1] (cfu/day)	Non-Continuous Sources[2,4] (% Reduction)	Load Allocation (cfu/day)	% Reduction to Meet LA[3]
S-092	9.49E+11	4.12E+11	2.06E+10	N/A	59	3.92E+11	59
S-233	4.21E+11	5.11E+11	2.56E+10	1.81E+11	28	3.05E+11	28
S-235	1.61E+12	8.94E+11	4.47E+10	N/A	47	8.49E+11	47
S-093	1.69E+12	1.59E+12	7.96E+10	9.45E+9	11	1.51E+12	11
RS-03346	2.05E+11	4.54E+10	2.27E+09	N/A	79	4.31E+10	79

Table Notes:

1. WLAs are expressed as a daily maximum; NA = not applicable, no point sources. Existing and future continuous discharges are required to meet the prescribed loading for the pollutant of concern. Loadings were developed based upon permitted flow and assuming an allowable permitted maximum concentration of 400cfu/100ml.
2. Percent reduction applies to all NPDES-permitted stormwater discharges, including current and future MS4, construction and industrial discharges covered under permits numbered SCS & SCR. Stormwater discharges are expressed as a percentage reduction due to the uncertain nature of stormwater discharge volumes and recurrence intervals. Stormwater discharges are

required to meet percentage reduction or the existing instream standard for pollutant of concern in accordance with their NPDES Permit.

3. Percent reduction applies to existing instream load; Where Percentage Reduction = (Existing Load-Load Allocation) / Existing Load
4. By implementing the best management practices that are prescribed in either the SCDOT annual SWMP or the SCDOT MS4 Permit to address fecal coliform, the SCDOT will comply with this TMDL and its applicable WLA to the maximum extent practicable (MEP) as required by its MS4 permit.

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1.0 Introduction

1.1 Background

FC bacteria are widely used as an indicator of pathogens in surface waters and wastewater. The presence of FCs in surface waters may signify a presence of pathogens, which in turn leads to a greater risk of health for individuals participating in recreational activities within the water body (USEPA, 2001). Acute gastrointestinal illnesses affect millions of people in the United States and cause billions of dollars of costs each year (Gaffield et al., 2003). Infections including respiratory, eye, ear, nose, throat, and skin diseases may also occur, of which many are caused by contaminated drinking water (USEPA, 1986). Improperly treated wastewater and untreated stormwater runoff has also been associated with a number of disease outbreaks, most notably an outbreak in Milwaukee affecting an estimated 403,000 people in 1993 (Corso et al., 2003).

Though occurring at low levels from natural sources, the concentration of FC bacteria can be elevated in water bodies as the result of pollution. Sources of FC bacteria are usually diffuse or nonpoint in nature and originate from stormwater runoff, failing septic systems, agricultural runoff and leaking sewers among other sources. Occasionally, the source of the pollutant is a point source. Section 303(d) of the Clean Water Act (CWA) and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop TMDLs for water bodies that are not meeting designated uses under technology-based pollution controls. The TMDL process establishes the allowable loading of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and in stream water quality conditions so that states can establish water quality-based controls to reduce pollution and restore and maintain the quality of water resources (USEPA 1991).

The State of South Carolina has placed 5 monitoring stations in the Ninety Six Creek watershed on South Carolina's Section 2008 §303(d) list for impairment due to FC bacteria. These stations are identified in Table 1 and Figure 1.

Table 1. Ninety Six Creek Watershed FC Impaired Waters.

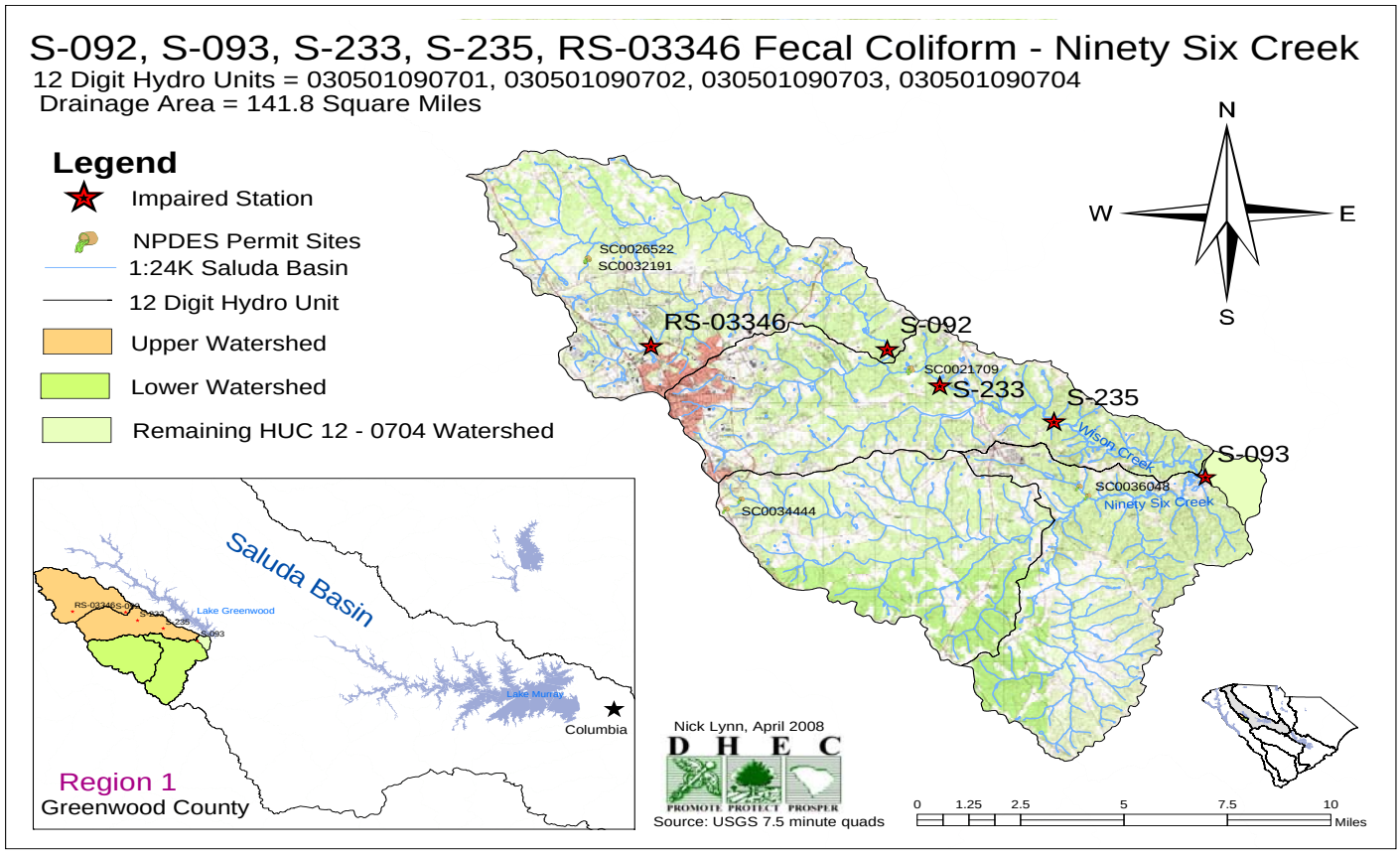
Waterbody	Station Number	Description
Coronaca Creek	S-092	Coronaca Creek at S-24-100 4 Miles NW of 96
Wilson Creek	S-233	Wilson Creek at S-24-101
Wilson Creek	S-235	Wilson Creek at S-24-124
Ninety Six Creek	S-093	Ninety Six Creek at SC 702 5.2 Miles ESE of 96
Rocky Creek	RS-03346	Rocky Creek at SC 72 Bypass and SC 254

1.2 Watershed Description

The headwaters of Coronaca Creek flow in a southeasterly direction across Greenwood County into Wilson Creek approximately 3 miles northeast of the City of Greenwood. Wilson Creek and its tributaries join Ninety Six Creek approximately 10 miles east of Greenwood and eventually flow into the Saluda River downstream of monitoring station S-093. It is estimated that there are approximately 168 stream miles in the watershed as well as 105 acres of lake waters (SCDHEC 2004). There are two general drainage areas within the Ninety Six Creek watershed, these are defined as:

1. Upper Watershed - the origin of Coronaca Creek down to the confluence with Wilson Creek
   - HUC 030501090701, 030501090702
2. Lower Watershed - the headwaters of Ninety Six Creek and its tributaries down to the confluence with Wilson Creek
   - HUC 030501090703, 030501090704

Figure 1. SCDHEC Monitoring Stations Impaired with Excessive FC Numbers.



Land use within the watershed is predominately forest and other non-cultivated vegetated lands (63%), mostly located in the lower Ninety Six Creek watershed (Table 2a). Developed lands (residential, commercial, industrial, or open urban space) comprise approximately 16% of the watershed but most of this land use is concentrated in the upper watershed. Pasture, crop, and cultivated lands comprise approximately 17% of the Ninety Six Creek watershed, as determined by the 2001 National Land Cover Data Set (NLCD 2001).

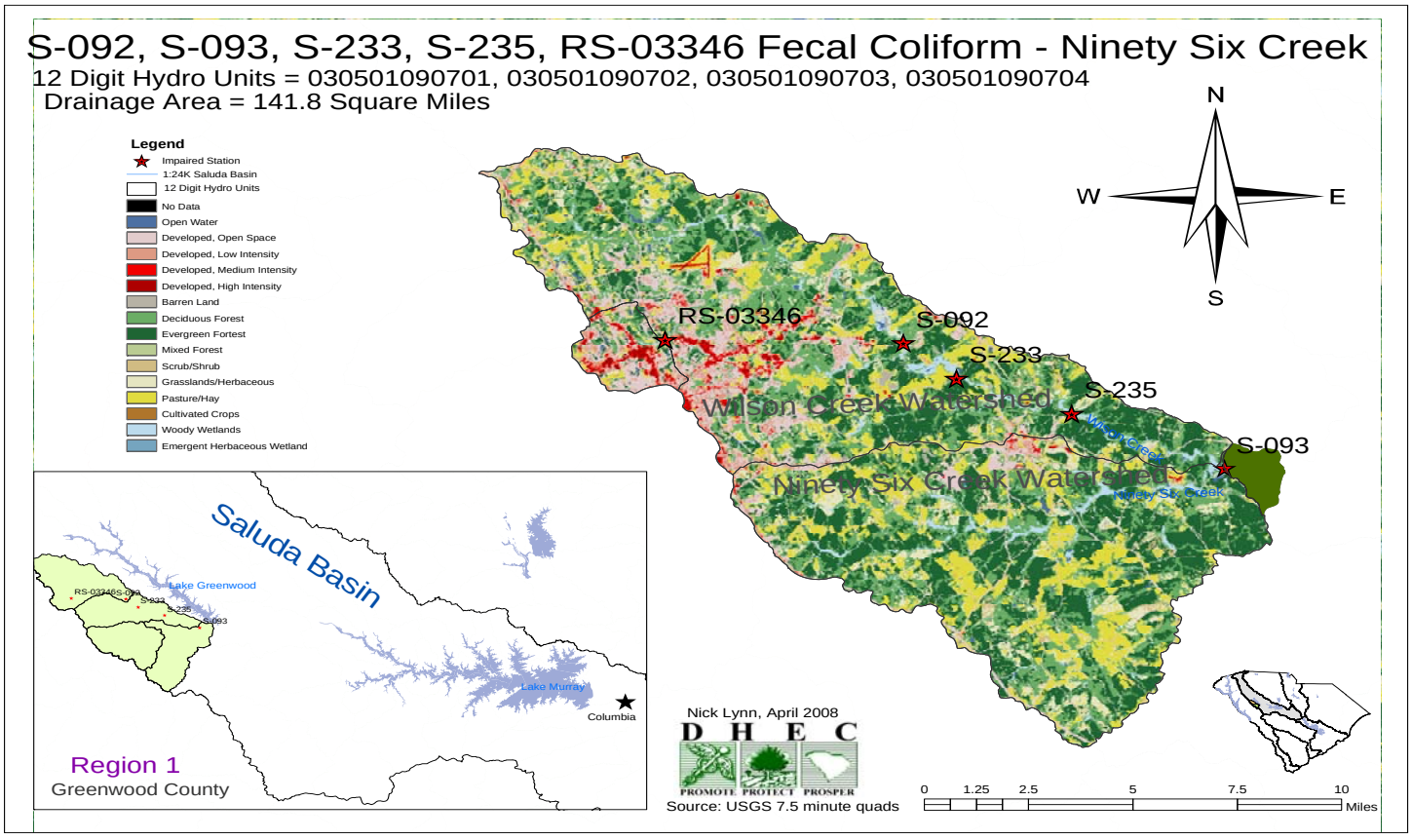
Table 2a. Ninety Six Creek Watershed Land Use (derived from NLCD 2001).

Land Use	Upper Watershed (ac)	%	Lower Watershed (ac)	%	Total Watershed (ac)	%	Greenwood County (ac)	%
Developed (residential, commercial, industrial)	11,347	22.9	3,255	7.9	14,601	16.1	31,613.8	10.7
Forest or otherwise vegetated (non-cultivated)	28,751	58.0	28,744	69.8	57,499	63.4	205,067.5	69.2
Wetlands	1,403	2.8	1122.36	2.7	2,525	2.8	6,089.4	2.1
Open Water	383.2	0.8	185.7	0.5	568.83	0.6	5,944.2	2.0
Pasture/crop	7,318	14.8	7,725	18.8	15,043	16.6	44,531.9	15.0
Barren	366.5	0.7	154.4	0.4	520.8	0.6	2,922.2	1.0
Total	**49,567**	**100**	**41,186**	**100**	**90,758**	**100**	**296,169**	**100**

Table 2b. Ninety Six Creek Watershed Developed Land Use by Station Reach (derived from NLCD 2001).

Station	Total Drainage Area of Station Reach (ac)	Total Developed Area (ac)	Percent Developed Area (%)
Headwaters to RS-03346	2927.8	1960.5	67.0
RS-03346 to S-092	23606.4	4651.0	19.7
S-092 to S-233	8838.4	2918.2	33.0
S-233 to S-235	10528.5	1631.9	15.5
S-235 to S-093	44857.2	3229.2	7.2
Total	**90758.3**	**14390.8**	**16.1**

Figure 2. Land Use within Ninety Six Creek Watershed (NLCD 2001).



The upper watershed (HUC 030501090701, 030501090702) drains approximately 49,500 acres. The major tributaries to Wilson Creek include Coronaca Creek, Sample Branch, Turner Branch, Rocky Creek, Stockman Branch and Brightmans Creek. The upper watershed is predominately forested and other vegetated lands (58%), with developed lands (residential, commercial, and industrial) representing 23% of the drainage area. The upper watershed is proportionally more developed than the County of Greenwood (Table 2a).

The lower watershed (HUC 030501090703, 030501090704) drains approximately 41,000 acres. Major tributaries to Ninety Six Creek include Henley Creek, Ropers Creek, Marion Creek, Tolbert Branch, Six Mile Creek, Kate Fowler Branch and Conally Branch. Land use within this watershed is dominated by forest or other vegetated lands (non-cultivated; 70%) and pasture, crop or cultivated land (19%). Approximately 8% of this drainage area is developed, which is proportionally lower than the counties overall 11% development (NLCD 2001).

The predominant soil types of the Ninety Six Creek watershed are of the Cecil-Pacolet-Hiwassee series (SCDHEC 2004) consisting of 105,000 of the approximate 296,000 acres of soil comprising the county. These series of soils are well drained, moderately permeable and are generally seen as forested areas or in cultivation. They are also rated as having a medium to rapid surface runoff speed. The erodibility of the soil (K-value) in the watershed averages 0.26 which implies that the soils are moderately susceptible to soil detachment (USDA 2008). Slope of the terrain averages 10% and ranges from 2-40% in the watershed.

1.3 Water Quality Standard

The impaired stream segments of the Ninety Six Creek basin are designated as Class Freshwater. Waters of this class are described as:

> "Freshwaters (FW) are 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)

South Carolina's Water Quality Standard (WQS) for FC in freshwater is:

> "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).

Primary contact recreation is not limited to large streams and lakes. Even streams that are too small to swim in, will allow small children the opportunity to play and immerse their hands and faces. The current WQS protects all surface waters for primary recreational use.

2.0 WATER QUALITY ASSESSMENT

The South Carolina Department of Health and Environmental Control (SCDHEC) currently conducts monitoring at 7 locations within the Ninety Six Creek watershed (SCDHEC 2004). Five sites are located within the upper Wilson Creek watershed and includes one station along Coronaca Creek, one station on Rocky Creek, and three stations along Wilson Creek. There are two monitoring stations in the lower watershed along Ninety Six Creek.

Waters in which no more than 10% of the samples collected over a five year period are greater than 400 FC counts or cfu/100 ml are considered to comply with the South Carolina WQS for FC bacteria. Waters with more than 10% of samples greater than 400 cfu/100 ml are considered impaired for FC bacteria and placed on South Carolina's §303(d) list[1].

There are 5 locations that are considered impaired due to FC WQS exceedences. Table 3 provides a summary of the number of samples collected, number of exceedences and exceedence percentage. Figure

[1] The frequency of sampling was fewer than five samples within a 30 day period, therefore the water quality assessment was based on the 10% standard (400/100 mL).

3 illustrates samples exceeding the water quality standard for monitoring conducted at S-092 between 1999 and 2006 (shown in green), as well as precipitation data shown in blue.

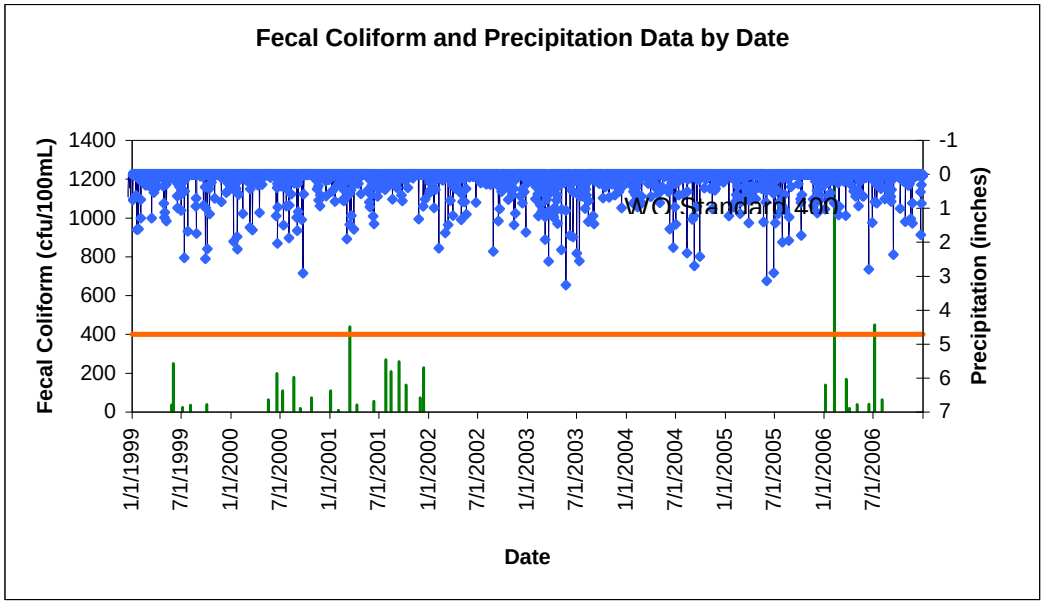
For S-092, a positive correlation was observed between FC and flow (r = 0.374) and a weak positive correlation was observed for FC and rain (r = 0.090). The remaining precipitation versus FC concentration figures are shown in appendix B.

For S-233, a negative correlation was observed between FC and flow (r = -0.246) as well as FC and rain (r = -0.357). For S-235, a weak negative correlation was observed between FC and flow (r = -0.047) and a negative correlation was observed between FC and rain (r = 0.182). For S-093, a weak positive correlation was observed between FC and flow (r = 0.064) and a positive correlation was observed between FC and rain (r = 0.251). For RS-03346, a weak positive correlation was observed between FC and flow (r = 0.097) and a strong positive correlation was observed between fecal coiform and rain (r = 0.931).

Table 3. FC Data Summary for Impaired Stations (1999-2006)

Station	Waterbody	Number of Samples	Number Samples >400/100mL	% Samples Exceed WQS
S-092	Coronaca Creek	31	3	9.6%
S-233	Wilson Creek	31	3	9.6%
S-235	Wilson Creek	34	1	2.9%
S-093	Ninety Six Creek	95	9	9.4%
RS-03346	Rocky Creek	12	5	41.6%
Total		**203**	**21**	**14.62%**

Figure 3. Precipitation and FC Data by Date for S-092.



3.0 SOURCE ASSESSMENT AND LOAD ALLOCATION

FC bacteria are used by the State of South Carolina as the indicator for pathogens in surface waters. Pathogens, which are usually difficult to detect, cause disease and make full body contact recreation in lakes and streams a risk to public health. Indicators such as FC bacteria, enteroccoci, or *E. coli* are easier to measure, have similar sources as pathogens, and persist in surface waters for a similar or longer length of time. These bacteria are not in themselves disease causing, but indicate the potential presence of organisms that may result in sickness. There are many sources of pathogen pollution in surface waters. In general these sources may be classified as point and nonpoint sources. With the implementation of technology-based controls, pollution from continuous point sources, such as factories and wastewater treatment facilities, has been greatly reduced. These point sources are required by the Clean Water Act (CWA) to obtain a NPDES permit. In South Carolina NPDES permits require that dischargers of sanitary wastewater must meet the state standard for FC at the point of discharge.

Municipal and private sanitary wastewater treatment facilities may occasionally be sources of pathogen or FC bacteria pollution. However, if these facilities are discharging wastewater that meets their permit limits, they are not causing impairment. If any of these facilities is not meeting its permit limits, enforcement actions/mechanisms are required.

Other non-continuous point sources required to obtain NPDES permits that may be a source of pathogens include Municipal Separate Storm Sewer Systems (MS4s) and stormwater discharges from industrial or construction sites. MS4s may require NPDES discharge permits for industrial or construction activities under the NPDES Stormwater regulations. These sources are also required to comply with the state standard for the pollutant(s) of concern. If MS4s and discharges from construction sites meet the percentage reduction or the water quality standard as prescribed in Section 5 of this TMDL document and required in their MS4 permit(s), they should not be causing or contributing to an instream FC bacteria impairment.

3.1 Point Sources

3.1.1 Continuous Point Sources

There are numerous active NPDES discharges in this watershed, including the Greenwood Mills 'Harris' and 'Matthews' industrial plants covered under South Carolina General Permits (SCG250127, SCG250118), but they do not discharge FC bacteria. Currently there are three active permitted domestic dischargers in the Ninety Six Creek watershed (Figure 1), two of which are considered minor (permitted flow < 1.0 million gallons per day) and one major (permitted flow > 1.0 million gallons per day). A list of NPDES treated sanitary waste dischargers and the adjacent closest downstream impaired segment that receives the discharge is provided in Table 4. The single "major" discharge in the Ninety Six Creek watershed is operated by Greenwood County (Wilson Creek WWTF, Figure A-1).

