EPA FINALIZED TMDL

Cattle Creek, Site E-108
Hydrologic Unit Code: 03050205-020
Fecal Coliform Bacteria

PROMOTE PROTECT PROSPER

South Carolina Department of Health and Environmental Control

September 29, 2004

In compliance with the provisions of the Federal Clean Water Act, 33 U.S.C §1251 et.seq., as amended by the Water Quality Act of 1987, P.L. 400-4, the U.S Environmental Protection Agency is hereby establishing a Total Maximum Daily Load (TMDL) for fecal coliform bacteria in the Cattle Creek Basin. Subsequent actions must be consistent with this TMDL.

______________________________________ ___________

James D. Giattina, Director | Date
Water Management Division

Abstract

Cattle Creek is a tributary of the Edisto River, South Carolina. Site E-108 (Cattle Creek at Dorchester County Road 19) has been placed on South Carolina's 303(d) list of impaired waters for fecal coliform standard violations. During the assessment period for the 2002 303(d) list (1996-2000), 27 % of samples violated the standard. The Cattle Creek Watershed is predominately rural and agricultural. There are several poultry and swine farms located within the watershed. In the early 1990's the watershed was 48% forest, 24% cropland and 22% wetlands. There is one permitted point source in the watershed, but it does not discharge fecal coliform bacteria. The probable sources of fecal coliform bacteria in the creek are runoff from cattle-in-streams, agricultural activities and failing septic systems.

The load-duration curve methodology was used to calculate the existing load and the TMDL load for Cattle Creek at S-18-19. The existing load was estimated to be 5.95×10^{11} cfu/day. The TMDL load was determined to be 2.16×10^{11} cfu/day, consisting of the Load Allocation of 2.05×10^{11} cfu/day and margin of safety of 1.08×10^{10} cfu/day. In order to reach the target load, which is equal to the Load Allocation, a reduction in the existing load to the creek of 66 % will be necessary. There are no MS4s in this watershed. Several TMDL implementation strategies to bring about these reductions are suggested.

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Tables and Figures

Cattle Creek (HUCs 03050205020010,020)

1.0 INTRODUCTION

1.1 Background

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

1.2 Watershed Description

The Cattle Creek watershed is located in Dorchester and Orangeburg Counties, in Mid-Atlantic Coastal Plain ecoregion of South Carolina (Figure 1). Cattle Creek drains into the Edisto River downstream of the North and South Fork confluence. There is no municipal sewer service available in the 170 km^2 (42086 acres) watershed. The area is not designated as an municipal storm sewer system (MS4).

South Carolina DHEC has one monitoring station along Cattle Creek; site E-108 is impaired and included on the 303(d) list for fecal coliform bacteria. The water quality monitoring station is on S-18-19 and approximately 16 km southeast of Branchville, SC.

Dorchester CPW/Hartzog Pit (SCG730091) is permitted to discharge mine dewatering into Cattle Creek. The effluent is not expected to be a significant source of fecal coliform bacteria in the watershed.

The predominant land uses (MRLC) in the part of the Cattle Creek watershed that drains to E-108 are forest (48%), cropland (24%) and wetlands (22%) (Table 1; Figure 2). At the time the MRLC data were collected the developed land was under 1%.

1.3 Water Quality Standard

The impaired stream segment, Cattle Creek, is designated as Class Freshwater. Waters of this class are described as follows:

> "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)