The Wilson Creek WWTF (SC0021709) is currently the largest of the three domestic dischargers in the watershed and is operating under a final discharge flow limit that expires September 30, 2009. Since this facility (located off of Emerald Road in the city of Greenwood) operates with a monthly average permitted flow of > 1.0 million gallons per day it is classified as a major operation. Under current terms and conditions of the Wilson Creek WWTF permit, the facility is permitted to discharge a monthly average of up to 12.0 million gallons per day (MGD). This facility was undergoing an expansion (Figure A-2) at the time of the site visit in June 2008.

The United Utilities Highland Forest WWTP (SC0034444) is operating under a final discharge flow limit that is effective through July 31, 2009 and is classified as minor. Under current terms and conditions the United Utilities Highland Forest WWTP is permitted to discharge a monthly average of up to 0.075 million gallons per day (MGD). This facility is located off of highway 25 South, within the Greenwood city limits.

The Ninety Six WWTF is located approximately 3.3 miles southeast of the City of Greenwood off highway 3. This facility is operating under a final discharge flow limit that is effective until June 30, 2009. The facility (Figure A-3) is permitted to discharge a monthly average of up to 0.55 MGD under the current terms and conditions of permit SC0036048. One of the facilities two clarifiers was out of service at the time a site visit was conducted in June of 2008.

Located approximately 2 miles west of Greenwood along Brightman Creek, the Northfalls WWTF was permitted to discharge 0.004 MGD from June of 1999 until becoming inactive in May of 2004. The facility operated under the permit SC0026522 and was characterized as minor domestic due to the fact its average monthly permitted flow was less than one million gallons per day. The facility was also permitted under SC0032191 from June 2000 until May 2005 with a permitted flow of 0.036 MGD. A June 2008 site visit revealed that the now inactive basin is presently heavily vegetated.

Table 4. NPDES Treated Sanitary Waste Dischargers in the Ninety Six Creek Watershed.

Impaired Station Watershed	Facility Name	Permit #	Type
S-092, S-233 S-235, S-093	NORTHFALL ACRES SD	SC0026522	Minor Domestic*
S-092, S-233 S-235, S-093	NORTHFALL ACRES SD	SC0032191	Minor Domestic**
S-233, S-235 S-093	GREENWOOD/WILSON CREEK WWTF	SC0021709	Major Domestic
S-093	UNITED UTIL/HIGHLAND FOREST SD	SC0034444	Minor Domestic
S-093	NINETY SIX WWTF	SC0036048	Minor Domestic

*NPDES Discharger became inactive May 30, 2004.
**NPDES Discharger became inactive May 31, 2005.

Future NPDES discharges in the referenced watershed are required to comply with the load reductions prescribed in the WLA and demonstrate consistency with the assumptions and requirements of the TMDL.

3.1.2 Non-Continuous Point Sources

Non-continuous point sources include all NPDES-permitted stormwater discharges, including current and future MS4s, construction and industrial discharges covered under permits numbered SCS and SCR and regulated under SC Water Pollution Control Permits Regulation 122.26(b)(14)&(15). All regulated MS4 entities have the potential to contribute FC pollutant loadings in the delineated drainage area used in the development of this TMDL.

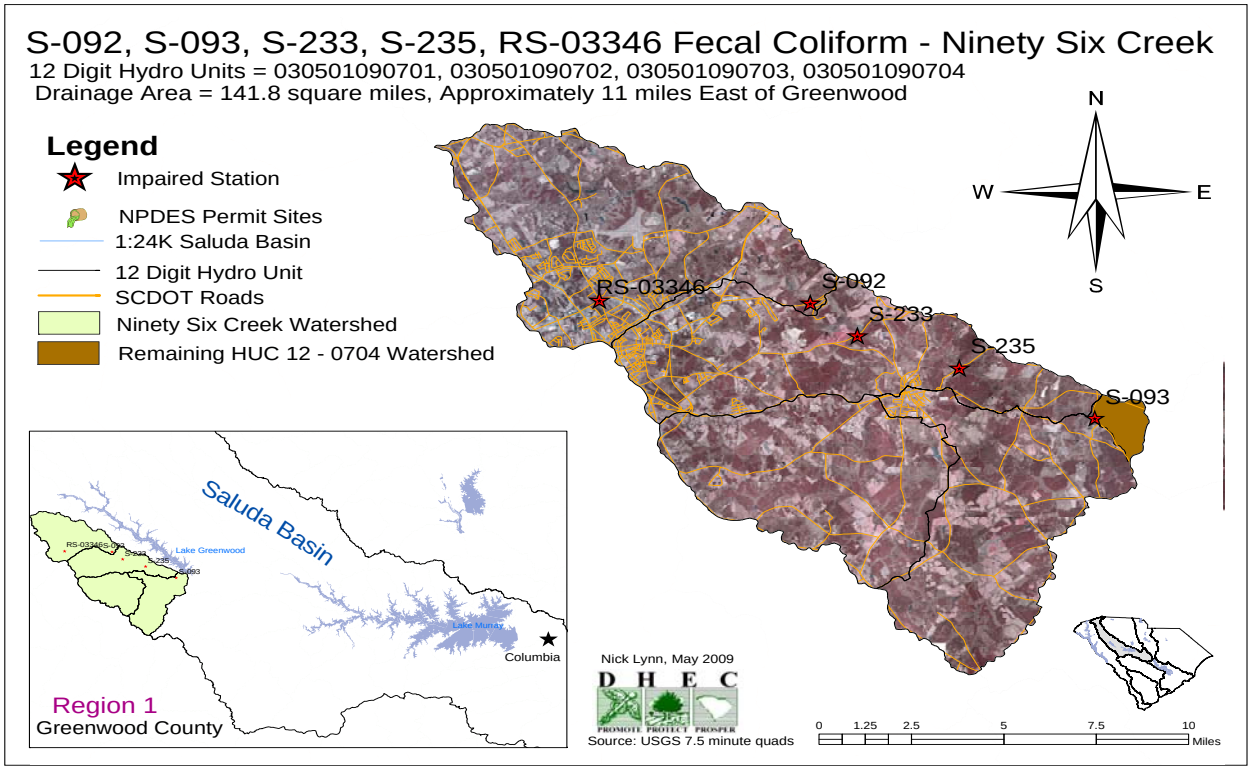
The South Carolina Department of Transportation (SCDOT) is currently the only designated Municipal Separate Storm Sewer System (MS4) within the watershed. The SCDOT operates under NPDES MS4 SCS040001 and owns and operates roads in the watershed (Figure 4). However, the Department recognizes that SCDOT is not a traditional MS4 in that it does not possess statutory taxing or enforcement powers. SCDOT does not regulate land use or zoning, issue building or development permits.

The City of Greenwood is a potentially designated MS4 located in this watershed. The Ninety-Six Creek watershed also contains the currently unregulated Town of Ninety Six in addition to the potentially-designated City of Greenwood. Similar to regulated MS4s, potentially designated MS4 entities (as listed in 64 FR, P. 688837) or other unregulated MS4 communities located in the Ninety Six Creek watershed may have the potential to contribute FC bacteria in stormwater runoff. If future MS4 permits are applicable to this watershed, then those discharges will be subject to the assumptions and requirements of the WLA portion of this TMDL. However, there may be industrial or construction activities going on at any time that could produce stormwater runoff.

Industrial facilities that have the potential to cause or contribute to a violation of a water quality standard are covered by the NPDES Storm Water Industrial General Permit (SCR000000). Construction activities are usually covered by the NPDES Storm Water Construction General Permit from DHEC (SCR100000). Where construction activities have the potential to affect water quality of a water body with a TMDL, the Storm Water Pollution Prevention Plan (SWPPP) for the site must address any pollutants of concern and adhere to any wasteload allocations in the TMDL. The Ninety Six Creek watershed has great potential for growth and development and therefore construction activities are likely to occur.

Sanitary sewer overflows (SSOs) to surface waters have the potential to severely impact water quality. These untreated sanitary discharges result in violations of the WQS. It is the responsibility of the NPDES wastewater discharger, or collection system operator for non-permitted 'collection only' systems, to ensure that releases do not occur. Unfortunately releases to surface waters from SSOs are not always preventable or reported. There were 198 reported releases in Greenwood County between 1999 and 2006, resulting in the release of over 947,000 gallons of untreated sanitary waste. It is not known what percentage of these releases occurred specifically in the Ninety Six Creek watershed. Figure A-4 shows a sanitary sewer in close proximity to Coronaca Creek. An overflow in this area could have an adverse impact on the creek and contribute to FC loading in the watershed. It has been shown that FC concentrations in typical SSOs are reported as 10^5 to 10^7 MPN/100mL (Novotny et al., 1989). Installation of a sufficient riparian buffer between sanitary sewers and surface waters is one suggested form of implementation for the Ninety Six Creek watershed TMDL.

Figure 4. SCDOT Owned and Maintained Roads in the Ninety-Six Creek Watershed



The Department acknowledges that progress with the assumptions and requirements of the TMDL by MS4s is expected to take one or more permit iteration. Achieving the WLA reduction for the TMDL may constitute MS4 compliance with its SWMP, provided the MEP definition is met, even where the numeric percent reduction may not be achieved in the interim.

3.2 Nonpoint Sources

The Department recognizes that there may be wildlife, agricultural activities, grazing animals, septic tanks, and/or other nonpoint source contributors located within unregulated areas (outside the permitted area) of the Ninety Six Creek watershed. Nonpoint sources located in unregulated areas are subject to the load allocation and not the waste load allocation of the TMDL document.

3.2.1 Wildlife

Wildlife (mammals and birds) can be a significant contributor of FC bacteria. Wildlife in this area typically includes deer, squirrels, raccoons, and other mammals as well as a variety of birds. Wildlife wastes are carried into nearby streams by runoff following rainfall or deposited directly in streams. Waterfowl may be a significant contributor of FC bacteria in this watershed, especially in impounded areas, which provide a desirable habitat for geese and ducks.

In 2008, SCDNR estimated that there are 30-45 deer per square mile within the Ninety Six Creek watershed of Greenwood County (SCDNR 2008). SCDNR estimated deer density based on suitable habitat (forests, croplands, and pastures). The FC production rate for deer has been shown to be 3.47×10^8 cfu/head-day in a study conducted by Yagow (1999), of which only a portion will enter the watershed. Based on a site assessment, wildlife is considered to be a significant contributor to the FC load within the rural portions of the watershed as numerous waterfowl and deer were seen.

3.2.2 Agricultural Activities

Agricultural activities that involve livestock, animal wastes, or unstabilized surfaces are potential sources of FC contamination of surface waters. Fecal matter can enter the waterway via runoff from the land or by direct deposition into the stream. Agricultural activities may represent a significant source in the Ninety Six Creek watershed due to the fact that these activities constitute a large portion of the land use. A fly over of the drainage area conducted in July, 2008 yielded an agricultural field (Figures A-5, A-6) which had been tilled up to and into Coronaca Creek's bank leaving an insufficient vegetative buffer. A ground level site visit also conducted in July (Figure A-7) confirmed that the field had been planted for row crops. Unstabilized soil directly adjacent to surface waters can contribute to FC loading during periods of runoff after rain events. During these events, wildlife wastes can be transported into the creek and carried downstream. Installation of a riparian buffer may be appropriate in reducing FC loading to receiving waters in areas where creek banks have been disturbed.

3.2.2.1 **Agricultural Animal Facilities**

Owners/operators of most commercial animal growing operations are required by SC Regulation 61-43, Standards for the Permitting of Agricultural Animal Facilities, to obtain permits for the handling, storage, treatment (if necessary) and disposal of the manure, litter, and dead animals generated at their facilities (SCDHEC 2002). The requirements of R. 61-43 are designed to protect water quality; therefore, we have a reasonable assurance that facilities operating in compliance with this regulation should not contribute to downstream water quality impairments. South Carolina currently does not have any confined animal feeding operations (CAFOs) under NPDES coverage; however, the State does have permitted animal feeding operations (AFOs) covered under R. 61-43. These permitted operations are not allowed to discharge to waters of the State and are covered under 'no discharge' (ND) permits. Discharges from these operations to waters of the State are illegal and are subject to enforcement actions by SCDHEC.

There are currently nine active animal feeding operations (AFOs) in the Ninety Six Creek watershed (Table 5). These facilities consist of seven broiler poultry operations, one pullet poultry operation, and one layer poultry operation permitted to hold over one million animals combined. These facilities are routinely inspected for compliance. Permitted agricultural facilities that operate in compliance with their permit are not considered to be sources of impairment. Numerous land application sites were observed during site visits to the area and appeared to not be directly contributing to the overall FC load of the watershed. Visited sites were well stabilized with extensive vegetative growth between application areas and surface waters. The

minimum separation distance in feet required between a manure utilization area and waters of the State (including ephemeral and intermittent streams) located down slope from the area is 100 feet when spray application is the application method or when the manure is spread on the ground surface, 75 feet when incorporation is the application method, and 50 feet when injection is the application method. When incorporation is accomplished within twenty-four hours of the initial application, the distance can be reduced to 50 feet (SCDHEC 2002).

Table 5. Permitted Active Animal Feeding Operations within the Ninety Six Creek Watershed.

Downstream Impaired	AFO Permit	Facility	Type of Livestock	Number Animals	Total Permitted Acres
S-093	ND0083852	Sudduth Poultry Farm	Poultry (Broilers)	109,600	26
S-233, S-235 S-093	ND0005193	Bailey-Nixon Poultry	Poultry (Pullets)	180,000	256
S-235, S-093	ND0061565	B & W Johnson Poultry	Poultry (Layers)	100,000	225
S-093	ND0080586	McDowell Broiler Fac.	Poultry (Broilers)	96,000	103
S-093	ND0082236	Two Oaks Broiler Farm	Poultry (Broilers)	135,500	58
S-093	ND0073636	Caroline Scott Farm	Poultry (Broilers)	120,000	35
S-093	ND0081248	JWM Poultry Farm	Poultry (Broilers)	96,000	26
S-092, S-233 S-235, S-093	ND0082333	M & D Poultry Farms	Poultry (Broilers)	139,500	21
S-235, S-093	ND0008486	Johnson Bros. Poultry	Poultry (Broilers)	132,000	598

NA = not available

3.2.2.2 Grazing Animals

Livestock, especially cattle, are frequently major contributors of FC bacteria to streams. Cattle on average produce some 1.0E+11 cfu/day per animal of FC bacteria (ASAE 1998). Grazing cattle and other livestock may contaminate streams with FC bacteria indirectly by runoff from pastures or directly by defecating into streams and ponds (Figure A-8). The grazing of unconfined livestock (in pastures) is not regulated by SCDHEC. The United States Department of Agriculture's National Agricultural Statistics Service reported 13,667 cattle and calves in Greenwood County respectively in 2002 (USDA 2002). Direct loading by cattle or other livestock to surface waters within the Ninety Six Creek watershed is likely to be a significant source of FC. Pasture and crop land use within the Ninety Six Creek watershed is estimated to be 10,825 acres, which was derived from NLCD 2001. Pasture and crop land use within Greenwood County is estimated to be 31,980 acres. By taking the ratio of the above land use, the Ninety Six Creek watershed is proportional to 33.8% of the Greenwood County pasture/crop land use, assuming an even distribution across Greenwood County. This relates to an estimated 4,619 cattle and calves within the Ninety Six Creek watershed, which combined, produces an average of 4.62E+14 cfu/day of FC bacteria. A site visit to the Ninety Six Creek watershed conducted in July, 2008 confirmed the contribution of livestock to the FC load as shown in Figure A-9 where cattle were seen accessing and laying down in the surface waters of Big Rock Creek.

BMP installation could minimize the impact of grazing animals to surface waters of the State. A study conducted in 1998 by the American Society of Agricultural and Biological Engineers (ASABE 1998) has shown that a vegetative buffer measuring 6.1 meters in width can reduce fecal runoff concentrations from 2.0E+7 to an immeasurable amount once filtered through the buffer. A buffer of this width was also shown to reduce phosphorous and nitrogen concentrations by 75%. Installing fencing along the streams within the watershed where livestock are present would also eliminate the direct contact of cattle with the streams. It has also been shown that installing water troughs within a pasture area in a West Virginia study reduced the amount of time cattle spent drinking directly from streams by 92% (ASABE 1997). An indirect result of this was a 77% reduction in stream bank erosion.

3.2.3 Leaking Sanitary Sewers and Illicit Discharges

Leaking sewer pipes and illicit sewer connections represent a direct threat to public health since they result in discharge of partially treated or untreated human wastes to the surrounding environment. Quantifying these sources is extremely speculative without direct monitoring of the source because the magnitude is directly proportional to the volume and its proximity to the surface water. Typical values of FC in untreated domestic wastewater range from 10^4 to 10^6 MPN/100mL (Metcalf and Eddy 1991). Illicit sewer connections into storm drains result in direct discharges of sewage via the storm drainage system outfalls. The existence of illicit sewer connections to storm drains is well documented in many urban drainage systems. Monitoring of storm drain outfalls during dry weather is needed to document the presence or absence of sewage in the drainage systems. The Greenwood Metropolitan District is currently managing a project consisting of the replacement of the Wilson Creek and Coronaca Creek trunk sewer system (Figure A-10).

3.2.4 Failing Septic Systems

Studies demonstrate that wastewater located four feet below properly functioning septic systems contains on average less than one FC bacteria organism per 100 mL (Ayres Associates 1993). Failed or non-conforming septic systems, however, can be a contributor of FC to Ninety Six Creek and its tributaries. Wastes from failing septic systems enter surface waters either as direct overland flow or via groundwater. Although loading to streams from failing septic systems is likely to be a continual source, wet weather events can increase the rate of transport of pollutants from failing septic systems because of the wash-off effect from runoff and the increased rate of groundwater recharge.

Based on the 2000 U.S. population census (U.S. Census Bureau 2000), there are estimated to be 13,703 septic systems within Greenwood County. Of the 25,729 households within the county, an estimated 28,778 people rely on a community sewer system. Approximately 8,660 households within the Ninety Six Creek watershed are serviced by a community sewer system. It is estimated that there is a total population of 30,612 people, living in 12,976 households, inside the drainage area. Assuming one septic tank per household that is not serviced by a community sewer system, it is estimated that there are 4,316 septic tanks within the Ninety Six Creek watershed. At the time of TMDL development, their status in relation to function is unknown.

3.2.5 Urban Runoff

Dogs, cats, and other domesticated pets are the primary source of FC deposited on the urban landscape. According to a 2002 study conducted by the American Veterinary Medical Association (AVMA 2002), there are 0.58 dogs and 0.66 cats on average per each household within an urban setting. Based on U.S. census data (U.S. Census Bureau 2000), it is estimated that there are 25,729 households within the County of Greenwood, of which 12,976 are within the Ninety Six Creek watershed. This results in approximately 7,421 dogs in the delineated area. It has been shown that dogs produce approximately 0.32 pounds of fecal waste per day (Geldrich, et al., 1962). This results in an estimated 2,375 pounds of waste deposited by domesticated dogs in the watershed per day. Based on the AVMA study and observations by Geldrich and others, there are approximately 8,564 cats in the drainage area producing 1,284 pounds of waste per day. There are also 'urban' wildlife, squirrels, raccoons, pigeons, and other birds in the watershed, all of which contribute to the FC load.

The City of Greenwood is a potentially designated MS4 located in this watershed. Similar to regulated MS4s, potentially designated MS4 entities (as listed in 64 FR, P. 688837) or other unregulated MS4 communities located in the Ninety Six Creek watershed, such as the Town of Ninety-Six, may have the potential to contribute FC bacteria in stormwater runoff.

4.0 LOAD-DURATION CURVE METHOD

The load-duration curve method was developed as a means of incorporating natural variability, uncertainty, and risk assessment into TMDL development (Bonta and Cleland 2003). The analysis is based on the range of hydrologic conditions for which there are appropriate water quality data. The load-duration curve method uses the cumulative frequency distribution of stream flow and pollutant concentration data to estimate existing and TMDL loads for a water body. Development of the load-duration curve is described in this chapter.

The load-duration curve method depends on an adequate period of record for flow data. USGS gauge 02165200, South Rabon Creek, was used to provide an adequate record. This gauge began recording daily flows in 1967 and provides the flow data required to establish the flow duration curves for S-092, S-093, S-233, S-235 and RS-03346.

Flow data for a ten year period (1997-2006) was used to establish flow duration curves. The records for this period were complete (i.e., no missing dates). The flow records were used to estimate flow at each of the 5 impaired monitoring stations. Drainage areas of each sampling station were delineated using USGS topographic maps and ArcMap software. The cumulative area drained was calculated and used to estimate flow based on the ratio of the monitoring station drainage area to the downstream USGS gauge. For example, the USGS South Rabon Creek gauge records flow from 29.5 square miles (sq mi). The cumulative drainage area at monitoring station S-093 (Ninety Six Creek at SC 702 5.2 Miles ESE of 96) is approximately 141.8 sq mi or 480% of the area drained at the South Rabon Creek gauge. Mean daily flow for the S-093 monitoring location was assumed to be 480% of the daily flow at the South Rabon Creek gauge.

Flow duration curves were developed by ranking flows from highest to lowest and calculating the probability of occurrence (presented as a percentage or duration interval), where zero corresponds to the highest flow. The duration interval can be used to determine the percentage of time a given flow is achieved or exceeded, based on the period of record. Flow duration curves were divided into five hydrologic condition categories (High Flows, Moist Conditions, Mid-Range, Dry Conditions and Low Flows). Categorizing flow conditions can assist in determining which hydrologic conditions result in the greatest number of exceedences. A high number of exceedences under dry conditions might indicate a point source or illicit connection issue, whereas moist conditions may indicate nonpoint sources. Data within the High Flow and Low Flow categories are generally not used in the development of a TMDL due to their infrequency.

A target load-duration curve was created by calculating the allowable load using daily flow, the FC WQS concentration and a unit conversion factor. The water quality target was set at 380 cfu/100ml for the instantaneous criterion, which is five percent lower than the water quality criteria of 400 cfu/100ml. A five percent explicit Margin of Safety (MOS) was reserved from the water quality criteria in developing target load-duration curves. The load-duration curve for station S-092 is presented in Figure 5 as an example. Load-duration curves for all FC impaired stations are provided in Appendix A.