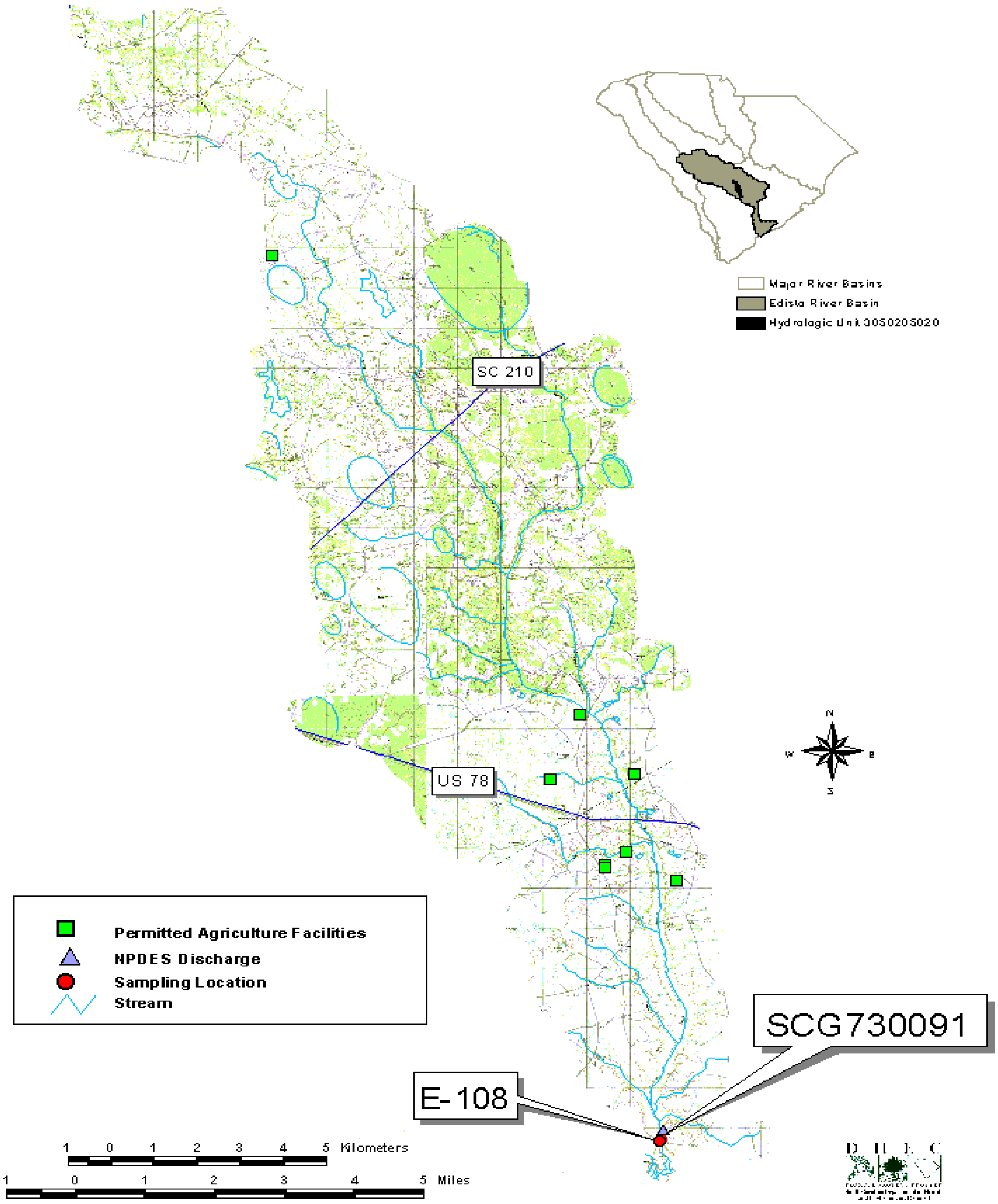

Figure 1. Map of the Cattle Creek Watershed in Mid-Atlantic Coastal Plain Ecoregion
Hydrologic Unit Code (HUC): 03050205-020

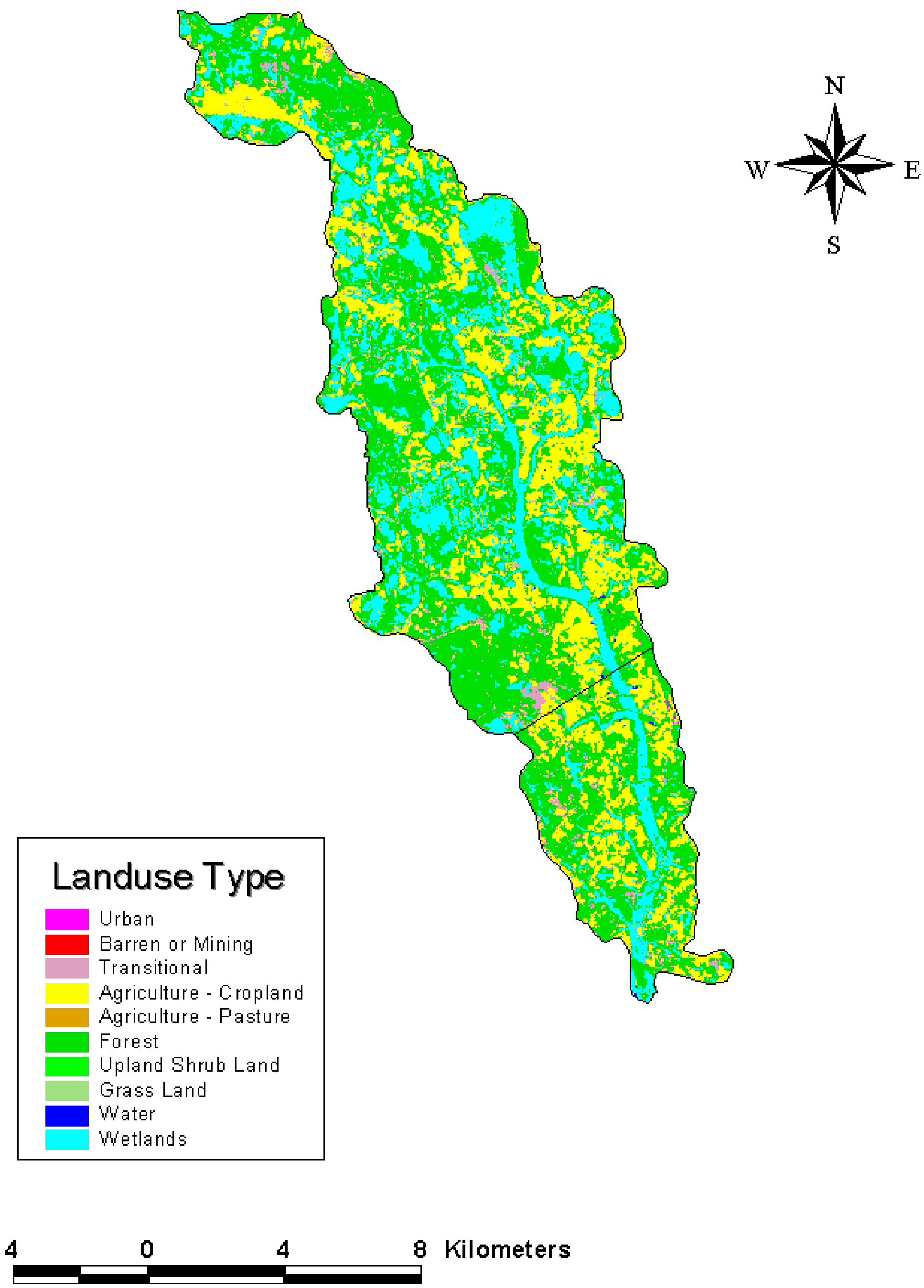

Figure 2. Map showing land uses in Cattle Creek Watershed Hydrologic Unit

Code(HUC): 03050205-020

South Carolina's standard 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).

Table 1. Land uses in the Cattle Creek watershed above E-108.

Land Use		**Area (hectares)**		**Percent**
Water		**12.15**		**0.07%**
Residential LI		4.32		0.03%
Residential HI		0.45		0.00%
Developed Total			**4.77**	**0.03%**
Transitional		**537.03**		**3.15%**
Bare Rock, Sand,Clay		**2.70**		**0.02%**
Deciduous Forest		1881.81		11.05%
Evergreen Forest		4311.81		25.32%
Mixed Forest		2047.86		12.02%
Forest - Total			**8241.48**	**48.39%**
Pasture/Hay		**358.47**		**2.10%**
Row Crops		4070.25		23.90%
Agriculture			**4070.25**	**23.90%**
Woody Wetlands		3732.57		21.92%
Emergent Herbaceous Wetlands		72.36		0.42%
Wetlands - Total			**3804.93**	**22.34%**
Total Area		**17031.78**		**100.0%**