For all curves, including Figure 5, the independent variable (X-Axis) represents the percentage of estimated flows greater than value x. The dependent variable (Y-Axis) represents the FC loading at each estimated flow expressed in terms of colony forming units per day (cfu/day). In each of the defined flow intervals for stations S-092 and RS-03346, existing and target loadings were calculated by the following equations:

Existing Load = Mid-Point Flow in Each Hydrologic Category x 90th Percentile FC Concentration x 10000

Target Load = Mid-Point Flow in Each Hydrologic Category x 380 (WQ criterion minus a 5% MOS) x 10000

Percent Reduction = (Existing Load – Target Load) / Existing Load

For the defined flow intervals for stations S-093, S-233 and S-235, existing and target loadings were calculated using the following equations.

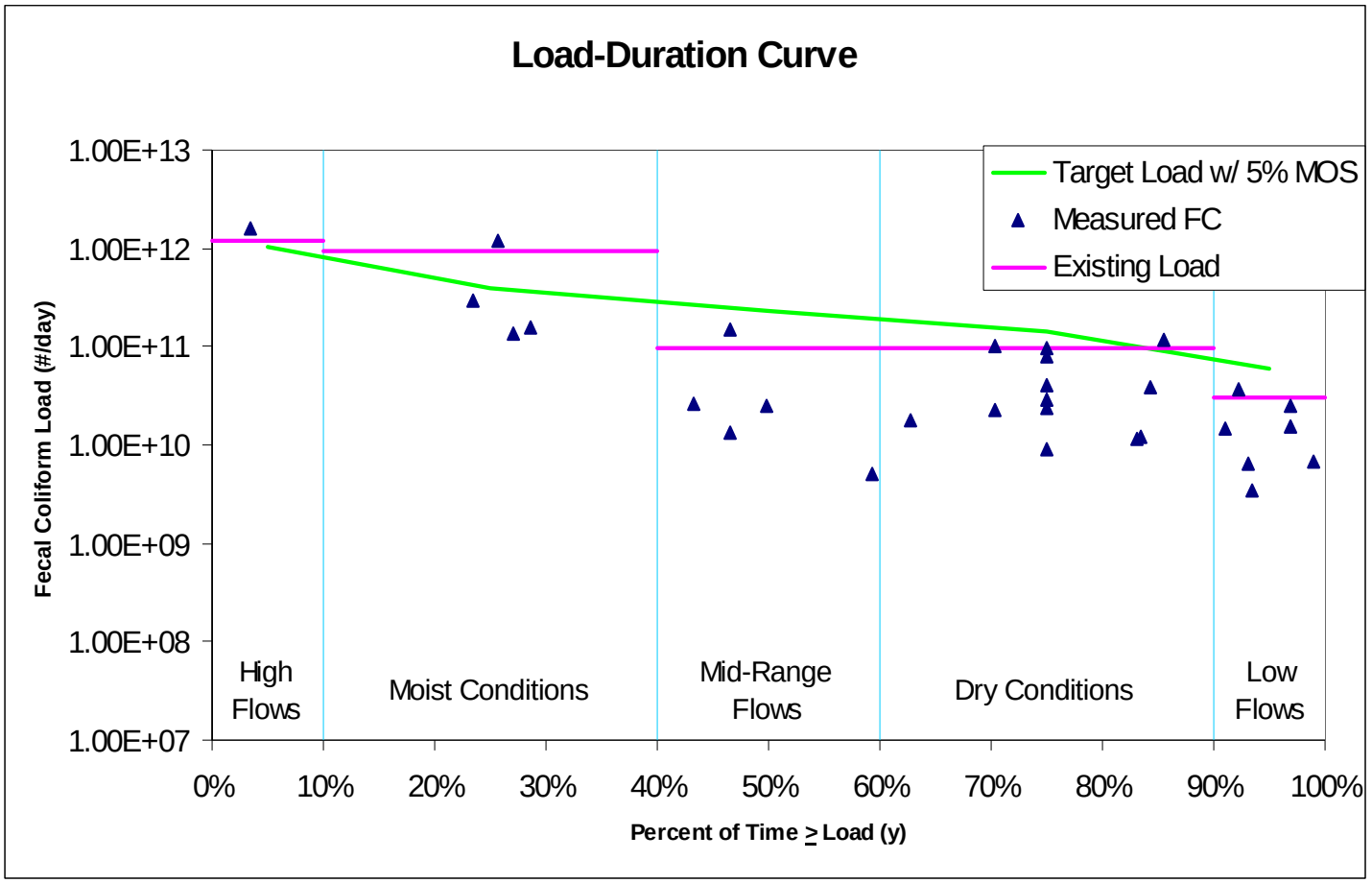
Existing Load = (Mid-Point Flow in Each Hydrologic Category + Discharge Monitoring Report Monthly Average Flow from SC0021709) x 90th Percentile FC Concentration x 10000

Target Load = (Mid-Point Flow in Each Hydrologic Category + Permitted Flow from SC0021709 (12MGD = 18.5 cfs)) x 380 (WQ criterion minus a 5% MOS) x 10000

Percent Reduction = (Existing Load – Target Load) / Existing Load

Instantaneous loads for each of the impaired stations were calculated. Measured FC concentrations from 1999 through 2006 were multiplied by measured (or estimated flow based on drainage area) flow on the day of sampling and a unit conversion factor. These data were plotted on the load-duration graph based on the flow duration interval for the day of sampling. Samples above the target line are violations of the WQS while samples below the line are in compliance (Figure 5; Appendix A). Only the instantaneous water quality criterion was targeted because there is insufficient data to evaluate against the 30-day geometric mean.

Figure 5. Load Duration Curve for Coronaca Creek Station S-092.



An existing load was determined for each hydrologic category for the TMDL calculations. For stations S-092 and RS-03346, the 90th percentile of measured FC concentrations within each hydrologic category were multiplied by the flow at each category midpoint (i.e., flow at the 25% duration interval for the Moist Conditions, 50% interval for Mid-Range, and 75% for Dry Condition).

For stations S-093, S-233 and S-235, the 90th percentile of measured FC concentrations within each hydrologic category were multiplied by the flow at each category midpoint (i.e., flow at the 25% duration interval for the Moist Conditions, 50% interval for Mid-Range, and 75% for Dry Condition) plus the discharge monitoring report monthly average flow from SC0021709. Due to the proportion of flow from SC0021709 to the flow from Wilson Creek, this was done to account for SC0021709's large contribution to the overall stream flow in Wilson Creek.

Existing loads are plotted on the load-duration curves presented in Appendix A as well as the example for station S-092 in Figure 5. These values were compared to the target load (which includes an explicit 5% MOS) at each hydrologic category midpoint to determine the percent load reduction necessary to achieve compliance with the WQS. This TMDL assumes that if the highest percent reduction is achieved than the WQS will be attained under all flow conditions.

5.0 DEVELOPMENT OF TOTAL MAXIMUM DAILY LOAD

A total maximum daily load (TMDL) for a given pollutant and water body is comprised of the sum of individual wasteload allocations (WLAs) for point sources, and load allocations (LAs) for both nonpoint sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, to account for the uncertainty in the relationship between pollutant loads and the quality of the receiving water body. Conceptually, this definition is represented by the equation:

$$TMDL = \sum WLAs + \sum LAs + MOS$$

The TMDL is the total amount of pollutant that can be assimilated by the receiving water body while still achieving compliance with WQS. In TMDL development, allowable loadings from all pollutant sources that cumulatively amount to no more than the TMDL must be established and thereby provide the basis to establish water quality-based controls.

For most pollutants, TMDLs are expressed as a mass load (e.g., kilograms per day). For bacteria, however, TMDLs are expressed in terms of number (#), colony forming units (cfu), organism counts (or resulting concentration), or MPN (Most Probable Number), in accordance with 40 CFR 130.2(l).

5.1 Critical Conditions

This TMDL is based on the flow recurrence interval between 10% and 90% and excludes extreme high and low flow conditions; flows that are characterized as 'Low' or 'High' in Figure 4 and Appendix A were not included in the analysis. The critical condition for each monitoring station is identified as the flow condition requiring the largest percent reduction, within the 10-90% duration intervals. Critical conditions for the Ninety Six Creek watershed pathogen impaired segments are listed in Table 6. This data indicates that for these stations, wet weather results in larger bacteria loads and is therefore the critical condition for those stations.

5.2 Existing Load

An existing load was determined for each hydrologic category for the TMDL calculations as described in Section 4.0 of this TMDL. The existing load under the critical condition, described in Section 5.1 above was used in the TMDL calculations. Loadings from all sources are included in this value: urban runoff, cattle-in-streams, leaking sewers, failing septic systems as well as all point sources. The existing load for each station in the Ninety Six Creek watershed is provided in Appendix F.

Table 6. Percent Reduction Necessary to Achieve Target Load by Hydrologic Category.

Station	Waterbody	Moist Conditions	Mid-Range Flow	Dry Conditions
S-092	Coronaca Creek	59		
S-233	Wilson Creek		28	
S-235	Wilson Creek	47		
S-093	Ninety Six Creek	11		
RS-03346	Rocky Creek	79		

Highlighted cells indicate critical condition.
NRN = no reduction needed. Existing load below target load.

5.3 Wasteload Allocation

The wasteload allocation (WLA) is the portion of the TMDL allocated to NPDES-permitted point sources (USEPA 1991). The WLA summation is determined by subtracting the margin of safety and the sum of the load allocation from the total maximum daily load. Note that all illicit dischargers, including SSOs, are illegal and not covered under the WLA of this TMDL.

5.3.1 Continuous Point Sources

There are three active permitted domestic dischargers in the Ninety Six Creek watershed (See Table 4). To determine the waste load allocation (WLA) for the three permitted sanitary dischargers, the average monthly permitted flow for these facilities was multiplied by an allowable permitted maximum concentration of 400 cfu/100mL and a unit conversion factor. The WLA for each of these dischargers, based on a permitted daily maximum of 400 cfu/100 ml, is presented in Table 7. The WLA for the largest sanitary waste water facility in the Ninety Six Creek watershed (Greenwood/Wilson Creek WWTF) is 181 billion colony forming units per day (1.81+E11 cfu/day) based on a permitted average monthly flow of 12 MGD. For the Ninety Six WWTF the waste load allocation was determined to be 8.32E+9 based on a permitted average monthly flow of 0.55 MGD. The WLA for the United Utilities/Highland Forest SD is 1.13E+9 based on a permitted average monthly flow of 0.075 MGD. Future continuous discharges are required to meet the prescribed loading for the pollutant of concern based on permitted flow and assuming an allowable permitted maximum concentration of 400cfu/100mL.

Table 7. Average Monthly Permitted Flow and WLAs for the NPDES Wastewater Discharges in the Ninety Six Creek Watershed.

Impaired Station	Facility Name	Permit #	Average Monthly Permitted Flow (MGD)	WLA (#/day)
S-092, S-233 S-235, S-093	Northfall Acres SD	SC0032191	0.036	Inactive
S-092, S-233 S-235, S-093	Northfall Acres SD	SC0026522	0.004	Inactive
S-233, S-235 S-093	Greenwood/Wilson Creek WWTF	SC0021709	12.0	1.81E+11
S-093	United Util/Highland Forest SD	SC0034444	0.075	1.13E+09
S-093	Ninety Six WWTF	SC0036048	0.55	8.32E+09

5.3.2 Non-Continuous Point Sources

Non-continuous point sources include all NPDES-permitted stormwater discharges, including current and future MS4s, construction and industrial discharges covered under permits numbered SCS & SCR and regulated under SC Water Pollution Control Permits Regulation 122.26(b)(14) & (15). Illicit discharges, including SSOs, are not covered under any NPDES permit and are subject to enforcement mechanisms. All areas defined as

"Urbanized Area" by the US Census are required under the NPDES Stormwater Regulations to obtain a permit for the discharge of stormwater. Other non-urbanized areas may be required under the NPDES Phase II Stormwater Regulations to obtain a permit for the discharge of stormwater.

Waste load allocations for stormwater discharges are expressed as a percentage reduction instead of a numeric loading due to the uncertain nature of stormwater discharge volumes and recurrence intervals. Regulated stormwater discharges are required to meet the percentage reduction or the existing instream standard for the pollutant of concern. The percent reduction is based on the maximum percent reduction (critical condition) within any hydrologic category necessary to achieve target conditions. Table 8 and Figure 6 present the reduction needed in each of the impaired segments. The reduction percentages in this TMDL also apply to the FC waste load attributable to those areas of the watershed which are covered or will be covered under NPDES MS4 permits.

Based on the available information at this time, the portion of the watershed that drains directly to a regulated MS4 and that which drains through the non-regulated MS4 has not been clearly defined for the MS4 jurisdictional area. Loading from both types of sources (regulated and non-regulated) typically occur in response to rainfall events, and discharge volumes as well as reoccurrence intervals are largely unknown. Therefore, the regulated MS4 is assigned the same percent reduction as the non-regulated sources in the watershed. The regulated MS4 entity is only responsible for implementing the TMDL WLA in accordance with MS4 permit requirements.

Compliance with terms and conditions of existing and future NPDES sanitary and stormwater permits (including all construction, industrial and MS4) may effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL. However, the Department recognizes that SCDOT is not a traditional MS4 in that it does not possess statutory taxing or enforcement powers. SCDOT does not regulate land use or zoning, issue building or development permits.

Table 8. Percent Reduction Necessary to Achieve Target Load.

Station	Waterbody	% Reduction
S-092	Coronaca Creek	59
S-233	Wilson Creek	28
S-235	Wilson Creek	47
S-093	Ninety Six Creek	11
RS-03346	Rocky Creek	79

5.4 Load Allocation

The Load Allocation applies to the nonpoint sources of FC bacteria and is expressed both as a load and as a percent reduction. The load allocation is calculated as the difference between the target load under the critical condition and the point source WLA. The load allocation for each station is listed in Table Ab-1 and table 9. There may also be unregulated MS4s located in the watershed that are subject to the LA component of this TMDL. At such time that the referenced entities, or other future unregulated entities become regulated NPDES MS4 entities and subject to applicable provisions of SC Regulation 61-68D, they will be required to meet load reductions prescribed in the WLA component of the TMDL. This also applies to future discharges associated with industrial and construction activities that will be subject to SC R. 122.26(b)(14)(15) (SCDHEC 2003).

5.5 Seasonal Variability

Federal regulations require that TMDLs take into account the seasonal variability in watershed loading. The variability in this TMDL is accounted for by using a 10-year hydrological data set and 12 month water quality sampling data set, which includes data collected from all seasons.

5.6 Margin of Safety

The margin of safety (MOS) may be explicit and/or implicit. The explicit margin of safety is 5% of the TMDL or 20 counts/100mL of the instantaneous criterion of 400 cfu/100 mL (380 cfu/100mL). Target loads are therefore 95% of the assimilative capacity (TMDL) of the waterbody. The MOS is expressed as the value calculated from the critical condition defined in Section 5.1 and is the difference between the TMDL and the sum of the WLA and LA. The calculated values of the MOS for each station are given in Table 9.

5.7 TMDL

For most pollutants, TMDLs are expressed as a mass load (e.g., kilograms per day). For bacteria, however, TMDLs are expressed in terms of cfu or organism counts (or resulting concentration), in accordance with 40 CFR 130.2(l). Only the instantaneous water quality criterion was targeted because there is insufficient data to evaluate against the 30-day geometric mean. The target load is defined as the load (from point and nonpoint sources) minus the MOS that a stream segment can receive while meeting the WQS. The TMDL value is the median target load within the critical condition (i.e., the middle value within the hydrologic category that requires the greatest load reduction) plus WLA and MOS. Values for each component of the TMDL for the impaired segments of the Ninety Six Creek watershed are provided in Table 9.

While TMDL development was primarily based on instantaneous water quality criterion, terms and conditions of NPDES permits for continuous discharges require facilities to demonstrate compliance with both geometric mean and instantaneous water quality criteria for FC bacteria in treated effluent. NPDES permits for continuous dischargers require data collection sufficient to monitor for compliance of both criteria at the point of outfall.

Table 9 indicates the percentage reduction or water quality standard required for each subwatershed (WQM Station). Note that all future regulated NPDES-permitted stormwater discharges will also be required to meet the prescribed percentage reductions, or the water quality standard. It should be noted that in order to meet the WQS for FC bacteria, prescribed load reductions must be targeted from all sources, including NPDES permitted and nonpoint sources.

Based on the information available at this time, the portion of the watershed that drains directly to a regulated MS4 and that which drains through the non-regulated MS4 has not been clearly defined. Loading from both types of sources (regulated and non-regulated) typically occur in response to rainfall events, and discharge volumes as well as recurrence intervals are largely unknown. Therefore, the regulated MS4 is assigned the same percent reduction as the non-regulated sources in the watershed. Compliance with the MS4 permit in regards to this TMDL document is determined at the point of discharge to waters of the state. The regulated MS4 entity is only responsible for implementing the TMDL WLA in accordance with their MS4 permit requirements and is not responsible for reducing loads prescribed as LA in this TMDL document.

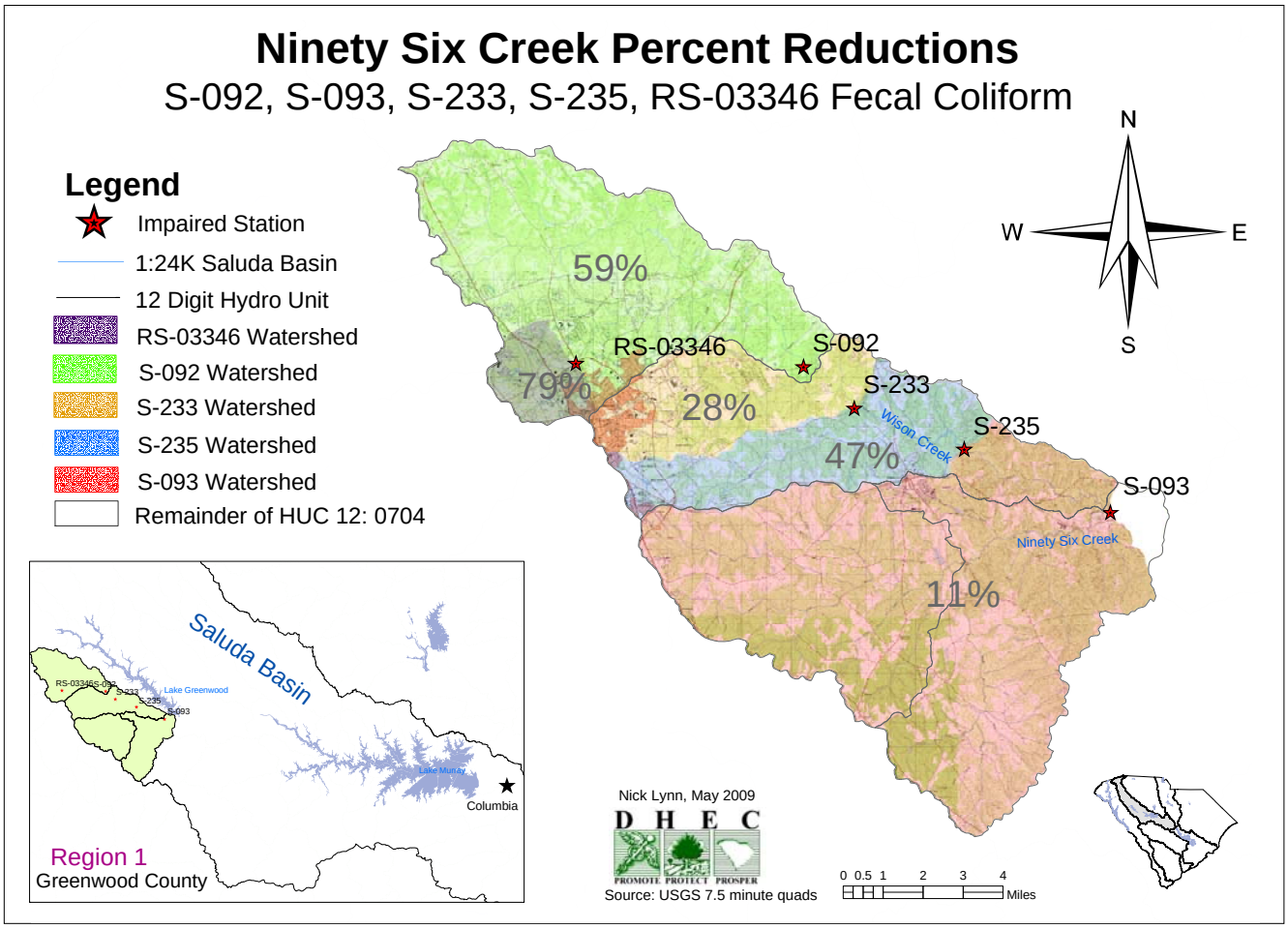
Table 9. TMDL Components for the FC Impaired Segments in the Ninety Six Creek Watershed. Loads are expressed as colony forming units (cfu) per day.

				Wasteload Allocation (WLA)		Load Allocation (LA)	
Station	Existing Load (cfu/day)	TMDL (cfu/day)	Margin of Safety (cfu/day)	Continuous Sources[1] (cfu/day)	Non-Continuous Sources[2,4] (% Reduction)	Load Allocation (cfu/day)	% Reduction to Meet LA[3]
S-092	9.49E+11	4.12E+11	2.06E+10	N/A	59	3.92E+11	59
S-233	4.21E+11	5.11E+11	2.56E+10	1.81E+11	28	3.05E+11	28
S-235	1.61E+12	8.94E+11	4.47E+10	N/A	47	8.49E+11	47
S-093	1.69E+12	1.59E+12	7.96E+10	9.45E+9	11	1.51E+12	11
RS-03346	2.05E+11	4.54E+10	2.27E+09	N/A	79	4.31E+10	79

Table Notes:

1. WLAs are expressed as a daily maximum; NA = not applicable, no point sources. Existing and future continuous discharges are required to meet the prescribed loading for the pollutant of concern. Loadings were developed based upon permitted flow and assuming an allowable permitted maximum concentration of 400cfu/100ml.
2. Percent reduction applies to all NPDES-permitted stormwater discharges, including current and future MS4, construction and industrial discharges covered under permits numbered SCS & SCR. Stormwater discharges are expressed as a percentage reduction due to the uncertain nature of stormwater discharge volumes and recurrence intervals. Stormwater discharges are required to meet percentage reduction or the existing instream standard for pollutant of concern in accordance with their NPDES Permit.
3. Percent reduction applies to existing instream load; Where Percentage Reduction = (Existing Load-Load Allocation) / Existing Load
4. By implementing the best management practices that are prescribed in either the SCDOT annual SWMP or the SCDOT MS4 Permit to address fecal coliform, the SCDOT will comply with this TMDL and its applicable WLA to the maximum extent practicable (MEP) as required by its MS4 permit.