2.0 WATER QUALITY ASSESSMENT

An assessment of water quality data collected in 1996 through 2000 at water quality monitoring station E-108 indicated that Cattle Creek at this location is impaired for recreational use. In addition to being listed on the 2002 303(d) list, Cattle Creek was also on the 1998 and 2000 lists for fecal coliform bacteria. Waters in which no more than 10% of the samples collected over a five year period are greater than 400 fecal coliform counts or cfu / 100 ml are considered to comply with the South Carolina water quality standard for fecal coliform bacteria. Waters with more than 10 percent of samples greater than 400 cfu/100 ml are considered impaired and listed for fecal coliform bacteria on South Carolina's 303(d) list. During the assessment period (1996-2000), 27 % of the samples did not meet the fecal coliform criterion at E-108. Cattle Creek fecal coliform data (1992-2002) are provided in Appendix A.

There is not a simple relationship between precipitation and fecal coliform concentrations in Cattle Creek (Figure 3). Fecal coliform concentrations show some increase with rainfall, as measured in nearby Branchville (cooperative monitoring station Branchville 6S); but the relationship is not clear. This pattern suggests that there are both sources of fecal coliform bacteria, such as cattle in the creeks or failing septic systems, and rainfall associated sources, such as runoff from litter applied fields. Note that there was very little precipitation data available for water years 2001 and 2002. A comparison between Branchville 6S rainfall and fecal coliform data for that time period was not possible.

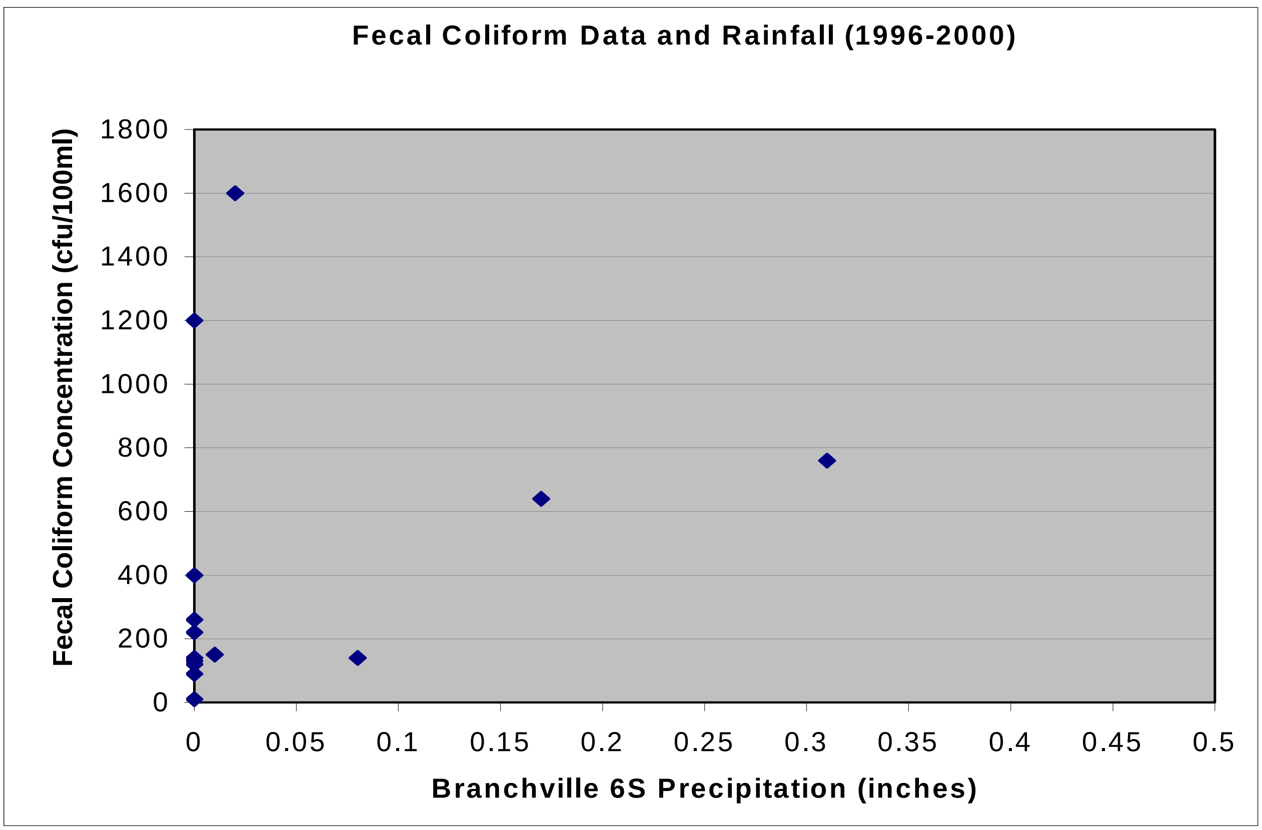

Figure 3. Comparison between precipitation and fecal coliform concentration in Cattle Creek.

3.0 SOURCE ASSESSMENT AND LOAD ALLOCATION

Surface waters may be contaminated by fecal coliform bacteria that originate from both point and nonpoint sources. Point sources are facilities, such as wastewater treatment plants and factories, that have NPDES permits and discharge wastewater through a pipe or similar structure. Until recently poorly treated or untreated municipal sewage has been a major source of fecal coliform bacteria. With improved treatment and enforcement brought about by the Clean Water Act, point sources are seldom sources of fecal coliform contamination. All point sources must have a NPDES permit and are required to treat wastewater to a minimum level. In South Carolina NPDES permittees that discharge sanitary wastewater must meet the state standards for fecal coliform at the point of discharge.

3.1 Point Sources in the Cattle Creek Watershed

There is one NPDES facility in this watershed, Dorchester CPW/Hartzog Pit (SCG730091). This facility, located just upstream of E-108, is permitted to discharge *mine dewatering wastewater*. Effluent does not contain a domestic source of fecal coliform bacteria and, therefore, there are no permit limitations for that parameter. There are no permitted Confined Animal Farms Operations (CAFOs) with NPDES coverage in this watershed. Also, this area is not designated as an MS4.

3.2 Nonpoint Sources in Cattle Creek Watershed

3.2.1 Wildlife

Wildlife (mammals and birds) contribute a low level of fecal coliform to surface waters. Wildlife wastes are carried into nearby streams by runoff during rainfall events or by direct deposition. Because of the higher infiltration rates reduce the amount of runoff and organic material on the land surface slows the velocity of the water that does runoff, forests typically do not contribute much fecal coliform bacteria to streams flowing through them. Of wildlife in the Cattle Creek watershed, deer, being the largest wild animals, are the most obvious. The SC Department of Natural Resources (Charles Ruth, DNR Deer Project Supervisor, personal communication, 2000) has estimated a density of 30-45 deer/mi^2 for this area. Other wildlife that are likely to be significant sources of fecal coliform bacteria in Cattle Creek are water birds. Wildlife are unlikely to be primary sources of fecal coliform bacteria in Cattle Creek. In any case control of these sources would be difficult to implement.

3.2.2 Agricultural Activities

Agricultural activities that involve livestock or animal wastes are potential sources of fecal coliform contamination of surface waters. Cattle Creek watershed has six actively-permitted animal feeding operations. Three facilities are permitted to have a total of 5953 swine (ND0003107, ND0011941, and ND0073342). The other three facilities are permitted for a total of 205000 broilers (ND0061221, ND0071609, and ND0081591). The 1997 Agricultural Census reports that there were 23684 cattle and calves in Dorchester County and Orangeburg Counties. Assuming cattle are distributed throughout each county within the pasture land, the ratio of pasture in the watershed to the counties as a whole indicates that about 631 animals are in the watershed. Although this number varies throughout the year depending on farm operations, the estimate is representative of the Cattle Creek watershed (Frank Stephens, NRCS, personal Communication, 2003).