Figure 6. Ninety Six Creek Percent Reductions



6.0 IMPLEMENTATION

As discussed in the *Implementation Plan for Achieving Total Maximum Daily Load Reductions From Nonpoint Sources for the State of South Carolina* (SCDHEC 1998), South Carolina has several tools available for implementing this TMDL. Specifically, SCDHEC's animal agriculture permitting program addresses animal operations and land application of animal wastes. The implementation of both point (WLA) and nonpoint (LA) source components of the TMDL are necessary to bring about the required reductions in FC bacteria loading to Big Creek and its tributaries in order to meet water quality standards. In addition, SCDHEC will work with the existing agencies in the area to provide nonpoint source education in the Ninety Six Creek watershed. Local sources of nonpoint source education and assistance include the City of Greenwood, Greenwood County, the Natural Resource Conservation Service (NRCS), the Greenwood County Soil and Water Conservation Services and the South Carolina Department of Natural Resources. In addition, Clemson Extension Service offers a 'Farm-A-Syst' package to farmers. Farm-A-Syst allows the farmer to evaluate practices on their property and determine the nonpoint source impact they may be having. It recommends best management practices (BMPs) to correct nonpoint source problems on the farm. NRCS can provide cost share money to land owners installing BMPs. Additional resources are provided in Section 7.0 of this TMDL.

SCDHEC is empowered under the State Pollution Control Act to perform investigations of and pursue enforcement for activities and conditions, which threaten the quality of waters of the state. In addition, other interested parties (universities, local stakeholder groups, etc.) may apply for CWA §319 grants to install BMPs that will implement the Load Allocation portion of this TMDL and reduce nonpoint source FC loading to Ninety Six Creek and its tributaries. Generic implementation strategies that may apply to the Ninety Six Creek watershed are discussed in section 3.0 of this document. TMDL implementation projects are given highest priority for 319 funding. CWA §319 grants are not available for implementation of the WLA component of this TMDL nor within any regulated jurisdictional MS4 area.

An iterative BMP approach as defined in the general storm water NPDES MS4 permit is expected to provide significant implementation of the WLA. Discovery and removal of illicit storm drain cross connection is one important element of the storm water NPDES permit. Public nonpoint source pollution education is another. Other permit requirements for implementing WLAs in approved TMDLs will vary across waterbodies, discharges, and pollutant(s) of concern. The allocations within a TMDL can take many different forms – narrative, numeric, specific BMPs – and may be complimented by other special requirements such as monitoring.

It is recognized that there will be nonpoint source pollutant loading within the MS4 jurisdictional boundary where MS4 has no jurisdictional authority. As appropriate information is made available to further define the pollutant contributions to the permitted MS4, an effort can be made to revise these TMDLs. This effort will be initiated as resources permit and if deemed appropriate. For the Department to revise these TMDLs the following information should be provided, but not limited too:

1. A mapped inventory of all existing and planned stormwater discharge points as well as service boundaries of the MS4 covered in the MS4 permit.
2. Provide information to establish the stormwater conveyance in a watershed in order to delineate the boundary and areas being drained by each of the stormwater discharge points as defined per the MS4 permit.
3. Information should be provided in an electronic format including geo-spatial information compatible with the GIS system used by the Department.

The level of monitoring necessary, deployment of structural and non-structural BMPs, evaluation of BMP performance, and optimization or revisions to the existing pollutant reduction goals of the SWMP or any other plan is TMDL and watershed specific. Hence, it is expected that NPDES permit holders evaluate their existing SWMP or other plans in a manner that would effectively address implementation of this TMDL with an acceptable schedule and activities for their permit compliance. The Department staff (permit writers, TMDL

project managers, and compliance staff) is willing to assist in developing or updating the referenced plan as deemed necessary. Please see Appendix D which provides additional information as it relates to evaluating the effectiveness of an MS4 Permit as it related to compliance with approved TMDLs.

Compliance with terms and conditions of existing and future NPDES sanitary and stormwater permits (including all construction, industrial and MS4) may effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL. For SCDOT, compliance with terms and conditions of its NPDES MS4 permit is effective implementation of the WLA to the MEP.

SCDHEC recognizes illicit discharge detection and elimination activities are conducted by MS4 entities as pursuant to compliance with existing MS4 permits. Note that these activities are designed to detect and eliminate illicit discharges that may contain FC bacteria. It is the intent of SCDHEC to work with the MS4 entities to recognize FC load reductions as they are achieved. SCDHEC acknowledges that these efforts to reduce illicit discharges and SSOs are ongoing and some reduction may already be accountable (i.e. load reductions occurring during TMDL development process). Thus, the implementation process is an iterative and adaptive process. Regular communication between all implementation stakeholders will result in successful remediation of controllable sources over time. As recreational uses are restored, SCDHEC will recognize efforts of implementers where their efforts can be directly linked to restoration.

The Department acknowledges that progress with the assumptions and requirements of the TMDL by MS4s is expected to take one or more permit iteration. Achieving the WLA reduction for the TMDL may constitute MS4 compliance with its SWMP, provided the MEP definition is met, even where the numeric percent reduction may not be achieved in the interim.

In addition to the resources cited above for the implementation of this TMDL in the Ninety Six Creek watershed, Clemson Extension has developed a Home-A-Syst handbook that can help rural homeowners reduce sources of NPS pollution on their property. This document guides homeowners through a self-assessment, including information on proper maintenance practices for septic tanks. SCDHEC also employs a nonpoint source educator and Watershed Manager who can assist with distribution of these tools as well as provide additional BMP information. Using existing authorities and mechanisms, these measures will be implemented in these watersheds in order to bring about the required reductions in FC bacteria loading to Ninety Six Creek and tributaries. DHEC may continue to monitor, according to the basin monitoring schedule, the effectiveness of implementation measures and evaluate stream water quality as the implementation strategy progresses.

The Department recognizes that **adaptive management/implementation** of this TMDL might be needed to achieve the water quality standard and we are committed towards targeting the load reductions to improve water quality in the Ninety Six Creek Watershed. As additional data and/or information become available, it may become necessary to revise and/or modify the TMDL target accordingly.

7.0 RESOURCES FOR POLLUTION MANAGEMENT

This section provides a listing of available resources to aid in the mitigation and control of pollutants. There are examples from across the nation, most of which are easily accessible on the world wide web.

7.1 General for Urban and Suburban Stormwater Mitigation

- National Management Measures to Control Nonpoint Source Pollution from Urban Areas – Draft. 2002. EPA842-B-02-003. Available at: http://www.epa.gov/owow/nps/urbanmm/index.html
- Stormwater Management Volume Two: Stormwater Technical Manual. Massachusetts Department of Environmental Management. 1997. Available at: http://www.mass.gov/dep/brp/stormwtr/stormpub.htm
- Fact Sheets for the six minimum control measures for storm sewers regulated under Phase I or Phase II. Available at: http://cfpub1.epa.gov/npdes/stormwater/swfinal.cfm?program_id=6
- A Current Assessment of Urban Best Management Practices. 1992. Metropolitan Washington Council of Governments. Washington, DC
- Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs. 1987. Metropolitan Washington Council of Governments. Washington, DC
- 2004 Stormwater Quality Manual. Connecticut Department of Environmental Protection 2004. Available at: http://dep.state.ct.us/wtr/stormwater/strmwtrman.htm
- Stormwater Treatment BMP New Technology Report. California Department of Transportation. 2004. SW-04-069-.04.02 Available at: http://www.dot.ca.gov/hq/env/stormwater/special/newsetup/_pdfs/new_technology/CTSW-RT-04-069.pdf
- Moonlight Beach Urban Runoff Treatment facility: Using Ultraviolet Disinfection to Reduce Bacteria Counts. Rasmus, J. and K. Weldon. 2003. StormWater, May/June 2003. Available at http://www.forester.net/sw_0305_moonlight.html
- Operation, Maintenance, and Management of Stormwater Management Systems. Livingston, Shaver, Skupien, and Horner. August 1997. Watershed Management Institute. Call: (850) 926-5310.
- Model Ordinances to Protect Local Resources – Stormwater Control Operation and Maintenance. USEPA Webpage: http://www.epa.gov/owow/nps/ordinance/stormwater.htm
- Stormwater O & M Fact Sheet Preventive Maintenance. USEPA 1999. 832-F-99-004. Available at: http://www.epa.gov/owm/mtb/prevmain.pdf
- The MassHighway Stormwater Handbook. Massachusetts Highway Department. 2004. Available at: http://166.90.180.162/mhd/downloads/projDev/swbook.pdf

- University of New Hampshire Stormwater Center: Dedicated to the protection of water resources through effective stormwater management. Available at: http://www.unh.edu/erg/cstev/index.htm#
- EPA's Stormwater website: http://www.epa.gov/region1/topics/water/stormwater.html

7.2 Illicit Discharges

- Illicit Discharge Detection and Elimination Manual - A Handbook for Municipalities. 2003. New England Interstate Water Pollution Control Commission. Available at: http://www.neiwpcc.org/PDF_Docs/iddmanual.pdf
- Model Ordinances to Protect Local Resources – Illicit Discharges. USEPA webpage: http://www.epa.gov/owow/nps/ordinance/discharges.htm

7.3 Pet Waste

- National Management Measure to Control Non Point Source Pollution from Urban Areas – Draft. USEPA 2002. EPA 842-B-02-2003. Available from: http://www.epa.gov/owow/nps/urbanmm/index.html
- Septic Systems for Dogs? Nonpoint Source News-Notes 63. Pet Waste: Dealing with a Real Problem in Suburbia. Kemper, J. 2000. New Jersey Department of Environmental Protection. Available from: http://www.state.nj.us/dep/watershedmgt/pet_waste_fredk.htm
- Stormwater Manager's Resource Center. Schueler, T., Center for Watershed Protection, Inc. http://www.stormwatercenter.net
- Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. U.S. EPA, Office of Water 1993. Washington, DC.
- National Menu of Best Management Practices for Stormwater Phase II. USEPA. 2002. Available at: http://www.epa.gov/npdes/menuofbmps/menu.htm
- Welcome to NVRC'S Four Mile Run Program. NVRC 2001. Available at: http://www.novaregion.org/fourmilerun.htm
- Boston's ordinance on dog waste. City of Boston Municipal Codes, Chapter XVI. 16-1.10A Dog Fouling. Available at: http://www.amlegal.com/boston_ma/
- Pet Waste and Water Quality. Hill, J.A., and D. Johnson. 1994. University of Wisconsin Extension Service. http://cecommerce.uwex.edu/pdfs/GWQ006.PDF
- Long Island Sound Study. Pet Waste Poster. EPA. Available at: http://www.longislandsoundstudy.net/pubs/misc/pet.html
- Source Water Protection Practices Bulletin: Managing Pet and Wildlife Waste to Prevent Contamination of Drinking Water. USEPA. 2001. EPA 916-F-01-027. Available at: http://www.epa.gov/safewater/protect/pdfs/petwaste.pdf

7.4 Wildlife

- An example of a bylaw prohibiting the feeding of wildlife: Prohibiting Feeding of Wildlife. Town of Bourne Bylaws Section 3.4.3. Available at: http://www.townofbourne.com/Town%20Offices/Bylaws/chapter__3.htm

- Integrated Management of Urban Canadian Geese. M Underhill. 1999. Conference Proceedings, Waterfowl Information Network.

- Urban Canadian Geese in Missouri. Missouri Conservationist Online. Available at: http://www.conservation.state.mo.us/conmag/2004/02/20.htm

7.5 Septic Systems

- National Management Measures to Control Nonpoint Source Pollution from Urban Areas – Draft. Chapter 6. New and Existing Onsite Wastewater Treatment Systems. USEPA 2002. EPA842-B-02-003. Available at: http://www.epa.gov/owow/nps/urbanmm/index.html

- Septic Systems. USEPA Webpage: http://cfpub.epa.gov/owm/septic/home.cfm

7.6 Field Application of Manure

- Conservation Standard Practice-Irrigation Water Management. Number 449. United States Department of Agriculture (USDA) Natural Resources Conservation Service. 2003. Available at: http://www.nrcs.usda.gov/technical/Standards/nhcp.html

- Conservation Standard Practice-Filter Strip. Number 393. USDA Natural Resources Conservation Service (NRCS). 2003. Available at: http://www.nrcs.usda.gov/technical/Standards/nhcp.html

- Buffer Strips: Common Sense Conservation. USDA Natural Resource Conservations Service. No Date. Website. Available at: http://www.nrcs.usda.gov/feature/buffers/

- Conservation Standard Practice-Riparian Forest Buffer. Number 391. USDA Natural Resource Conservation Service. 2003. Available at: http://www.nrcs.usda.gov/technical/Standards/nhcp.html

- Conservation Standard Practice-Riparian Herbaceous Cover. Number 390 USDA Natural Resource Conservation Service. 2003. Available at: http://www.nrcs.usda.gov/technical/Standards/nhcp.html

7.7 Grazing Management

- Conservation Standard Practice-Stream Crossing. Number 578. USDA Natural Resource Conservation Service. 2003. Available at: http://www.nrcs.usda.gov/technical/Standards/nhcp.html

- Guidance Specifying Management Measures for Nonpoint Source Pollution in Coastal Waters. Chapter 2. Management Measures for Agricultural Sources. Grazing Management. USEPA. Available at: http://www.epa.gov/owow/nps/MMGI/Chapter2/ch2-2e.html

7.8 Animal Feeding Operations and Barnyards

- National Management Measures to Control Nonpoint Source Pollution from Agriculture. USEPA 2003. Report: EPA 841-B-03-004. Available at: http://www.epa.gov/owow/nps/agmm/index.html
- Livestock Manure Storage. Software designed to asses the threat to ground and surface water from manure storage facilities. USEPA. Available at: http://www.epa.gov/seahome/manure.html
- National Engineering Handbook Part 651. Agricultural Waste Management Field Handbook. NRCS. Available At: http://www.wcc.nrcs.usda.gov/awm/awmfh.html
- Animal Waste Management. NRCS website: http://www.wcc.nrcs.usda.gov/awm/
- Animal Waste Management Software. A tool for estimating waste production and storage requirements. Available at: http://www.wcc.nrcs.usda.gov/awm/awm.html
- Manure Management Planner. Software for creating manure management plans. Available at: http://www.agry.purdue.edu/mmp/
- Animal Feeding Operations Virtual Information Center. USEPA website: http://cfpub.epa.gov/npdes/afo/virtualcenter.cfm

7.9 Federal Agriculture Resources: Program Overviews, Technical Assistance, and Funding

- USDA-NRCS assists landowners with planning for the conservation of soil, water, and natural resources. Local, state, and federal agencies and policymakers also rely on NRCS expertise. Cost shares and financial incentives are available in some cases. Most work is done with local partners. The NRCS is the largest funding source for agricultural improvements. To find out about potential funding, see: http://www.ma.nrcs.usda.gov/programs/. To pursue obtaining funding, contact a local NRCS coordinator. Contact information is available at:: http://www.ma.nrcs.usda.gov/contact/employee_directory.html
- NRCS provides a wealth of information and BMP fact sheets tailored to agricultural and conservation practices through the NRCS Electronic Field Office Technical Guide at: http://efotg.nrcs.usda.gov/efotg_locator.aspx?map=SC
- The 2002 USDA Farm Bill (http://www.nrcs.usda.gov/programs/farmbill/2002/) provides a variety of programs related to conservation. Information can be found at: http://www.nrcs.usda.gov/programs/farmbill/2002/products.html. The following programs can be linked to from the USDA Farm Bill website:
  - Conservation Security Program (CSP): http://www.nrcs.usda.gov/programs/csp/
  - Conservation Reserve Program (CRP): http://www.nrcs.usda.gov/programs/crp/
  - Wetlands Reserve Program (WRP): http://www.nrcs.usda.gov/programs/wrp/
  - Environmental Quality Incentives Program (EQIP): http://www.nrcs.usda.gov/programs/eqip/
  - Grassland Reserve Program (GRP): http://www.nrcs.usda.gov/programs/GRP/
  - Conservation of Private Grazing Land Program (CPGL): http://www.nrcs.usda.gov/programs/cpgl/
  - Wildlife Habitat Incentives Program (WHIP): http://www.nrcs.usda.gov/programs/whip/
  - Farm and Ranch Land Protection Program (FRPP): http://www.nrcs.usda.gov/programs/frpp/

- Resource Conservation and Development Program (RC&D): http://www.nrcs.usda.gov/programs/rcd/

- CORE4 Conservation Practices. The common sense approach to natural resource conservation. USDA-NRCS (1999). This manual is intended to help USDA-NRCS personnel and other conservation and nonpoint source management professionals implement effective programs using four core conservation practices: conservation tillage, nutrient management, pest management, and conservation buffers, available at: http://www.nrcs.usda.gov/technical/ECS/agronomy/core4.pdf

- County soil survey maps are available from NRCS at: http://soils.usda.gov

- Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. U.S. EPA, Office of Water (1993). Developed for use by State Coastal Nonpoint Pollution Control Programs, Chapter 2 of this document covers erosion control, animal feeding operation management, grazing practices, and management of nutrients, pesticides, and irrigation water, available at: http://www.epa.gov/owow/nps/MMGI/Chapter2/index.html.

- Farm-A-Syst is a partnership between government agencies and private business that enables landowners to prevent pollution on farms, ranches, and in homes using confidential environmental assessments, available at: http://www.uwex.edu/farmasyst/

- State Environmental Laws Affecting South Carolina Agriculture: A comprehensive assessment of regulatory issues related to South Carolina agriculture has been compiled by the National Association of State Departments, available at: http://www.nasda-hq.org/nasda/nasda/Foundation/state/states.htm

- Waterborne Pathogens in Agricultural Wastewater. Rosen, B. H., 2000. USDA, NRCS, Watershed Science Institute. Available at: ftp://ftp-fc.sc.egov.usda.gov/WSI/pdffiles/Pathogens_in_Agricultural_Watersheds.pdf

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American Society of Agricultural and Biological Engineers (ASABE). 1998. Vegetative Filter Strip Removal of Cattle Manure Constituents in Runoff. *Transactions of the ASAE*, Vol. 41(5): 1375-1381