3.2.2.1 *Land Application of Poultry Litter and Swine Refuse*

Litter (waste) from the poultry is removed from the poultry houses periodically and stored. If not stored properly, rainwater may carry fecal coliform bacteria into nearby streams. The litter is usually applied to pastures as the final disposal. Improper application also has the potential to contaminate nearby streams. There are approximately 157 permitted sprayfields associated with poultry facilities and located in the watershed. As a final step, swine operations also typically apply wastes to land. There are 15 fields that are permitted for that animal waste application. All of these sprayfields may not actually be in use; estimates represent a total number of *permitted* land application sites and not *operating* disposal sites.

3.2.2.2 *Grazing Animals*

Livestock such as cattle, goats, and horses spend most of their time grazing on pasture land. Runoff from rainfall may wash some of the manure deposited on the pastures into nearby by streams. Good grass cover on the pastures and intact riparian buffers should reduce the likelihood of the bacteria reaching streams.

Cattle and other livestock that are allowed access to streams deposit manure directly into the streams. Manure deposited in streams can be a significant source of fecal coliform bacteria. As a result of the drought many farmers have found alternate sources of water to provide their livestock, which would reduce the likelihood of the cattle accessing streams.

3.2.2.3 Failing Septic Systems

Improperly designed or installed septic systems and septic systems that no longer function properly are potential sources of fecal coliform contamination. Using a GIS, the 2000 census database layer was compared to a sewer line data layer and the boundaries of the Cattle Creek watershed. There is no sewer service available to homes there. An estimated 1780 people in 770 households in the Cattle Creek watershed are connected to septic systems. The precise failure rate of these septic systems is unknown; but Schueler (1999) has reported failure rates of 20 %. However, in this watershed the load from failing septic systems is probably much smaller than the load from agricultural activities. A complete unknown is the possibility of direct or illicit discharges to the creek in this rural watershed.

3.2.3 Urban Runoff

Urbanized or developed land typically generates an increased loading for pollutants relative to forest and other undeveloped land uses. Dogs, cats, and other pets are the primary source of fecal coliform deposited on the urban landscape. There are also ‘urban’ wildlife, such as squirrels, raccoons, pigeons, and other birds, all of which contribute to the fecal coliform load. Impervious surfaces increase the amount of runoff relative to predevelopment conditions. Only 3% of the total land area of the Cattle Creek Watershed is considered urban; therefore, urban fecal coliform loading is considered insignificant.

4.0 LOAD-DURATION METHOD

Load-duration curves were developed as a method of developing TMDLs that applies to all hydrologic conditions. The load-duration curve method uses the cumulative frequency distribution of stream flow and pollutant concentration data to estimate the existing and the TMDL loads for a water body. Development of the load-duration curve is described in this chapter.

In the ideal situation a long period of record for flow data would be available for the water body of interest. A longer period of record increases the confidence in the results of the load-duration method. Cattle Creek, like most small streams in South Carolina is not gauged. Nearby Cow Castle Creek, Orangeburg County is comparable, gauged, in the same ecoregion, and with similar land uses & topography. Data from the gauge (USGS 02174250) on Cow Castle Creek, South Carolina for the period of record Jan. 1, 1996 to Sept 30, 2002 was used to generate the flow-duration curve. The Cattle Creek watershed is somewhat larger, 167.3 km^2 compared to 60.6 km^2 for Cow Castle Creek gauge.

The flow for Cattle Creek was estimated by multiplying the daily flow rates from Cow Castle Creek by the ratio of Cattle Creek drainage area to that of Cow Castle Creek (2.77:1). The flows were ranked from low to high and the values that exceed certain selected percentiles determined. The load-duration curve was generated by calculating the load from the observed fecal coliform concentrations, the flow rate that corresponds to the date of sampling, and a conversion factor (Figure 4). The load was plotted against the appropriate flow recurrence interval to generate the curve. The target line was created by calculating the allowable load from the flow and the appropriate fecal coliform standard concentration in the same manner. Sample loads above this line are violations of the standard, while loads below the line are in compliance.