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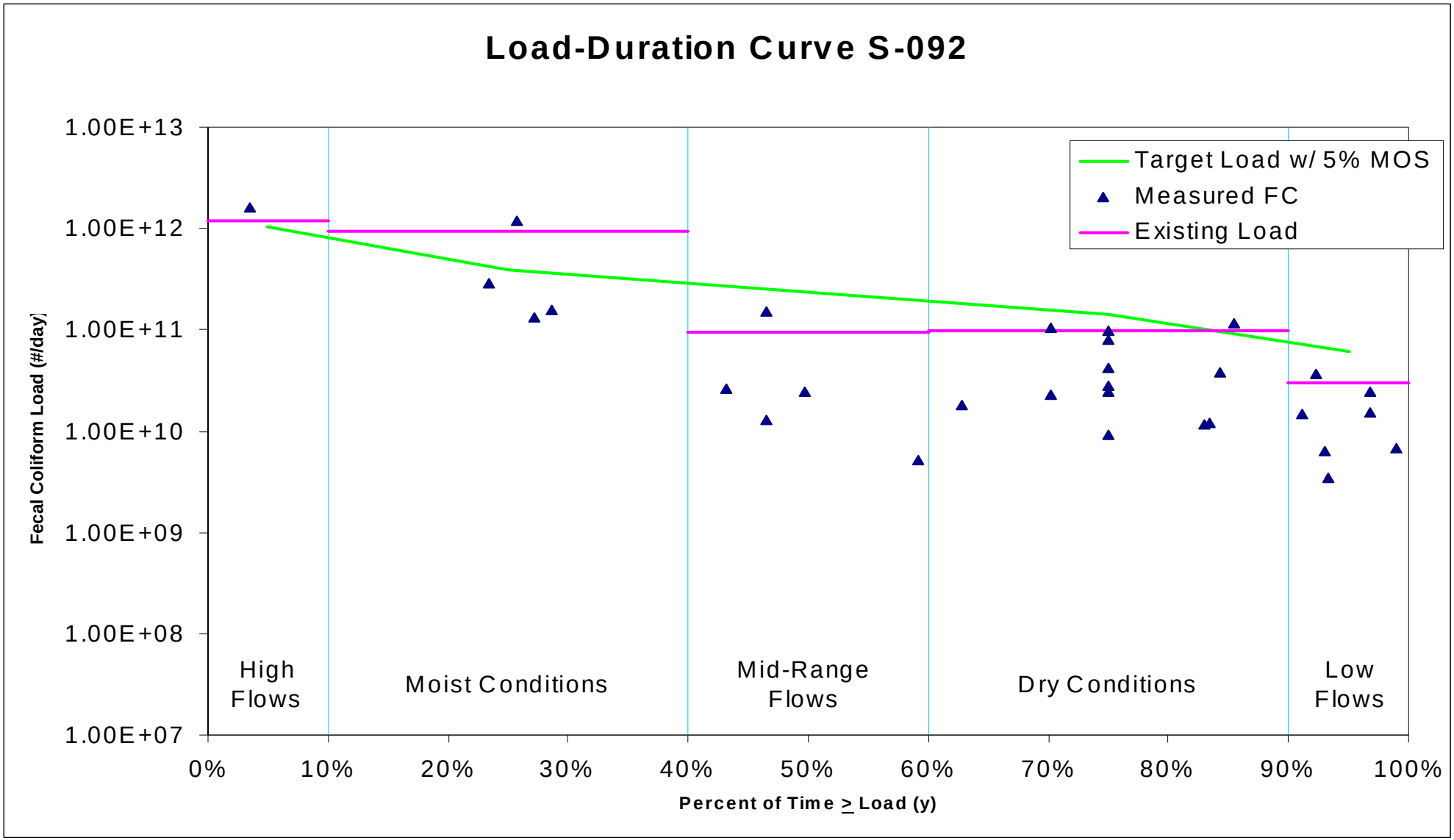
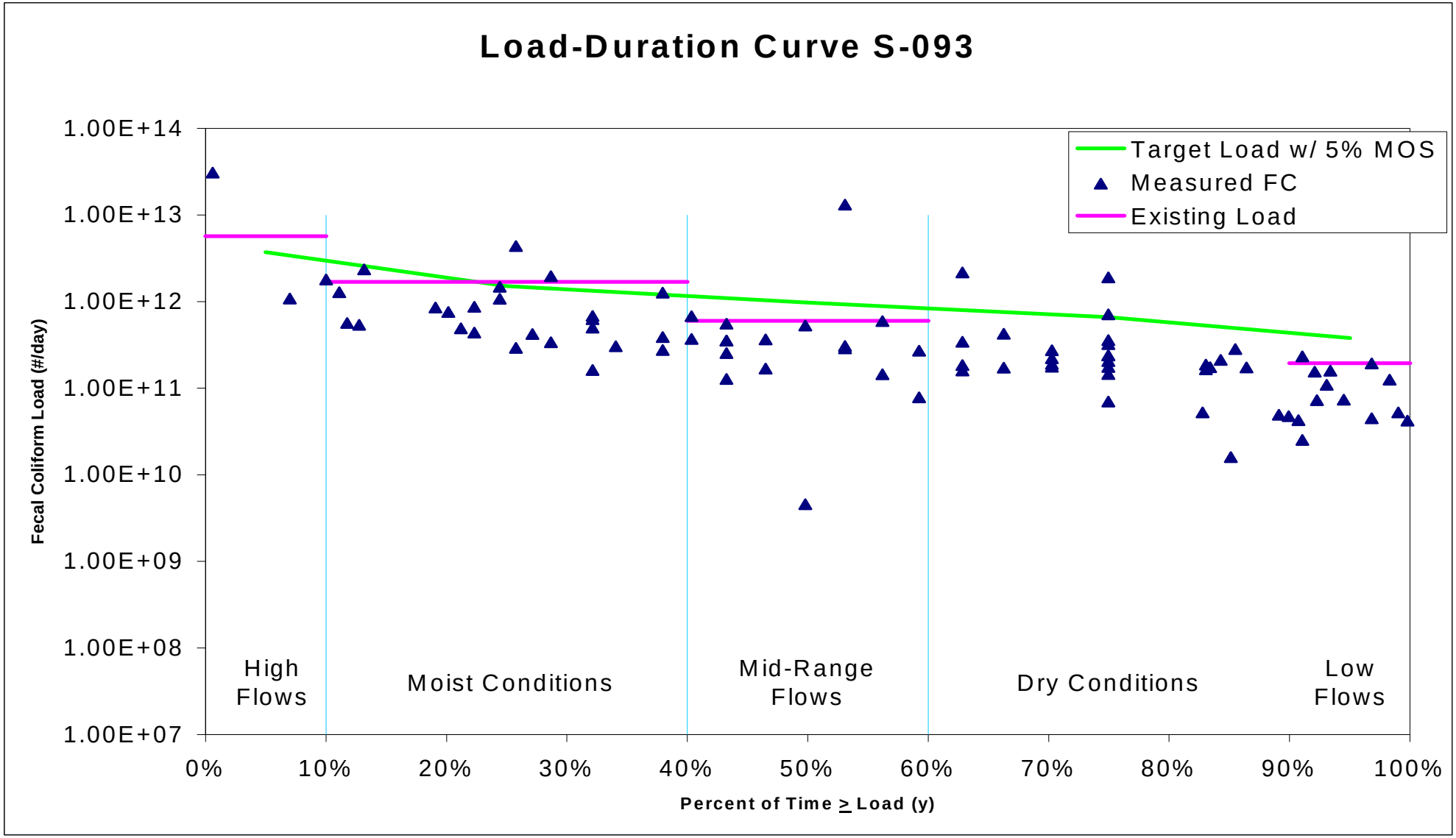
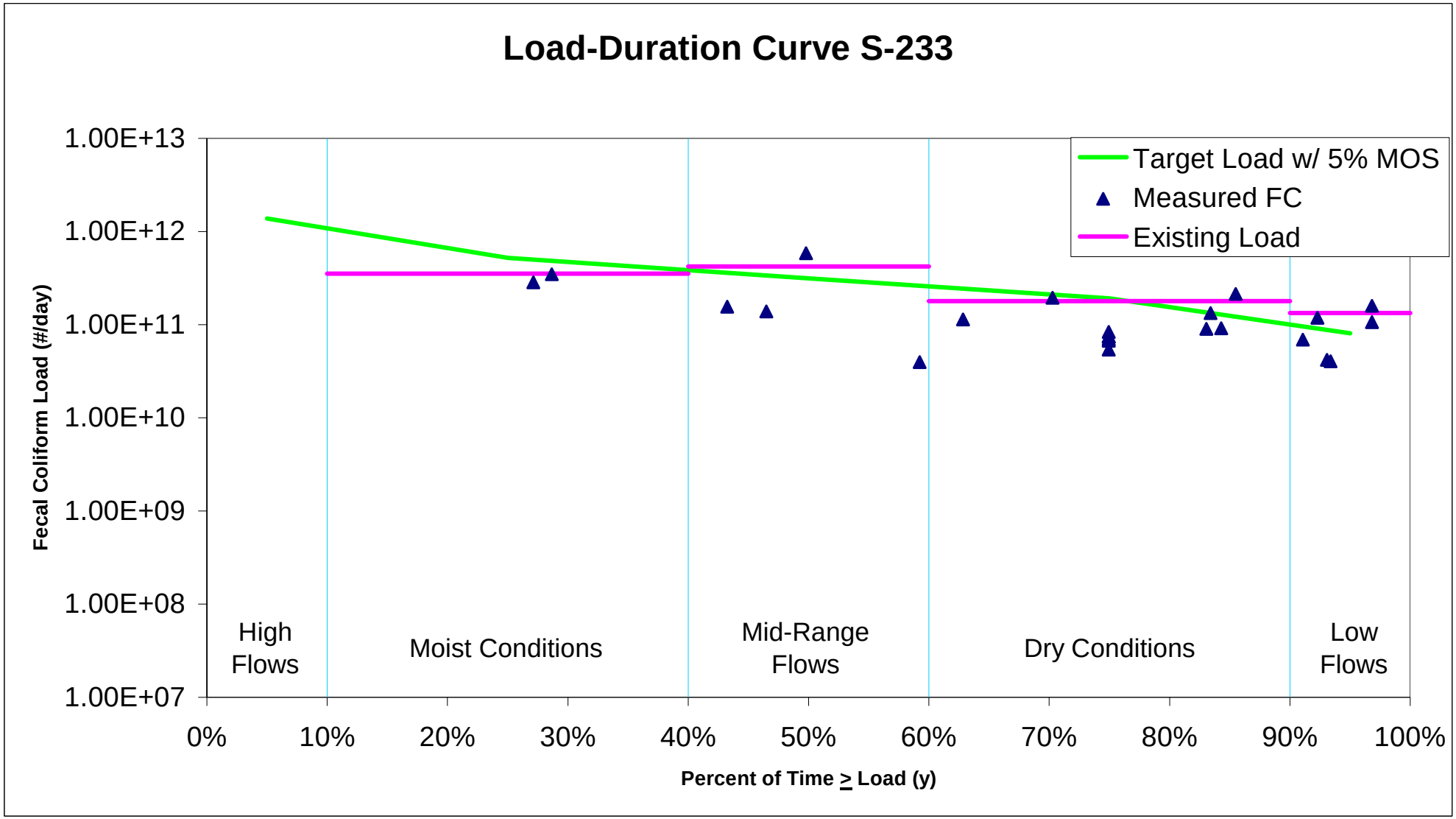
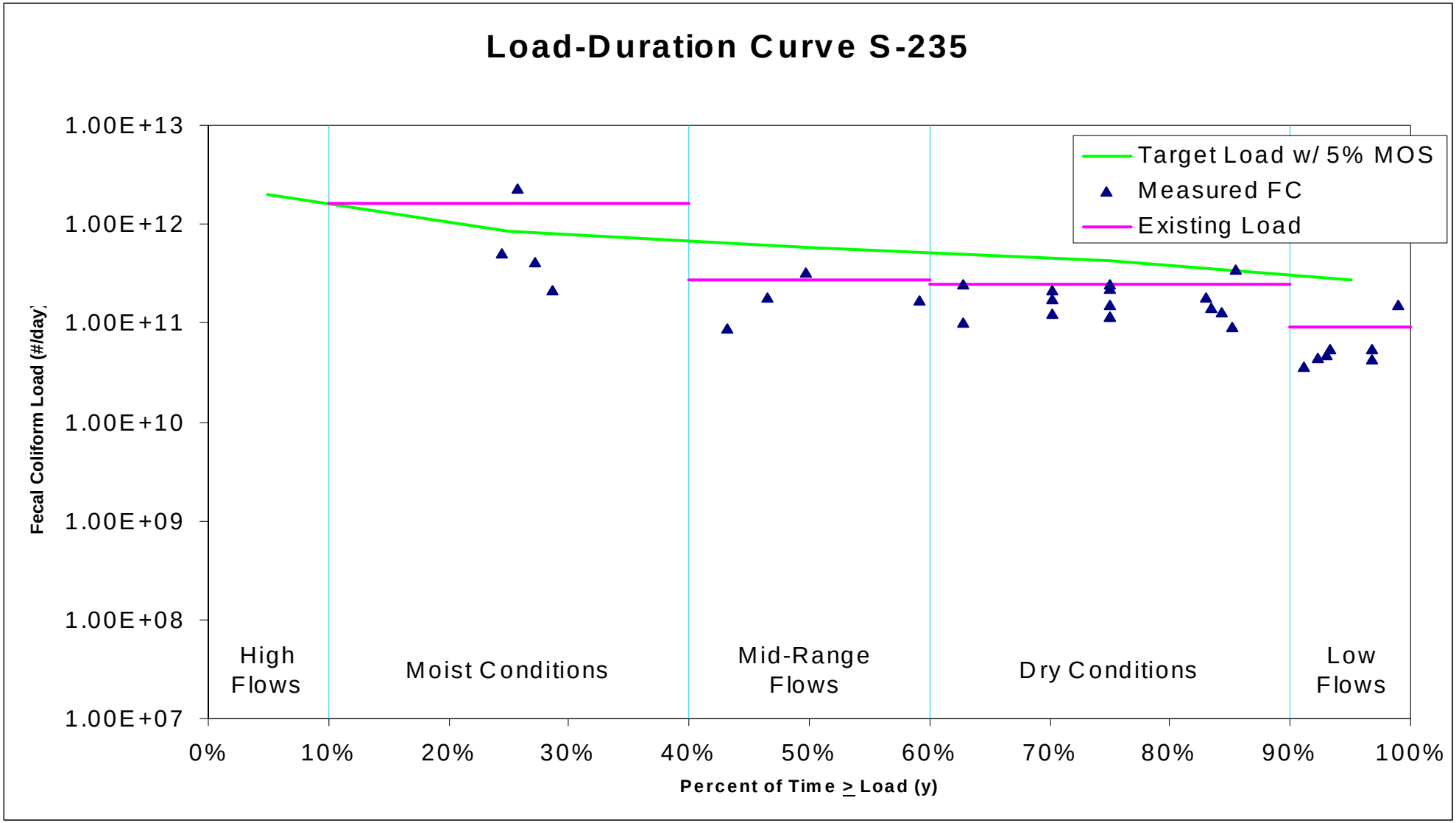
Appendix A

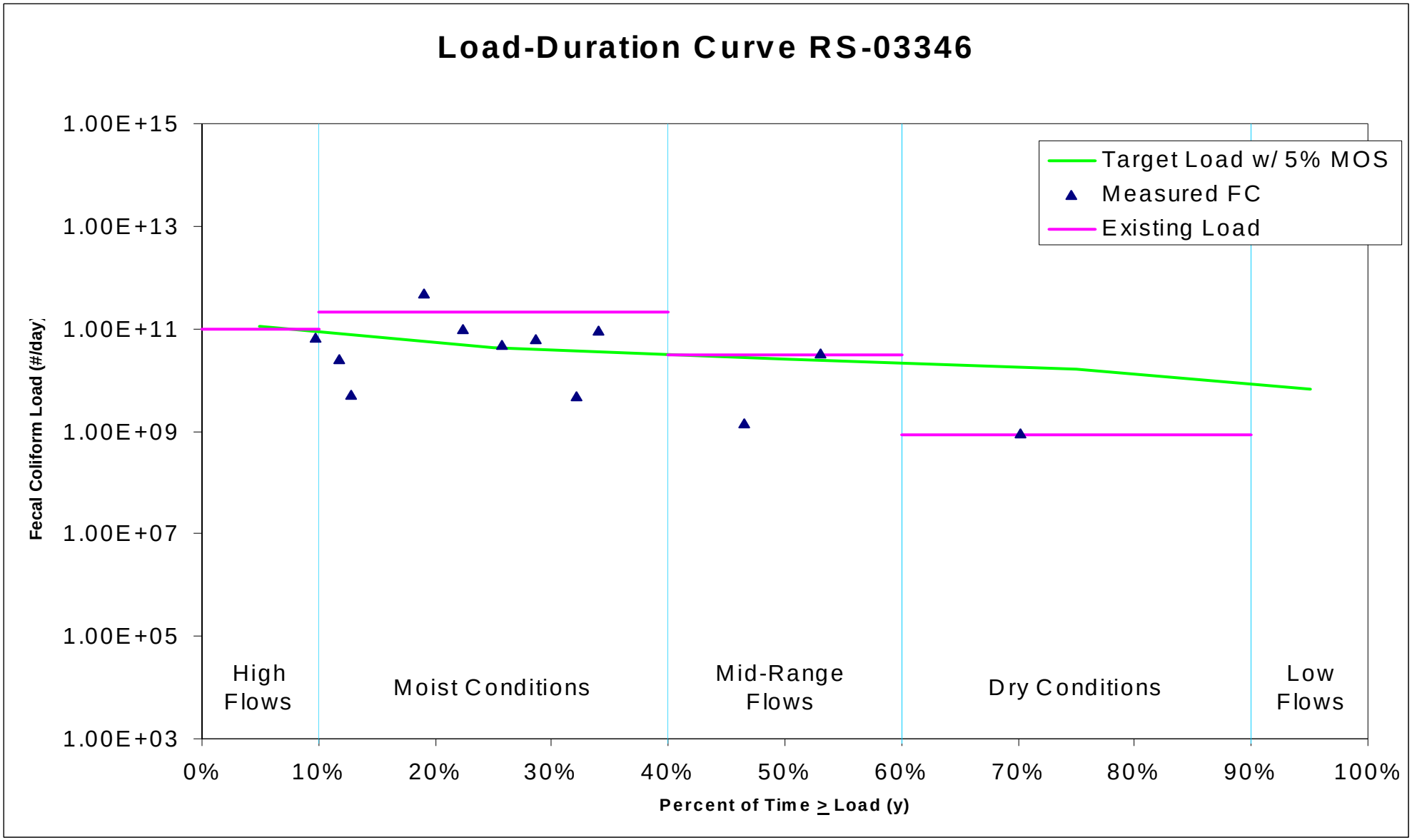
LOAD DURATION CURVES


Load-Duration Curve S-092
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
1.00E+07
Fecal Coliform Load (#/day)
Target Load w/ 5% MOS
Measured FC
Existing Load
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditions
Low Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time ≥ Load (y)


Load-Duration Curve S-093
Target Load w/ 5% MOS
Measured FC
Existing Load
Fecal Coliform Load (#/day)
1.00E+14
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
1.00E+07
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditions
Low Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time ≥ Load (y)

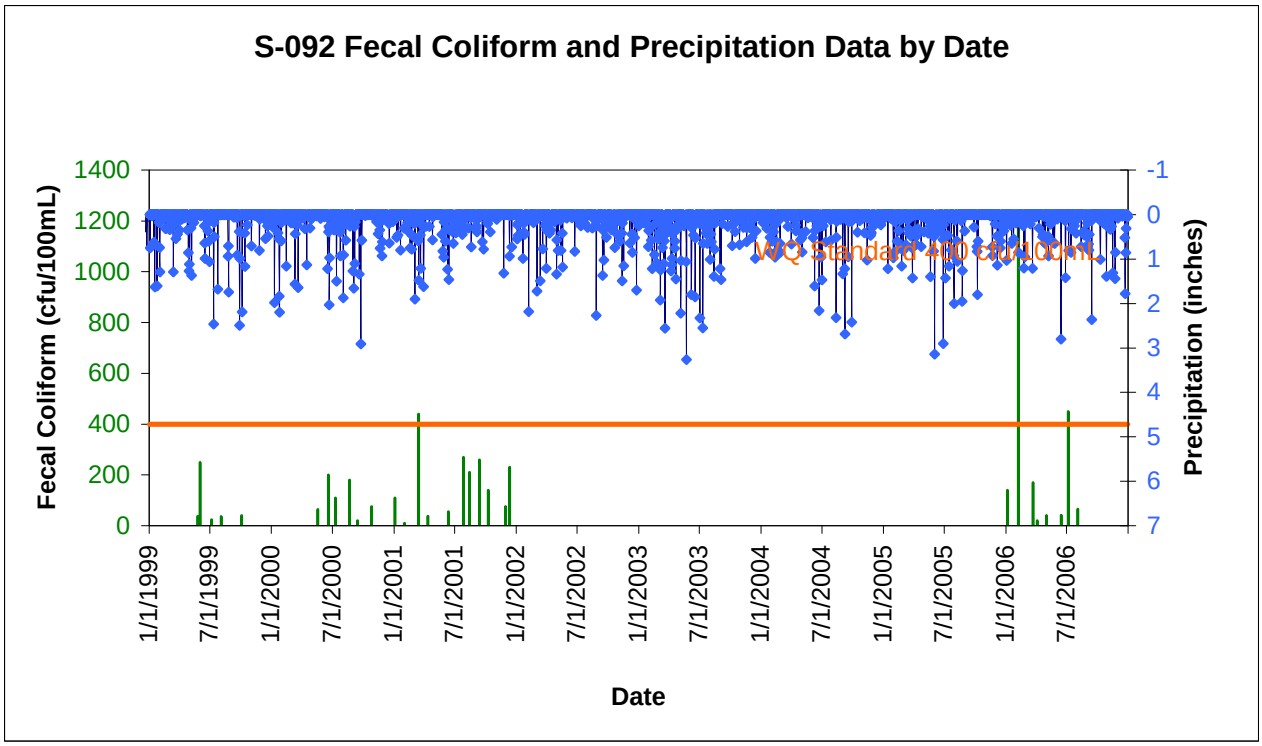

Load-Duration Curve S-233
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
1.00E+07
Fecal Coliform Load (#/day)
Target Load w/ 5% MOS
Measured FC
Existing Load
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditions
Low Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time ≥ Load (y)


Load-Duration Curve S-235
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
1.00E+07
Fecal Coliform Load (#/day)
Target Load w/ 5% MOS
Measured FC
Existing Load
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditions
Low Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time ≥ Load (y)


Load-Duration Curve RS-03346
1.00E+15
1.00E+13
1.00E+11
1.00E+09
1.00E+07
1.00E+05
1.00E+03
Fecal Coliform Load (#/day)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time ≥ Load (y)
Target Load w/ 5% MOS
Measured FC
Existing Load
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditions
Low Flows

Appendix B

RAIN CHARTS


S-092 Fecal Coliform and Precipitation Data by Date
Fecal Coliform (cfu/100mL)
Precipitation (inches)
WQ Standard 400 cfu/100mL
1400
1200
1000
800
600
400
200
0
-1
0
1
2
3
4
5
6
7
1/1/1999
7/1/1999
1/1/2000
7/1/2000
1/1/2001
7/1/2001
1/1/2002
7/1/2002
1/1/2003
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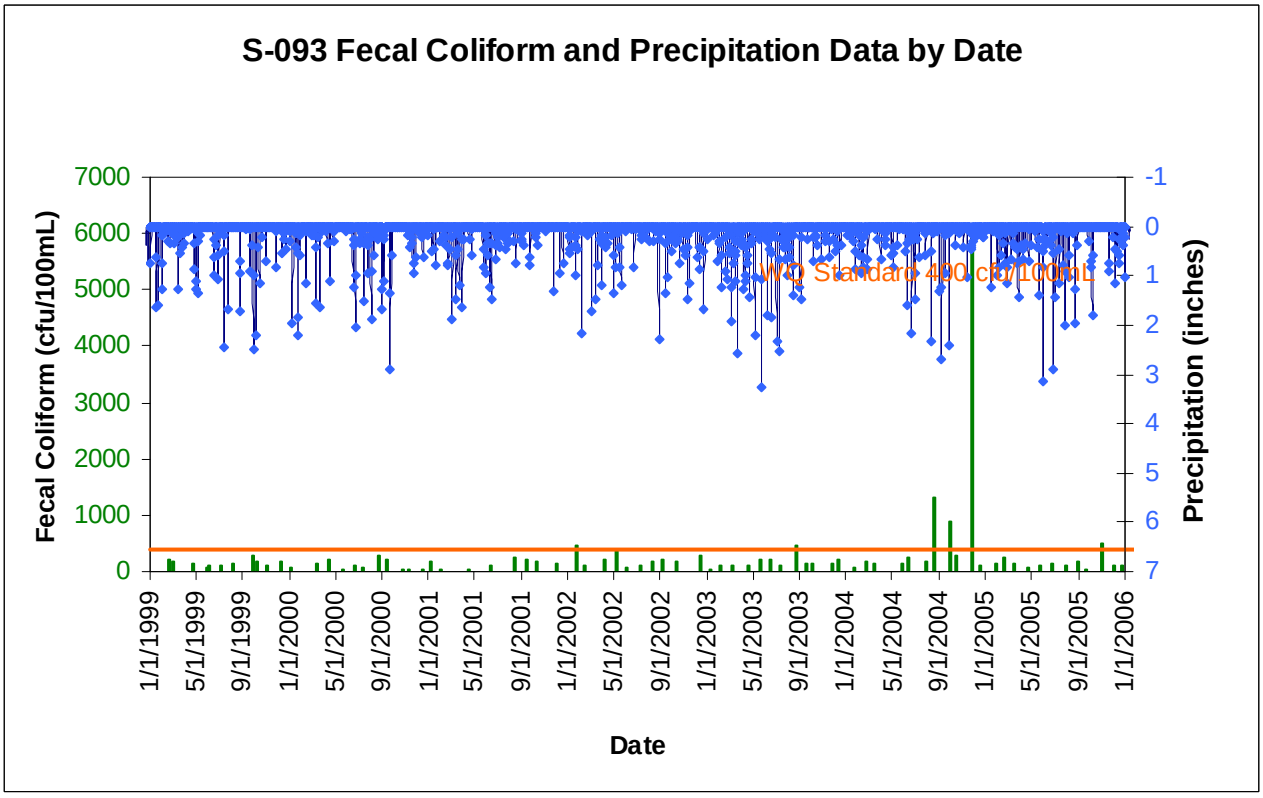
7/1/2005
1/1/2006
7/1/2006
Date


S-093 Fecal Coliform and Precipitation Data by Date
Fecal Coliform (cfu/100mL)
Precipitation (inches)
WQ Standard 400 cfu/100mL
7000
6000
5000
4000
3000
2000
1000
0
-1
0
1
2
3
4
5
6
7
1/1/1999
5/1/1999
9/1/1999
1/1/2000
5/1/2000
9/1/2000
1/1/2001
5/1/2001
9/1/2001
1/1/2002
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9/1/2002
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5/1/2003
9/1/2003
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5/1/2004
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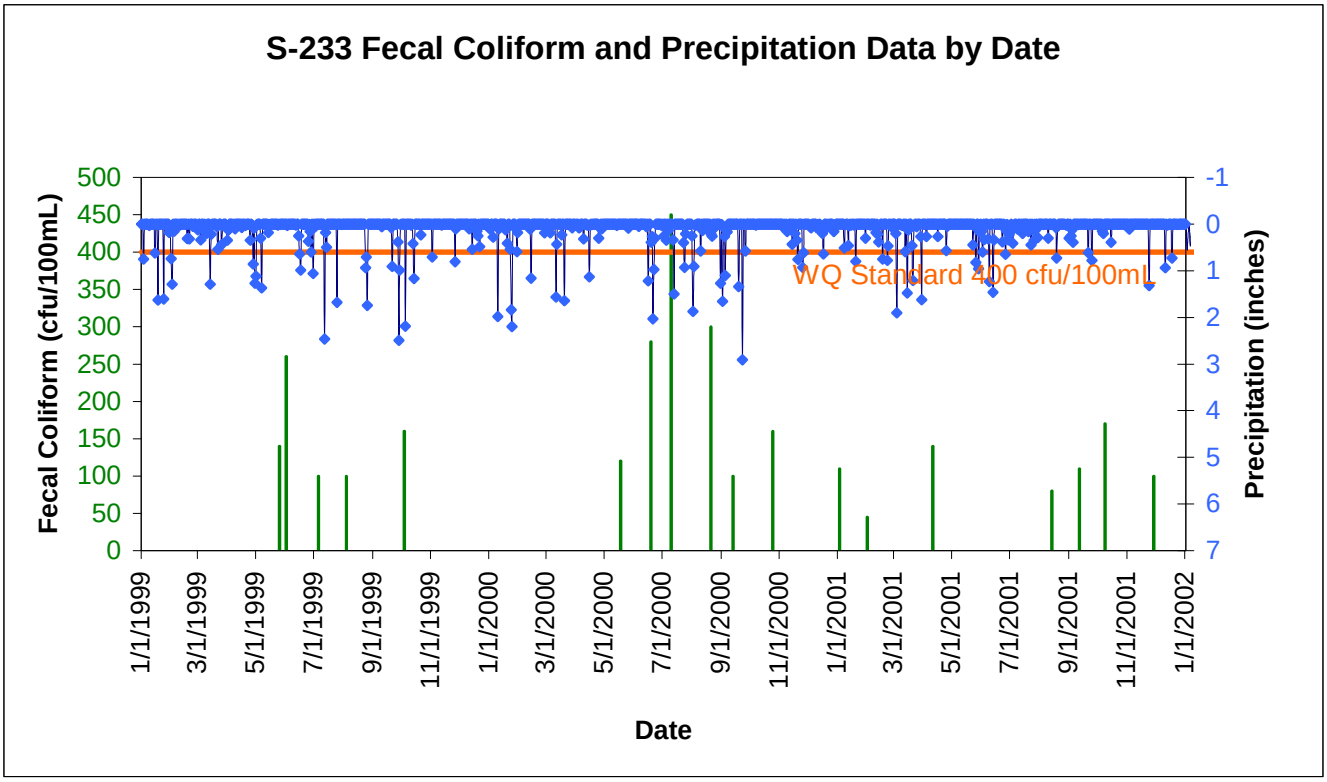
1/1/2005
5/1/2005
9/1/2005
1/1/2006
Date


S-233 Fecal Coliform and Precipitation Data by Date
Fecal Coliform (cfu/100mL)
Precipitation (inches)
WQ Standard 400 cfu/100mL
Date
500
450
400
350
300
250
200
150
100
50
0
-1
0
1
2
3
4
5
6
7
1/1/1999
3/1/1999
5/1/1999
7/1/1999
9/1/1999
11/1/1999
1/1/2000
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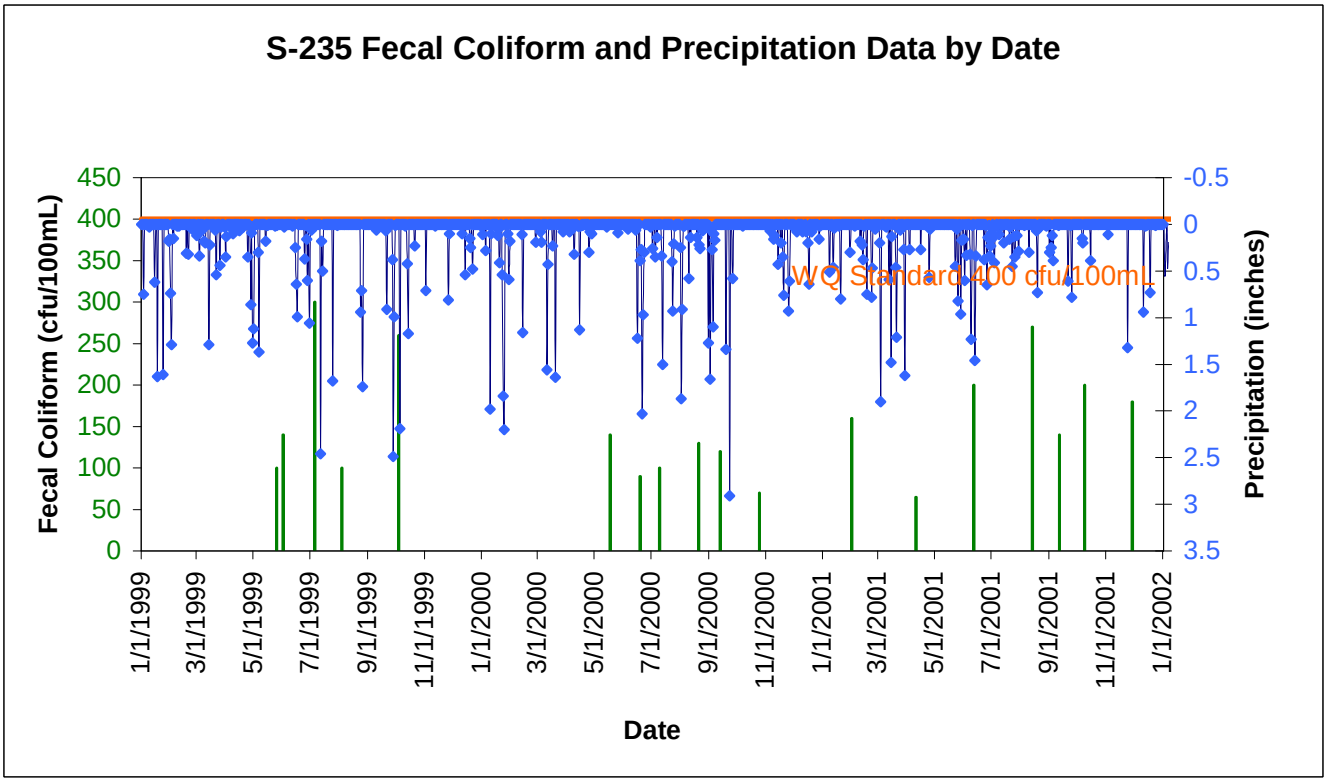
S-235 Fecal Coliform and Precipitation Data by Date
Fecal Coliform (cfu/100mL)
Precipitation (inches)
WQ Standard 400 cfu/100mL
Date
450
400
350
300
250
200
150
100
50
0
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
1/1/1999
3/1/1999
5/1/1999
7/1/1999
9/1/1999
11/1/1999
1/1/2000
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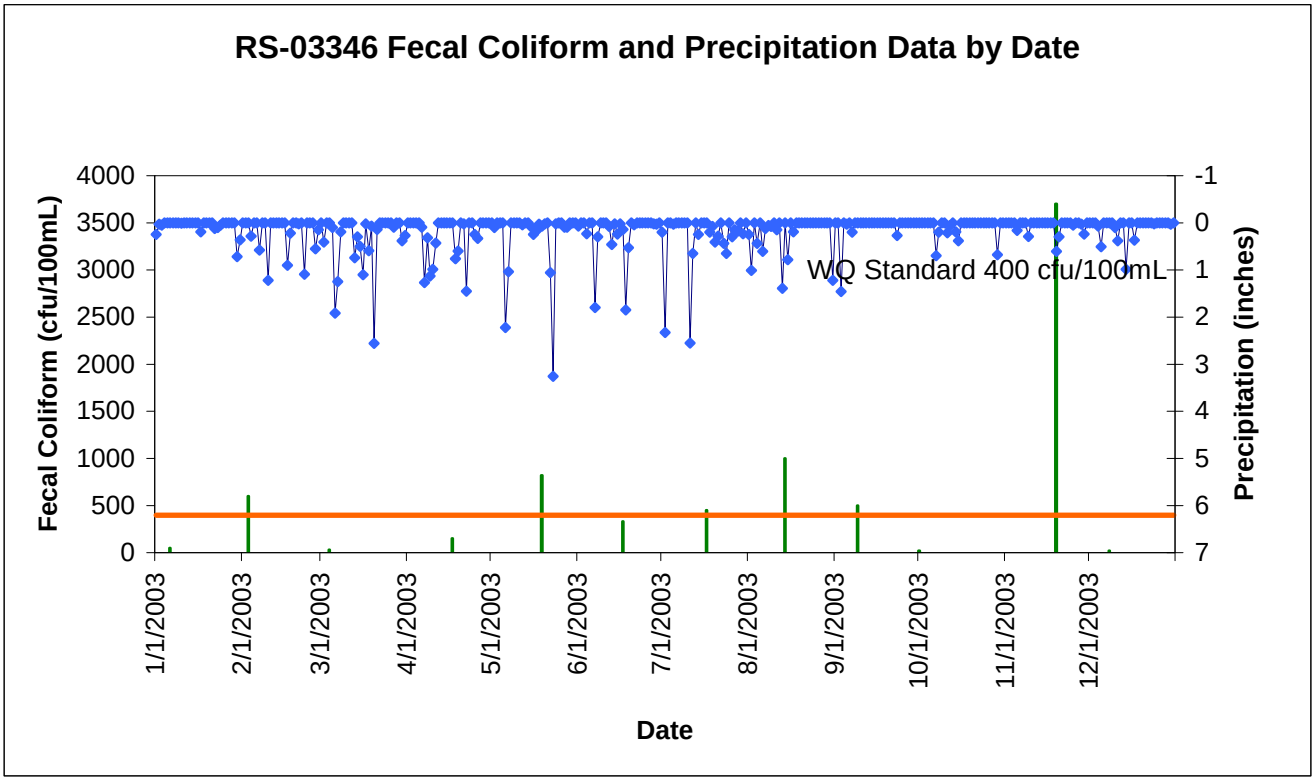
RS-03346 Fecal Coliform and Precipitation Data by Date
Fecal Coliform (cfu/100mL)
Precipitation (inches)
WQ Standard 400 cfu/100mL
4000
3500
3000
2500
2000
1500
1000
500
0
-1
0
1
2
3
4
5
6
7
1/1/2003
2/1/2003
3/1/2003
4/1/2003
5/1/2003
6/1/2003
7/1/2003
8/1/2003
9/1/2003
10/1/2003
11/1/2003
12/1/2003
Date

Appendix C

FIGURES

Figure A-1. Wilson Creek WWTF (SC0021709)

Figure A-2. Wilson Creek WWTF (SC0021709) Expansion

Figure A-3. Ninety Six Creek WWTF (SC0036048)

Figure A-4. Sanitary sewer in close proximity to Coronaca Creek

Figure A-5. Aerial photo of agricultural field adjacent to Coronaca Creek

Figure A-6. Aerial photo of agricultural field adjacent to Coronaca Creek

Figure A-7. Ground level photo of agricultural field adjacent to Coronaca Creek

Figure A-8. Unstabilized stream bank along Big Rock Creek with cattle defecation

Figure A-9. Livestock standing in the middle of Big Rock Creek

Figure A-10. Wilson Creek and Coronaca Creek Trunk Sewer Replacement

Appendix D

EVALUATING THE PROGRESS OF MS4 PROGRAMS

Evaluating the Progress of MS4 Programs:
Meeting the Goals of TMDLs and Attaining Water Quality Standards

Bureau of Water

August 2008

Described below are potential approaches that may be used by MS4 permit holders. These are recommendations and examples only, as SCDHEC-BOW recognizes that other approaches may be utilized or employed to meet compliance goals.

1. Calculate pollutant load reduction for each best management practice (BMP) deployed:
    - Retrofitting stormwater outlets
    - Creation of green space
    - LID activities (e.g., creation of porous pavements)
    - Creations of riparian buffers
    - Stream bank restoration
    - Scoop the poop program (how many pounds of poop were scooped/collected)
    - Street sweeping program (amount of materials collected etc.)
    - Construction & post-construction site runoff controls
2. Description & documentation of programs directed towards reducing pollutant loading
    - Document tangible efforts made to reduce impacts to urban runoff
    - Track type and number of structural BMPs installed
    - Parking lot maintenance program for pollutant load reduction
    - Identification and elimination of illicit discharges
    - Zoning changes and ordinances designed to reduce pollutant loading
    - Modeling of activities & programs for reducing pollutant reductions
3. Description & documentation of social indicators, outreach, and education programs
    - Number/Type of training & education activities conducted and survey results
    - Activities conducted to increase awareness and knowledge – residents, business owners. What changes have been made based on these efforts? Any measured behavior or knowledge changes?
    - Participation in stream and/or lake clean-up events or activities
    - Number of environmental action pledges
4. Water quality monitoring: A direct and effective way to evaluate the effectiveness of stormwater management plan activities.
    - Use of data collected from existing monitoring activities (e.g., SCDHEC data for ambient monitoring program available through STORET; water supply intake testing; voluntary watershed group's monitoring, etc)

- Establish a monitoring program for permitted outfalls and/or waterbodies within MS4 areas as deemed necessary– use a certified lab

- Monitoring should focus on water quality parameters and locations that would both link pollutant sources and BMPs being implemented

5. Links:

   - Evaluating the Effectiveness of Municipal Stormwater Programs. September 2007. EPA 833-F-07-010

   - The BMP database - http://www.bmpdatabase.org/BMPPerformance.htm (this link is specifically to the BMP performance page, and lot more)

   - EPA's STORET data warehouse - http://www.epa.gov/storet/dw_home.html

   - EPARegion 5: STEPL – Spreadsheet tool for estimating pollutant loads http://it.tetratech-ffx.com/stepl/

   - Measurable goals guidance for Phase II Small MS4 - http://cfpub.epa.gov/npdes/stormwater/measurablegoals/index.cfm

   - Environmental indicators for stormwater program- http://cfpub.epa.gov/npdes/stormwater/measurablegoals/part5.cfm

   - National menu of stormwater best management practices (BMPs) - http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm

   - SCDHEC – BOW: 319 grant program has attempted to calculate the load reductions for the following BMPs:

     - Septic tank repair or replacement
     - Removing livestock from streams (cattle, horses, mules)
     - Livestock fencing
     - Waste Storage Facilities (aka stacking sheds)
     - Strip cropping
     - Prescribed grazing
     - Critical Area Planting
     - Runoff Management System
     - Waste Management System
     - Solids Separation Basin
     - Riparian Buffers

Appendix E

FC DATA SUMMARY

S-092									
Date	5/26/1999	6/2/1999	7/6/1999	8/4/1999	9/27/1999	10/4/1999	5/18/2000	6/19/2000	7/10/2000
FC (cfu/day)	38	250	24	36	0	40	64	200	110
Date	8/21/2000	9/13/2000	10/25/2000	1/3/2001	2/1/2001	3/15/2001	4/11/2001	6/12/2001	7/26/2001
FC (cfu/day)	180	20	75	110	10	440	38	56	270
Date	8/14/2001	9/12/2001	10/9/2001	11/29/2001	12/12/2001	1/5/2006	2/7/2006	3/23/2006	4/4/2006
FC (cfu/day)	210	260	140	75	230	140	1200	170	20
Date	5/2/2006	6/15/2006	7/6/2006	8/3/2006					
FC (cfu/day)	40	42	450	65					

S-233									
Date	5/26/1999	6/2/1999	7/6/1999	8/4/1999	9/27/1999	10/4/1999	5/18/2000	6/19/2000	7/10/2000
FC (cfu/day)	140	260	100	100	0	160	120	280	450
Date	8/21/2000	9/13/2000	10/25/2000	1/3/2001	2/1/2001	3/15/2001	4/11/2001	6/12/2001	7/26/2001
FC (cfu/day)	300	100	160	110	45	0	140	0	0
Date	8/14/2001	9/12/2001	10/9/2001	11/29/2001	12/11/2001	1/5/2006	2/7/2006	3/23/2006	4/4/2006
FC (cfu/day)	80	110	170	100	0	190	0	240	130
Date	5/2/2006	6/15/2006	7/6/2006	8/3/2006					
FC (cfu/day)	590	240	420	0					

S-235									
Date	5/26/1999	6/2/1999	7/6/1999	8/4/1999	9/27/1999	10/4/1999	5/18/2000	6/19/2000	7/10/2000
FC (cfu/day)	100	140	300	100	0	260	140	90	100
Date	8/21/2000	9/13/2000	10/25/2000	2/1/2001	3/15/2001	4/11/2001	6/12/2001	7/26/2001	8/14/2001
FC (cfu/day)	130	120	70	160	0	65	200	0	270
Date	9/12/2001	10/9/2001	11/29/2001	12/12/2001	1/5/2006	2/7/2006	3/23/2006	4/4/2006	5/2/2006
FC (cfu/day)	140	200	180	0	220	1200	120	140	260
Date	6/15/2006	7/6/2006	8/3/2006	9/5/2006	10/23/2006	11/8/2006	12/12/2006		
FC (cfu/day)	210	540	380	250	140	260	240		

S-093									
Date	1/4/1999	2/16/1999	3/2/1999	4/21/1999	5/26/1999	6/2/1999	7/6/1999	8/4/1999	9/27/1999
FC (cfu/day)	0	200	160	140	88	120	120	140	280
Date	10/4/1999	11/1/1999	12/6/1999	1/4/2000	2/15/2000	3/13/2000	4/13/2000	5/18/2000	6/19/2000
FC (cfu/day)	160	100	190	70	0	140	220	48	90
Date	7/10/2000	8/21/2000	9/13/2000	10/25/2000	11/6/2000	12/12/2000	1/3/2001	2/1/2001	3/15/2001
FC (cfu/day)	70	300	200	30	52	44	160	40	0
Date	4/11/2001	6/12/2001	7/26/2001	8/14/2001	9/12/2001	10/9/2001	11/29/2001	12/12/2001	1/22/2002
FC (cfu/day)	50	110	0	240	220	190	140	0	450
Date	2/14/2002	3/4/2002	4/3/2002	5/6/2002	6/3/2002	7/8/2002	8/7/2002	9/3/2002	10/9/2002
FC (cfu/day)	100	0	200	400	55	100	160	220	190
Date	11/6/2002	12/12/2002	1/6/2003	2/3/2003	3/4/2003	4/17/2003	5/19/2003	6/16/2003	7/10/2003
FC (cfu/day)	0	290	52	100	100	100	220	220	110
Date	8/19/2003	9/15/2003	10/1/2003	11/24/2003	12/10/2003	1/21/2004	2/19/2004	3/10/2004	4/7/2004
FC (cfu/day)	460	140	140	140	220	70	180	140	2
Date	5/25/2004	6/10/2004	7/28/2004	8/16/2004	9/30/2004	10/14/2004	11/23/2004	12/16/2004	1/24/2005
FC (cfu/day)	140	250	170	1300	900	290	6000	100	140
Date	2/16/2005	3/16/2005	4/21/2005	5/23/2005	6/23/2005	7/28/2005	8/31/2005	9/19/2005	10/31/2005
FC (cfu/day)	250	140	80	120	130	100	160	50	480
Date	11/29/2005	12/21/2005	1/5/2006	2/7/2006	3/23/2006	4/4/2006	5/2/2006	6/15/2006	7/6/2006
FC (cfu/day)	100	100	120	1200	580	150	230	150	270
Date	8/3/2006	9/5/2006	10/23/2006	11/8/2006	12/12/2006				
FC (cfu/day)	100	1200	15	290	170				

RS-03346									
Date	1/6/2003	2/3/2003	3/4/2003	4/17/2003	5/19/2003	6/17/2003	7/17/2003	8/14/2003	9/9/2003
FC (cfu/day)	50	600	30	150	820	330	450	1000	500
Date	10/1/2003	11/19/2003	12/8/2003						
FC (cfu/day)	20	3700	20						

Appendix F

DATA TABLES

90th Percentile FC Concentrations (#/100 mL)

Hydro Categ Range	High Flow 0-10	Moist Cond. 10-40	Mid Range 40-60	Dry Flow 60-90	Low Flow 90-100	Samples
S-092	440	921	154	258	186	31
S-233	0	225	410	256	345	31
S-235	0	824	220	288	205	34
S-093	595	454	258	291	268	95
RS-03346	330	1810	452	20	0	12

Mid Point Hydrologic Category Flow (cfs)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
S-092	111.58	42.13	25.28	15.45	6.54
S-233	157.19	64.22	42.00	28.61	15.81
S-235	200.00	79.86	50.72	34.72	18.29
S-093	390.50	152.20	95.02	60.87	29.59
RS-03346	12.28	4.46	2.78	1.70	0.72

Existing Load (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
S-092	1.20E+12	9.49E+11	9.52E+10	9.75E+10	2.97E+10
S-233	0.00E+00	3.54E+11	4.21E+11	1.79E+11	1.33E+11
S-235	0.00E+00	1.61E+12	2.73E+11	2.44E+11	9.17E+10
S-093	5.68E+12	1.69E+12	6.00E+11	4.33E+11	1.94E+11
RS-03346	9.92E+10	2.05E+11	3.08E+10	8.32E+8	0.00E+00

Target Load (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
S-092	1.04E+12	3.92E+11	2.35E+11	1.44E+11	6.08E+10
S-233	1568E+12	6.95E+11	3.05E+11	3.64E+11	2.53E+11
S-235	1.97E+12	8.49E+11	5.78E+11	4.20E+11	2.77E+11
S-093	3.72E+12	1.51E+12	9.76E+11	6.64E+11	3.80E+11
RS-03346	1.14E+11	4.31E+10	2.59E+10	1.58E+10	6.69E+09

Load Reduction Necessary (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
S-092	N/A	5.57E+11	N/A	N/A	N/A
S-233	N/A	N/A	1.07E+10	N/A	N/A
S-235	N/A	7.61E+11	N/A	N/A	N/A
S-093	N/A	1.8E+11	N/A	N/A	N/A
RS-03346	N/A	1.61E+11	N/A	N/A	N/A

% Load Reduction Necessary

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
S-092	N/A	59	N/A	N/A	N/A
S-233	N/A	N/A	26	N/A	N/A
S-235	N/A	47	N/A	N/A	N/A
S-093	N/A	11	N/A	N/A	N/A
RS-03346	N/A	79	N/A	N/A	N/A

Responsiveness Summary
Ninety Six Creek TMDL Document

Comments were received from the following:

South Carolina Department of Transportation
Upstate Forever

Comments from South Carolina Department of Transportation

TMDL Excerpt 1 (p. ii):

"Probable sources of fecal contamination include wildlife, agricultural runoff, failing septic systems, illicit connections, leaking sewers, sanitary sewer overflows and urban runoff."

Comment 1:

"SCDOT agrees with this statement. These sources should be addressed by appropriate reduction requirements in the TMDL. Requiring only SCDOT to reduce loading will not in any way address the impaired stations."

Response 1:

Wildlife, agricultural runoff, failing septic systems, illicit connections, leaking sewers, sanitary sewer overflows and urban runoff are nonpoint sources of pollution and as such are covered under the load allocation portion of the TMDL document. Load allocations are provided in Table Ab-1, Table 9, and are further discussed in detail in section 5.4 of this TMDL document. Reductions from all sources, including point and nonpoint sources, are required for meeting the overall percentage reduction in the referenced TMDL and to achieve the water quality standard for the pollutant of concern.

TMDL Excerpt 2 (p. ii):

"Compliance with terms and conditions of existing and future NPDES sanitary and stormwater permits may effectively implement…and demonstrate consistency with the assumptions and requirements of the TMDL."

Comment 2:

"Any reduction in fecal coliform from SCDOT would have no measurable impact on the overall fecal coliform levels since SCDOT roads produce essentially no fecal coliform. Therefore, SCDOT believes this is an untrue statement based on the current wording of the TMDL."

Response 2:

The statement on p.ii of the referenced TMDL document reads as follows:

> "Compliance with terms and conditions of existing and future NPDES sanitary and stormwater permits (including all construction, industrial,

> and MS4) may effectively implement **the WLA** and demonstrate consistency with the assumptions and requirements of the TMDL."

To leave out the portion of the statement, "the WLA", will take the referenced statement out of context. Compliance with terms and conditions of existing and future NPDES sanitary and stormwater permits might only effectively implement the WLA portion of the TMDL. The percent reductions from both the LA and WLA components of the TMDL will need to be met to meet the requirements of the TMDL. The Department believes that roads, facilities or properties owned and/or operated by SCDOT in this TMDL drainage area have the potential to be a source or conveyance of FC bacteria.

TMDL Excerpt 3 (p. 6):

"Sources of FC bacteria are usually diffuse or nonpoint in nature and originate from stormwater runoff, failing septic systems, agricultural runoff and leaking sewers among other sources."

Comment 3:

"Why are other sources listed throughout the TMDL until it comes to the percent reduction table, in which SCDOT is the only entity listed? SCDOT should not have a waste load reduction since its input is negligible. Also, there is a failure in the TMDL to acknowledge that leaking septic tanks are regulated by SCDHEC and the local health department and leaking sanitary sewer lines are also regulated by SCDHEC."

Response 3:

Wildlife, agricultural runoff, failing septic systems, illicit connections, leaking sewers, sanitary sewer overflows and urban runoff are nonpoint sources of pollution and as such are covered under the load allocation portion of the TMDL document. Percent reductions, including the load allocation portion of the TMDL, are provided in Table Ab-1, Table 9, and are further discussed in detail in section 5.4 of this TMDL document. Reductions from all sources, including point and nonpoint sources, are required to meet the overall percentage reductions of the referenced TMDL and achieve the water quality standard for the pollutant of concern. Therefore, SCDOT is not the sole source responsible for reducing FC loading to the referenced watershed. In addition, future NPDES discharges in the referenced watershed are also required to comply with the load reductions prescribed in the WLA.

The referenced TMDL document does not identify the input from SCDOT as "negligible". It is stated on p. 12 of the referenced TMDL document, that:

> "Based on current information as well as the physical interconnected nature of SCDOT owned or operated properties in relation to urbanized area and the potential for growth in the referenced watershed, SCDOT is considered to be a contributing source of FC bacteria in the delineated drainage area used in the development of this TMDL document."

As such, compliance with terms and conditions of NPDES stormwater permits may effectively implement the WLA and demonstate consistency with the assumptions and requirements of the TMDL. In this situation, SCDOT may need to revise the existing SWMP or any other plan in a manner that would effectively address the TMDL requirements with an acceptable schedule for

permit compliance. The level of monitoring necessary, if any, deployment of structural and non-structural BMPs to reduce pollutant loading, assessing the performance of BMPs, documenting BMP effectiveness, and revising the existing pollutant reduction goals of the stormwater management plan or any such other plan is watershed specific.

It should be noted that unauthorized discharges to Waters of the State, including leaky septic tanks and leaking sewer lines, are illegal and subject to compliance and enforcement mechanisms. Sections 3.2.3 and 3.2.4 (p. 16) of the referenced TMDL document discuss leaking sanitary sewers, illicit discharges, and failing septic systems. Maintenance of septic tanks is the responsibility of individual owners. Maintenance of sewer lines is the responsibility of the collection system owner. NPDES permitted stormwater entities (regulated MS4s) must have an illicit discharge detection program in place to help identify illegal discharges, such as those referenced above, in order to insure that they are eliminated.

TMDL Excerpt 4 (p. 9):

Water Quality Assessment

Comment 4:

"Where were these samples tested and what protocols were used in this testing?"

Response 4:

Samples used in the development of this TMDL document were taken from stations S-092, S-233, S-235, S-093, and RS-03346 as described in section 1.1 and provided in Table 1 and Figure 1 of the referenced document. The exact location is listed under the "Description" column of Table 1 on p. 6.

Table 1. Ninety Six Creek Watershed FC Impaired Waters.

Waterbody	Station Number	Description
Coronaca Creek	S-092	Coronaca Creek at S-24-100 4 Miles NW of 96
Wilson Creek	S-233	Wilson Creek at S-24-101
Wilson Creek	S-235	Wilson Creek at S-24-124
Ninety Six Creek	S-093	Ninety Six Creek at SC 702 5.2 Miles ESE of 96
Rocky Creek	RS-03346	Rocky Creek at SC 72 Bypass and SC 254

The EPA approved membrane filter method is currently used to sample fecal coliform bacteria in freshwater streams. Guided by 40 CFR Part 136, this approach was used and is outlined in 'Standard Methods', 9222D (APHA et al., 2006). Sampling is conducted under an approved Quality Assurance Project Plan (QAPP), which must be approved by the State Quality Assurance Management Officer (SQAMO) or Quality Assurance (QA) Officer (within SCDHEC Bureau of Environmental Services). In addition, a SCDHEC EQC (Environmental Quality Control) standard operating procedures (SOP) and quality assurance manual is also used. Ambient monitoring is covered under section 7, part 2 of the SOP and QA manual.

TMDL Excerpt 5 (p. 9):

"Waters in which no more than 10% of the samples collected over a five year period are greater than 400 FC counts or cfu/100ml are considered to comply with South Carolina's WQS for FC bacteria."

Comment 5:

"Of the five stations listed, only one (RS-03346) should actually be impaired under SCDHEC's guidelines. On pg. 10, Table 3 shows the percentage of samples in the five year period over 400 cfu/100ml. Only one of the stations (RS-03346) was greater than 10% and it is the most upstream station. Also its High Flow of 12.28 cfs and Low Flow of 0.72 cfs are an order of magnitude lower than other stations, thus since there is little dilution the concentrations are high regardless of the FC loading. Additionally this station is located directly down gradient of the Greenwood urban area, thus the City and WWTFs are likely significant contributors."

Response 5:

Stations are listed on the §303(d) based on data collected from 2002-2006, the time frame consistent with the 2008 303(d) assessment. As a result of this stations S-092, S-233, S-235, S-093, and RS-03346 are included on the 2008 303(d) list as impaired for FC bacteria. Table 3 on p. 10 does not show the "percentage of samples in the five year period over 400 cfu/100ml." Table 3 presents data used in the development of the referenced TMDL document which was taken from an 8 year time frame (1999-2006). Compared to the data used in listing these sites on the §303(d) list, additional data was used. These additional data points account for the percentages presented in Table 3.

The magnitude of the high and low flows for RS-03346 in relation to other water quality monitoring flows is not relevant to the listing of impaired stations on the §303(d) list or the subsequent development of TMDLs. SCDHEC samples for FC bacteria at the referenced water quality monitoring station to comply with the State FC bacteria water quality standard. The measured data taken and presented in appendix E of the referenced TMDL document is greater than the 10% standard (400 cfu/100ml) as outlined in section 1.3 of the TMDL document (p.9).

The referenced TMDL document acknowledges that the City of Greenwood, WWTFs, etc., have the potential to contribute to FC loading in the watershed. The WWTFs in the watershed are subject to the WLA portion of the TMDL. Existing and future continuous discharges (WWTFs, etc.) are required to meet the prescribed loading for the pollutant of concern. Loadings are developed based upon permitted flow and assuming an allowable permitted maximum concentration of 400 cfu/100ml. If these facilities are discharging wastewater that meets their permit limits, they are not causing or contributing to an impairment. If any of these facilities is not meeting its permit limits, compliance and enforcement actions/mechanisms are in place to address these issues.

Non-continuous point sources in the watershed (i.e. MS4 entities, etc.) are also subject to the WLA portion of the TMDL. Currently, the City of Greenwood is a potentially designated MS4 located in the referenced watershed subject to the LA portion of the TMDL. Similar to regulated MS4s, potentially designated MS4 entities (as listed in 64 FR, P. 688837) or other unregulated MS4 communities located in the Ninety Six Creek watershed may have the potential to contribute FC bacteria in stormwater runoff. If future MS4 permits for the City of Greenwood are

applicable to this watershed, then those discharges will be subject to the assumptions and requirements of the WLA portion of this TMDL.

TMDL Excerpt 6 (p. 11):

Indicators such as FC bacteria, enteroccoci or E. coli are measured to represent pathogens

Comment 6:

"1n 1986 the USEPA recommended moving from FC to enteroccoci or E. coli since FC has been shown to not correspond well with the presence of pathogens. A TMDL should not be based on an invalid indicator."

Response 6:

The current water quality standard for indicators of pathogens in the State of South Carolina is based on FC bacteria. South Carolina's Water Quality Standard (WQS) for fecal coliform in freshwater is:

> "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).

TMDLs are developed for pollutants that are listed on the section 303(d) list which do not meet the existing promulgated water quality standard. As presented on p. 6 of the referenced TMDL document, the presence of FCs in surface waters may signify a presence of pathogens, which in turn leads to a greater risk of health for individuals participating in recreation activities within water bodies (USEPA, 2001).

TMDL Excerpt 7 (p. 11):

Regarding municipal and private sanitary wastewater treatment facilities – "if these facilities are discharging wastewater that meets their permit limits, they are not causing impairment."

Comment 7:

"If SCDOT and other MS4s are meeting the measurable goals in their NPDES permits to the maximum extent practicable (MEP), they should be held to the same standard as WWTFs and not be subject to percent reduction requirements. In fact, SCDHEC's own statement in the second specific comment above acknowledges that permit changes may have to be made for other permitted entities to achieve the TMDL goals."

Response 7:

The TMDL document states that stormwater dischargers in the watershed are required to meet the percentage reduction or the existing instream standard for the pollutant of concern. Waste load allocations for stormwater discharges are expressed as a percentage reduction instead of a numeric loading due to the uncertain nature of stormwater discharge volumes and recurrence intervals. For FC, loading is expressed as a concentration. Since loading is expressed as a concentration, permit changes will not have to be made for other entities to achieve the TMDL goals because concentration is not accumulative. If continuous or non-continuous permitted

NPDES entities are meeting the percentage reduction or the water quality standard, then they are not causing or contributing to the impairment.

TMDL Excerpt 8 (p. 12):

"Based on current information as well as the physical interconnected nature of SCDOT owned or operated properties **in relation to urbanized area** and the potential for growth in the referenced watershed, SCDOT is considered to be a contributing source of FC bacteria in the delineated drainage area used in the development of this TMDL document."

Comment 8:

"This language leaves SCDOT with all liability while acknowledging the contribution of two unregulated MS4s (City of Greenwood and Town of Ninety Six). SCDHEC has the authority to designate an MS4 at any time to address water quality issues."

Response 8:

SCDOT is not solely responsible for reducing FC loading to the referenced watershed. Wildlife, agricultural runoff, failing septic systems, illicit connections, leaking sewers, sanitary sewer overflows and urban runoff are nonpoint sources of pollution and as such are covered under the load allocation portion of the TMDL document. Percent reductions, including the load allocation portion of the TMDL, are provided in Table Ab-1, Table 9, and are further discussed in detail in section 5.4 of this TMDL document. Percent reductions from all sources, including point and nonpoint sources, are required to meet the water quality standard and implement the referenced TMDL.

The City of Greenwood is a potentially designated MS4 located in this watershed. Similar to regulated MS4s, potentially designated MS4 entities (as listed in 64 FR, P. 688837) or other unregulated MS4 communities (such as the Town of Ninety Six) located in the Ninety Six Creek watershed may have the potential to contribute FC bacteria in stormwater runoff. As a potentially designated MS4, the City of Greenwood is expected to become a regulated MS4 entity in the near future. When future MS4 permits (including but not limited to the City of Greenwood) are applicable to this watershed, those discharges will be subject to the assumptions and requirements of the WLA portion of this TMDL.

At the present time, the Town of Ninety Six is an unregulated MS4 community in the watershed subject to the load allocation (LA) portion of the TMDL and currently does not meet the NPDES Phase II designation requirements set forth in SC Water Pollution Control Permits Regulation 122.32(f)&(g). Should future MS4 permits apply to this watershed, those discharges will be subject to the assumptions and requirements of the WLA portion of this TMDL.

TMDL Excerpt 9 (p. 12):

"SCDOT owned or operated roads relative to the numerous animal feeding operations (AFOs) and land application sites in the referenced watershed may also be a contributing source of FC bacteria through conveyance."

Comment 9:

"SCDOT has no authority to regulate AFOs and land application sites and should not be held accountable for the FC bacteria contributed by them. These activities are regulated by SCDHEC and are its responsibility."

Response 9:

By definition of MS4 as prescribed in R.61-9 section 122.26(b), "Municipal separate storm sewer" means a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains)". SCDOT is a phase I MS4 which may have the potential to **contribute** or **convey** fecal coliform loading to waters of the State. The location of the numerous animal feeding operations and land application sites in relation to SCDOT roads in the watershed compounds the possibility of conveying FC bacteria through the SCDOT MS4.

AFOs are inspected by SCDHEC for permit compliance. Permitted agricultural facilities that operate in compliance with their permit are not considered to be sources of impairment. Discharges from these operations to waters of the State are illegal and are subject to enforcement actions by SCDHEC and are therefore not provided a percentage reduction.

TMDL Excerpt 1 (p. 14):

Regarding AFOs, "These permitted operations are not allowed to discharge to waters of the State and are covered under 'no discharge' (ND) permits. Discharges from these operations to waters of the State are illegal and are subject to enforcement actions by SCDHEC."

Comment 10:

"These are the same AFOs which on pg. 12 are said to be a contributing source "through conveyance." If they convey FC to waters of the state either directly or through SCDOT facilities, they are not a "no discharge" facility."

Response 10:

The statement referred to by SCDOT on p. 12 of the referenced TMDL document reads as follows:

> "SCDOT owned or operated roads relative to the numerous animal feeding operations (AFOs) and land application sites in the referenced watershed may also be a contributing source of FC bacteria through conveyance."

This statement clearly says that <u>SCDOT owned or operated roads</u> may be a contributing source of FC bacteria through conveyance and not the AFOs. AFOs are inspected by SCDHEC for permit compliance. Permitted agricultural facilities that operate in compliance with their no discharge (ND) permit are not considered to be sources of impairment. Discharges from these operations to waters of the State are illegal and are subject to compliance and enforcement actions by SCDHEC and are therefore not provided a percentage reduction.

TMDL Excerpt 11 (p. 14-15):

"Wildlife is considered to be a significant contributor to the FC load within the rural portions of the watershed as numerous waterfowl and deer were seen." …. "Agricultural activities *(including Agricultural Animal Facilities and Grazing Animals)* may represent a significant source in the Ninety Six Creek watershed due to the fact that these activities constitute a large portion of the land use." *emphasis added*

- "wildlife is considered to be a significant contributor to the FC load within the rural portions of the watershed as numerous waterfowl and deer were seen."
- "Agricultural activities may represent a significant source in the Ninety Six Creek watershed due to the fact that these activities constitute a large portion of the land use."
- "Livestock, especially cattle, are frequently major contributors of FC bacteria to streams."
- "A site visit to the Ninety Six Creek watershed conducted in July, 2008 confirmed the contribution of livestock to the FC load as shown in Figure A-9 where cattle were seen accessing and laying down in the surface waters of Big Rock Creek."

Comment 11:

"If agricultural sources are acknowledged as significant contributors to the FC bacteria load, they should not be exempt from the TMDL simply because their contribution may be difficult to ascertain or they are already permitted separately. They should be listed as contributors and assigned a percent reduction. Short of listing each source, the percent reduction for other contributors should at the very least be reduced to account for these non-urban sources."

Response 11:

Wildlife and agricultural sources present in the referenced watershed are listed as potential contributors to the FC bacteria load in the source assessment section (Section 3.0, p. 11-16) of the Ninety Six Creek TMDL document . AFOs in the referenced watershed are not allowed to discharge to waters of the State and are covered under 'no discharge' (ND) permits. Discharges from these operations to waters of the State are illegal and are subject to compliance and enforcement actions by SCDHEC and are therefore not provided a percentage reduction.

The wildlife and agricultural sources that are discussed by SCDOT as referenced from the TMDL document on p. 14-15 are nonpoint sources of pollution. Therefore, they fall under the load allocation (LA) portion of the referenced TMDL document. The load allocations and percentage reductions for the SCDHEC water quality monitoring stations in the watershed are presented in Table Ab-1 and Table 9 of the TMDL document.

TMDL Excerpt 12 (p. 16):

"Leaking sewer pipes and illicit sewer connections represent a direct threat to public health since they result in discharge of partially treated or untreated human wastes to the surrounding environment." …. "Failed or non-conforming septic systems, however, can be a contributor of FC to Ninety Six Creek and its tributaries. Wastes from failing septic systems enter surface waters either as direct overland flow or via groundwater. Although loading to steams from failing septic systems is likely to be a continual source, wet weather events can increase the rate of transport of pollutants from failing septic systems because of the wash-off effect from runoff and the increased rate of groundwater recharge."

Comment 12:

"Since leaking sanitary sewers, illicit discharges and failing septic systems are acknowledged as significant contributors to the FC bacteria load and are regulated, the entities that operate and maintain them should not be exempt from the TMDL simply because their contribution may be difficult to ascertain or they are already permitted separately. They should be listed as contributors and assigned a percent reduction. Short of listing each source, the percent reduction for other contributors should at the very least be reduced to account for these sources."

Response 12:

Unauthorized discharges to Waters of the State, including leaking sewer lines and other illicit discharges, are illegal and subject to compliance and enforcement mechanisms. Maintenance of sewer lines is the responsibility of the collection system owner. NPDES permitted stormwater entities (regulated MS4s) must have an illicit discharge detection program in place to help identify illegal discharges, such as those referenced above, in order to insure that they are eliminated.

TMDL Excerpt 13 (p. 16):

Failure to acknowledge Sanitary Sewer Overflows (SSOs)

Comment 13:

"SSOs have concentrations on the order of about 10^5 to 10^7 CFU/100ml. That is 5 to 7 orders of magnitude over the WQS. There were 198 reported releases in Greenwood County during the study period. The number of these releases which were in the study area is unknown but because of the very small number of samples used to calculate the TMDL, even capturing one of these would greatly skew the results."

Response 13:

Section 3.1.2 (Non-Continuous Point Sources) on p. 13 of the referenced TMDL document acknowledges that SSOs have the potential to severely impact water quality in the referenced watershed. It is further stated, that between 1999 and 2006, 198 reported SSOs occurred in Greenwood County resulting in the release of approximately 947,000 gallons of untreated sanitary waste. However, due to the limited amount of information available on reported SSOs accessible by the Department, it is not feasible to include estimates of individual SSO loadings in the development of the Ninety Six Creek TMDL.

TMDL Excerpt 14 (p. 16):

"Dogs, cats, and other domesticated pets are the primary source of FC deposited on the urban landscape."

Comment 14:

"This source should be addressed when assigning SCDOT the only allocated load for the impaired stations within this TMDL watershed. SCDOT has no control over dogs, cats, and other domesticated pets."

Response 14:

Dogs, cats, and other domesticated pets in unregulated portions of the watershed are nonpoint sources of pollution subject to the load allocation portion of the TMDL as presented in Table Ab-1 and Table 9. It is the responsibility of the MS4 operator to implement and maintain a public education and outreach component of their stormwater management plan (SWMP) to reduce FC bacteria loading to Waters of the State in regulated portions of the watershed.

TMDL Excerpt 15 (p. 16):

"The City of Greenwood is a potentially designated MS4 located in this watershed. Similar to regulated MS4s, potentially designated MS4 entities (as listed in 64 FR, P. 6999.7) or **other unregulated MS4 communities** located in the Ninety Six watershed may have the potential to contribute FC bacteria in stormwater runoff."

Comment 15:

"The City of Greenwood should most certainly be a named contributor to this TMDL. If you examine Figure 2 (Land Use) and then examine Figure 6 (% reductions) it is obvious that the stations with the highest reduction are nearest these unregulated MS4s. The unregulated MS4s should bear some of the burden of implementing the TMDL."

Response 15:

At the present time, the City of Greenwood is a potentially designated MS4 entity and is currently not regulated. If a future MS4 permit for the City of Greenwood is applicable to this watershed, then those discharges will be subject to the assumptions and requirements of the WLA portion of this TMDL. Until that time, the City of Greenwood and other unregulated MS4 communities located in the Ninety Six Creek watershed will be included in the load allocation (LA) portion of the referenced TMDL. The LA and percentage reductions are provided in table Ab-1 and table 9 of the referenced document. FC loading reductions from all sources (WLA and LA) are required in order to achieve the TMDL target.

TMDL Excerpt 16 (p. 19):

5.1 Critical Conditions. "The critical condition for each monitoring station is identified as the flow condition requiring the largest percent reduction, within the 10-90% duration intervals."

Comment 16:

"The way the percent reduction statistics are presented gives the impression that all of the data set was used when in fact only a **small** portion was considered. One of the useful properties of load duration curve methodology is that it gives a picture of loadings under different flow condition. SCDHEC, however, is misusing this aspect of Load Duration Curves (LDC) to generate the highest possible % reductions that are perceived to represent the entire dataset when in fact they represent only a small percentage of it. The measured FC loadings are divided into one of 5 flow conditions. This is a useful tool as it may help identify the potential sources of contamination. The problem is the use of the 'critical condition." It is not statistically valid to calculate a TMDL based on a 90^{th} percentile value of the extremely small sample set of FC in this Critical Condition category."

Response 16:

The load duration curve (LDC) approach was used in development of the Ninety Six Creek with concurrence from EPA Region 4. This approach is used regionally and nationally and is consistent with guidance from EPA. The LDC does in fact divide the FC loadings into one of 5 flow conditions. They are as follows: high flows, moist conditions, mid-range flows, dry conditions, and low flows. The high and low flows represent extremes in the data and are removed when calculating the percent reduction required for individual water quality monitoring stations. As an example, station S-092 consists of 30 data points over a period of two and a half years. Of those 30 points, 8 of those fall within the high and low flow extremes and are removed when calculating the percent reduction. For this instance, that leaves 22 remaining data points which comprises 73% of the initial data set. The Department, with concurrence from EPA Region 4, believes that this method is valid, scientifically defensible, and protective of critical conditions in the watershed.

TMDL Excerpt 17 (p. 23):

Table 10

Comment 17:

"SCDOT should not be the only entity assigned responsibility to attain the target load since there are other identified sources of FC in the watershed."

Response 17:

Wildlife, agricultural runoff, failing septic systems, illicit connections, leaking sewers, sanitary sewer overflows and urban runoff are nonpoint sources of pollution and as such are covered under the load allocation portion of the TMDL document. Percent reductions, including the load allocation portion of the TMDL, are provided in Table Ab-1, Table 9, and are further discussed in detail in section 5.4 of this TMDL document. Percent reductions from all sources, including point and nonpoint sources, are required for implementation of the referenced TMDL and to achieve the water quality standard for the pollutant of concern. Therefore, SCDOT is not solely responsible for reducing FC loading to the referenced watershed. In addition, future NPDES discharges in the referenced watershed are also required to comply with the load reductions prescribed in the WLA.

TMDL Excerpt 18 (p. 32-37):

Appendix A – Load Duration Curves

Comment 18:

"The science of this TMDL is not adequate. The flow data is unacceptable as is shown in the straight-line nature of the Load Duration Curves. Even monthly average flows are used in some cases. This is because the gauges available were in ineffective locations to measure flows representative of the WQ stations. Irrespective of the applicability of the flow data, this does not excuse this abuse of the public's perception of statistical analysis. The Load Duration Curve graphs don't match the correct values (see attached spreadsheet)."

Response 18:

The approach used in developing the referenced TMDL document was developed with concurrence from EPA region 4. Available data was used and where unavailable, estimates were calculated. The Department believes the methods used and presented in the referenced TMDL document are valid, scientifically defensible, and protective of critical conditions in the watershed. Please see response 19 for an explanation on the percentage reduction values presented by SCDHEC.

TMDL Excerpt 19 (p. 54-56):

Appendix F – Data Tables

Comment 19:

"The math in these tables is wrong. The reported values don't match what they should be if calculated correctly (see attached spreadsheet)."

Response 19:

For stations S-092 and RS-03346, the Departments calculations for the percent reduction required is consistent with the values presented by SCDOT (see table below). S-092 requires a percentage reduction of 59% and RS-03346 a reduction of 79%. For stations S-233, S-235, and S-093 however, the Departments calculations for percent reductions differs from what is presented by SCDOT. Station S-233 requires a percentage reduction of 28%. Station S-235 a reduction of 47%, and 11% for station S-093.

Percent Reduction
Presented by SCDOT

Station	High flow	Moist Cond.	Mid Range	Dry Flow	Low Flow
S-092	14%	59%	-147%	-47%	-104%
S-233	No Load	-69%	7%	-48%	-10%
S-235	No Load	54%	-73%	-32%	-85%
S-093	36%	16%	-47%	-31%	-42%
RS-03346	-15%	79%	16%	-1800%	No Load

As stated in section 4.0 of the referenced TMDL document (p. 19), for stations S-093, S-233, and S-235, the 90th percentile of measured FC concentrations within each hydrologic category was multiplied by the flow at each category midpoint **plus** the discharge monitoring report (DMR) monthly average flow from SC0021709. This was done to account for SC0021709's relatively large contribution to the overall stream flow in Wilson Creek, and due to the proportion of flow from SC0021709 to the flow from Wilson Creek. SCDOT failed to include this aspect of the method used in developing load reductions in their own calculations. Without the addition of DMR monthly average flow for stations S-093, S-233, and S-235 to account for SC0021709's contribution to overall stream flow, the percent reduction presented in the TMDL document by the Department would have matched the values presented by SCDOT but would not be representative of the actual flow from Wilson Creek. To estimate flow without the contribution from SC0021709, would result in greater error of the estimate.

TMDL Excerpt 20 (p. 22-23, 54-56):

Load and Percent Reductions – Tables 9 and 10, Appendix F – Data Tables

Comment 20:

"The mathematical basis for the required reductions appears invalid. For example, the critical condition for Station S-092 falls into "Moist Conditions" category. It is not statistically valid to perform a normal distribution with the average and standard deviation to produce a 90^{th} percentile number, with only 4 data points that have no temporal relationship to one another while representing this result as if all 31 points were used."

Response 20:

The load duration curve method is a regionally and nationally accepted approach used to develop TMDLs and this method has been used extensively by SCDHEC with concurrence from EPA Region 4. This TMDL is based on the flow recurrence interval between 10% and 90% and excludes extreme high and low flow conditions. Flows that are characterized as 'Low' or 'High' in Figure 5 of the TMDL document (p. 18) are considered extremes and were not included in the analysis. The remaining 23 data points were used. The critical condition for S-092 is "Moist Conditions", which is the flow condition requiring the largest percent reduction within the 10-90% duration intervals. In addition, federal regulations require that TMDLs take into account the seasonal variability in watershed loading. The variability in this TMDL is accounted for by using a 10-year hydrological data set and 12 month water quality sampling data set (12-96 data points per water quality monitoring station), which includes data collected from all seasons.

Comments from Upstate Forever

Comment 1:

The Data are Not Sufficient to Support a TMDL for this Watershed**:**

"Overall, this data contained in the Draft TMDL presents a very thin case for even conducting a review, much less going through the process of establishing a TMDL. The details of methodology, in terms of data handling, screening, and processing are reasonable and rational. However, the inherent problem is the quality and representativeness of the data. This data is extremely weak due to data gaps, geographic imbalance in the monitoring program, and the dominant drought condition. No information is provided on other relevant water quality parameters to give this data additional credibility or to enable inferences of any sort. The allocation of indicator bacteria loading based on marginal data for an unconvincing parameter is useful only in that this general knowledge should be used to encourage and incentivize landowners and permittees to minimize NPS pollution."

Response 1:

The data used in the development of the referenced TMDL document consists of up to 96 individual data points from 1999 - 2006. Sampling is conducted under an approved Quality Assurance Project Plan (QAPP), which must be approved by the State Quality Assurance Management Officer (SQAMO) or Quality Assurance (QA) Officer. In addition, a SCDHEC

EQC (Environmental Quality Control) standard operating procedures (SOP) and quality assurance manual is also used. Ambient monitoring is covered under section 7, part 2 of the SOP and QA manual. The Department believes, with concurrence from EPA region 4, that the data collected is valid, scientifically defensible, and adequate for TMDL development. Federal regulations also require that TMDLs take into account the seasonal variability in watershed loading. The variability in this TMDL is accounted for by using a 10-year hydrological data set and 12 month water quality sampling data set, which includes data collected from all seasons.

Comment 2:

When an adequate TMDL is prepared, several issues should be addressed:

a. An adaptive management and implementation approach can result in consistently effective measures for improving water quality. Periodically reviewing the TMDL for revisions and/or modifications as necessary will ensure that the provisions made in the TMDL consider current situations as data becomes available. However, because there are many permits issued for continuous and non-continuous point sources, any modifications and/or revisions made to the TMDL over time could have implications for permits issued in the Ninety Six Creek Watershed. Therefore, when the SC Department of Health and Environmental Control include a section in the TMDL that would require the reopening of all related permits to reflect improved fecal coliform limits in order that they comply with any revisions made to the Ninety Six Creek Watershed TMDL.

b. There is no discussion of the performance and compliance of the three NPDES facilities in the watershed. These records should be considered to either confirm or refute a relationship with the exceedance events. Also, there is no discussion of other water quality parameters that may be correlated with or even contribute to the FC values. There is no discussion of whether flows were low, normal, or high on the date of sampling, or whether waters were clear, marginally turbid, or highly turbid.

c. Additionally, while SC DHEC is not involved in zoning, land use or other land designations, we feel that the TMDL should emphasize the benefits that riparian buffer areas contribute in reducing fecal coliform inputs from non-point sources (NPS). While the TMDL identifies both point source and non-point source inputs, it only places restrictions on inputs from municipal separate storm sewer systems and wastewater treatment facilities. Assuming data for the study is sufficient, this is ineffective to reduce inputs from agricultural or urban runoff. Twice the TMDL recommends installation of buffers (§3.1.2 Non-continuous Point Sources and §3.2.2 Agricultural Activities). However, the TMDL provides neither a discussion of streamside management practices nor the physical buffer requirements necessary to reduce NPS inputs. We suggest the addition of a section that highlights the benefits that riparian buffers create in reducing fecal coliform inputs to the watershed. Additionally, data may support an incentive to remove the TMDL restrictions if adequate riparian buffer protections are in place.

Response 2:

a. For FC bacteria, existing and future continuous point sources are given a loading based upon permitted flow and assuming an allowable permitted maximum concentration of 400 cfu/100ml. If the prescribed loading and concentration are

being met, then these entities are not causing or contributing to the water quality impairment. Discharging above permit limits is illicit and subject to compliance and enforcement mechanisms.

The Department recognizes that adaptive management/implementation of this TMDL might be needed to achieve the water quality standard and we are committed towards targeting the load reductions to improve water quality in the Ninety Six Creek watershed. As additional data and/or information becomes available, it may become necessary to revise and or modify the TMDL target accordingly.

b. Existing and future continuous discharges (WWTFs, etc.) are required to meet the prescribed loading for the pollutant of concern. Loadings are developed based upon permitted flow and assuming an allowable permitted maximum concentration of 400 cfu/100ml. If these facilities are discharging wastewater that meets their permit limits, they are not causing or contributing to an impairment. If any of these facilities is not meeting its permit limits, compliance and enforcement actions/mechanisms are in place to address these issues.

   Discharge monitoring report (DMR) data for all of the NPDES continuous point source discharges that were active in the referenced watershed during the period of 1999-2006 have been reviewed. Of the five wastewater treatment facilities (WWTF) that were active during this time period, an insignificant number of exceedances were reported. Of the 6 exceedances reported from 620 DMRs, the values were reported from 440 cfu/100ml to 1200 cfu/100ml.

c. With the acknowledgement of the riparian buffer references in sections 3.0 and 6.0 of the referenced document, the Department makes every attempt to highlight possible BMPs that may be effective in reducing FC bacteria in TMDL watersheds. Additional resources are referenced in section 7.0 of this TMDL document.

Amendments to the Ninety Six Creek TMDL Document

As a result of comments received by the Department during the public comment period from July 31st, 2009 to September 1st, 2009 and subsequent appeal by SCDOT to the SCDHEC Board, the following amendments have been made to the Ninety Six Creek TMDL Document. Changes are shown as bold font and are reflected in the most recent version of the referenced TMDL document.

Amendment Location 1:

Abstract

Amendment:

The following paragraph has been revised:

> "The watershed is divided into two distinct sub-basins: The Upper Wilson Creek watershed and the lower Ninety Six Creek watershed. The upper watershed is more developed whereas the lower watershed is predominately forest or agriculture lands. There are currently three active NPDES permitted sanitary

waste dischargers within the watershed. Probable sources of fecal contamination include wildlife, agricultural runoff, failing septic systems, illicit connections, leaking sewers, sanitary sewer overflows and urban runoff. The load-duration curve methodology was used to calculate existing and TMDL loads for each impaired segment. Existing pollutant loadings and proposed TMDL reductions for critical hydrologic conditions are presented in Table Ab-1. Critical hydrologic conditions were defined as either moist, mid-range, or dry depending on which condition demonstrated the highest load reductions necessary to meet water quality standards. In order to achieve the target load (slightly below water quality standards) for Ninety Six Creek and tributaries, reductions in the existing loads of up to 79% will be necessary at some stations. Compliance with terms and conditions of existing and future NPDES sanitary and stormwater permits (including all construction, industrial and MS4) may effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL. **For SCDOT, compliance with terms and conditions of its NPDES MS4 permit is effective implementation of the WLA to the Maximum Extent Practicable (MEP).** Required load reductions in the LA portion of this TMDL can be implemented through voluntary measures and are eligible for CWA §319 grants."

Amendment Location 2:

Table Ab-1 and Table 9 Footnote

Amendment:

Table notes 2 and 4 have been revised as follows:

Table Notes:

1. WLAs are expressed as a daily maximum; NA = not applicable, no point sources. Existing and future continuous discharges are required to meet the prescribed loading for the pollutant of concern. Loadings were developed based upon permitted flow and assuming an allowable permitted maximum concentration of 400cfu/100ml.
2. Percent reduction applies to all NPDES-permitted stormwater discharges, including current and future MS4, construction and industrial discharges covered under permits numbered SCS & SCR. Stormwater discharges are expressed as a percentage reduction due to the uncertain nature of stormwater discharge volumes and recurrence intervals. Stormwater discharges are required to meet percentage reduction or the existing instream standard for pollutant of concern **in accordance with their NPDES Permit.**
3. Percent reduction applies to existing instream load; Where Percentage Reduction = (Existing Load-Load Allocation) / Existing Load
   By implementing the best management practices that are prescribed in either the SCDOT annual SWMP or the SCDOT MS4 Permit to address fecal coliform, the SCDOT will comply with this TMDL and its applicable WLA to the maximum extent practicable (MEP) as required by its MS4 permit.
4. **By implementing the best management practices that are prescribed in either the SCDOT annual SWMP or the SCDOT MS4 Permit to address fecal coliform, the SCDOT will comply with this TMDL and its applicable WLA to the maximum extent practicable (MEP) as required by its MS4 permit.**

Amendment Location 3:

Section 1.2, Pages 2-4

Amendment:

The following paragraphs and table have been revised in section 1.2 to reflect land use values for the Ninety Six Creek watershed.

> Land use within the watershed is predominately forest and other non-cultivated vegetated lands
> (**63%**), mostly located in the lower Ninety Six Creek watershed (Table 2a). Developed lands (residential, commercial, industrial, or open urban space) comprise approximately **16%** of the watershed but most of this land use is concentrated in the upper watershed. Pasture, crop, and cultivated lands comprise approximately **17%** of the Ninety Six Creek watershed, as determined by the 2001 National Land Cover Data Set (NLCD 2001).

Land Use	Upper Watershed (ac)	%	Lower Watershed (ac)	%	Total Watershed (ac)	%	Greenwood County (ac)	%
Developed (residential, commercial, industrial)	11,347	22.9	3,255	7.9	14,601	16.1	31,613.8	10.7
Forest or otherwise vegetated (non-cultivated)	28,751	58.0	28,744	69.8	57,499	63.4	205,067.5	69.2
Wetlands	1,403	2.8	1122.36	2.7	2,525	2.8	6,089.4	2.1
Open Water	383.2	0.8	185.7	0.5	568.83	0.6	5,944.2	2.0
Pasture/crop	7,318	14.8	7,725	18.8	15,043	16.6	44,531.9	15.0
Barren	366.5	0.7	154.4	0.4	520.8	0.6	2,922.2	1.0
Total	**49,567**	**100**	**41,186**	**100**	**90,758**	**100**	**296,169**	**100**

Station	Total Drainage Area of Station Reach (ac)	Total Developed Area (ac)	Percent Developed Area (%)
Headwaters to RS-03346	2927.8	1960.5	67.0
RS-03346 to S-092	23606.4	4651.0	19.7
S-092 to S-233	8838.4	2918.2	33.0
S-233 to S-235	10528.5	1631.9	15.5
S-235 to S-093	44857.2	3229.2	7.2
Total	**90758.3**	**14390.8**	**16.1**

> The upper watershed (HUC 030501090701, 030501090702) drains approximately **49,500 acres**. The major tributaries to Wilson Creek include Coronaca Creek, Sample Branch, Turner Branch, Rocky Creek, Stockman Branch and Brightmans Creek. The upper watershed is predominately forested and other vegetated lands (**58%**), with developed lands (residential, commercial, and industrial) representing **23%** of the drainage area. The upper watershed is proportionally more developed than the County of Greenwood (Table 2a).

The lower watershed (HUC 030501090703, 030501090704) drains approximately **41,000** acres. Major tributaries to Ninety Six Creek include Henley Creek, Ropers Creek, Marion Creek, Tolbert Branch, Six Mile Creek, Kate Fowler Branch and Conally Branch. Land use within this watershed is dominated by forest or other vegetated lands (non-cultivated; **70%**) and pasture, crop or cultivated land (**19%**). Approximately **8%** of this drainage area is developed, which is proportionally lower than the counties overall 11% development (NLCD 2001).

Amendment Location 4:

Section 3.1.2, Page 7

Amendment:

Section 3.1.2 has been revised to read as follows:

Non-continuous point sources include all NPDES-permitted stormwater discharges, including current and future MS4s, construction and industrial discharges covered under permits numbered SCS and SCR and regulated under SC Water Pollution Control Permits Regulation 122.26(b)(14)&(15). **All regulated MS4 entities have the potential to contribute FC pollutant loadings in the delineated drainage area used in the development of this TMDL.**

The South Carolina Department of Transportation (SCDOT) is currently the only designated Municipal Separate Storm Sewer System (MS4) within the watershed. The SCDOT operates under NPDES MS4 SCS040001 and owns and operates roads in the watershed (Figure 4). However, the Department recognizes that SCDOT is not a traditional MS4 in that it does not possess statutory taxing or has enforcement powers. SCDOT does not regulate land use or zoning, issue building or development permits.

The City of Greenwood is a potentially designated MS4 located in this watershed. **The Ninety-Six Creek watershed also contains the currently unregulated Town of Ninety Six in addition to the potentially-designated City of Greenwood.** Similar to regulated MS4s, potentially designated MS4 entities (as listed in 64 FR, P. 688837) or other unregulated MS4 communities located in the Ninety Six Creek watershed may have the potential to contribute FC bacteria in stormwater runoff. If future MS4 permits are applicable to this watershed, then those discharges will be subject to the assumptions and requirements of the WLA portion of this TMDL. However, there may be industrial or construction activities going on at any time that could produce stormwater runoff.

Industrial facilities that have the potential to cause or contribute to a violation of a water quality standard are covered by the NPDES Storm Water Industrial General Permit (SCR000000). Construction activities are usually covered by the NPDES Storm Water Construction General Permit from DHEC (SCR100000). Where construction activities have the potential to affect water quality of a water body with a TMDL, the Storm Water Pollution Prevention Plan (SWPPP) for the

site must address any pollutants of concern and adhere to any wasteload allocations in the TMDL. The Ninety Six Creek watershed has great potential for growth and development and therefore construction activities are likely to occur. Sanitary sewer overflows (SSOs) to surface waters have the potential to severely impact water quality. These untreated sanitary discharges result in violations of the WQS. It is the responsibility of the NPDES wastewater discharger, or collection system operator for non-permitted 'collection only' systems, to ensure that releases do not occur. Unfortunately releases to surface waters from SSOs are not always preventable or reported. There were 198 reported releases in Greenwood County between 1999 and 2006, resulting in the release of over 947,000 gallons of untreated sanitary waste. It is not known what percentage of these releases occurred specifically in the Ninety Six Creek watershed. Figure A-4 shows a sanitary sewer in close proximity to Coronaca Creek. An overflow in this area could have an adverse impact on the creek and contribute to FC loading in the watershed. It has been shown that FC concentrations in typical SSOs are reported as 10^5 to 10^7 MPN/100mL (Novotny et al., 1989). Installation of a sufficient riparian buffer between sanitary sewers and surface waters is one suggested form of implementation for the Ninety Six Creek watershed TMDL.

The Department acknowledges that progress with the assumptions and requirements of the TMDL by MS4s is expected to take one or more permit iteration. Achieving the WLA reduction for the TMDL may constitute MS4 compliance with its SWMP, provided the MEP definition is met, even where the numeric percent reduction may not be achieved in the interim.

Amendment Location 5:

Section 3.2.5, Page 11

Amendment:

The second paragraph of section 3.2.5 has been revised to read as follows:

The City of Greenwood is a potentially designated MS4 located in this watershed. Similar to regulated MS4s, potentially designated MS4 entities (as listed in 64 FR, P. 688837) or other unregulated MS4 communities located in the Ninety Six Creek watershed**, such as the Town of Ninety-Six,** may have the potential to contribute FC bacteria in stormwater runoff.

Amendment Location 6:

Section 3.2.5, Page 11

Amendment:

The first paragraph of section 3.2.5 has been revised to read as follows:

Non-continuous point sources include all NPDES-permitted stormwater discharges, including current and future MS4s, construction and industrial discharges covered under permits numbered SCS & SCR and regulated under SC Water Pollution Control Permits Regulation 122.26(b)(14) & (15). Illicit

discharges, including SSOs, are not covered under any NPDES permit and are subject to enforcement mechanisms. All areas defined as "Urbanized **Area**" by the US Census are required under the NPDES Stormwater Regulations to obtain a permit for the discharge of stormwater. Other non-urbanized areas may be required under the NPDES Phase II Stormwater Regulations to obtain a permit for the discharge of stormwater.

Amendment Location 7:

Section 5.3.2, Page 16

Amendment:

The last paragraph of section 5.3.2 has been revised to read as follows:

> Compliance with terms and conditions of existing and future NPDES sanitary and stormwater permits (including all construction, industrial and MS4) may effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL. **However, the Department recognizes that SCDOT is not a traditional MS4 in that it does not possess statutory taxing or enforcement powers. SCDOT does not regulate land use or zoning, issue building or development permits.**

Amendment Location 8:

Section 5.7, Page 19

Amendment:

The last 2 paragraphs of section 5.7 have been revised to read as follows:

> **Table 8 indicates the percentage reduction or water quality standard required for each subwatershed** (WQM Station). Note that all future regulated NPDES-permitted stormwater discharges will also be required to meet the prescribed percentage reductions, or the water quality standard. It should be noted that in order to meet the WQS for FC bacteria, prescribed load reductions must be targeted from all sources, including NPDES permitted and nonpoint sources.
>
> **Based on the information available at this time, the portion of the watershed that drains directly to a regulated MS4 and that which drains through the non-regulated MS4 has not been clearly defined. Loading from both types of sources (regulated and non regulated) typically occur in response to rainfall events, and discharge volumes as well as reccurrence intervals are largely unknown. Therefore, the regulated MS4 is assigned the same percent reduction as the non-regulated sources in the watershed. Compliance with the MS4 permit in regards to this TMDL document is determined at the point of discharge to waters of the state. The regulated MS4 entity is only responsible for implementing the TMDL WLA in accordance with their MS4 permit requirements and is not responsible for reducing loads prescribed as LA in this TMDL document.**

Amendment Location 9:

Section 6.0, Page 20

Amendment:

The following paragraph in the implementation section of the Ninety Six Creek TMDL document has been revised to read as follows:

> Compliance with terms and conditions of existing and future NPDES sanitary and stormwater permits (including all construction, industrial and MS4) may effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL. **For SCDOT, compliance with terms and conditions of its NPDES MS4 permit is effective implementation of the WLA to the MEP.**