The water quality target was set at 380 counts per 100 mL for the instantaneous criterion, which is five percent lower than the water quality criteria of 400 counts per 100 mL. A five percent explicit MOS was reserved from the water quality criteria in developing the load-duration curves. The instantaneous criterion was targeted as a conservative approach and should be protective of both the instantaneous and 30-day geometric mean fecal coliform bacteria standards.

The trend line was determined for loads that are above the target line. The trend line for Cattle Creek with the best fit was a power curve; the r^2 was 0.9912. The equation for the line and supporting data are provided in Appendix B. This trend line represents samples that violated the water quality standard. The existing load to Cattle Creek was calculated from values along this trend line. Violating loads were between the 4 % and 82 % flow recurrence intervals. The existing load is the average of loads from the 10 % to 80 % recurrence intervals at 5 % intervals, i.e. 5, 10, 15, 20, 25 … 80.

The TMDL load is calculated from the target line in the same manner, that is the average of loads at 5 % intervals from 10 % to 90 %. The Load Allocation values are 95 % of the loads from the target line, that is the TMDL load minus the Margin of Safety. Calculations for both existing and TMDL loads are provided in Appendix B.

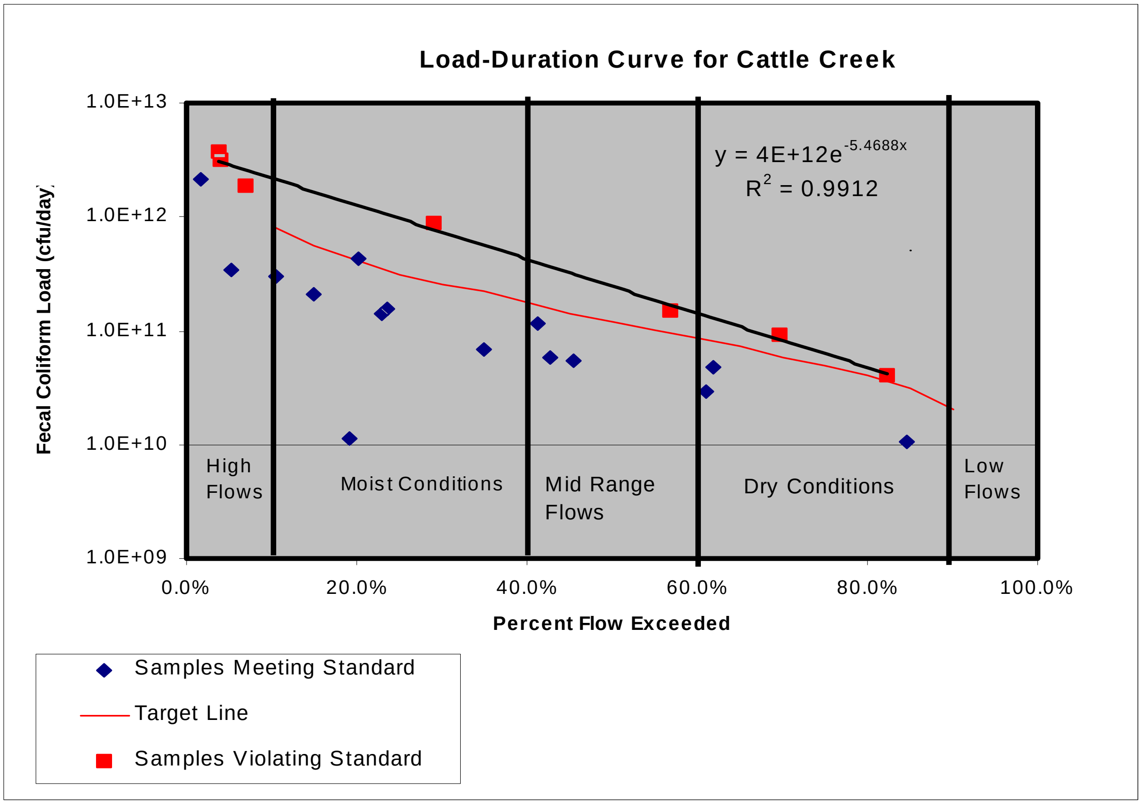

Figure 4. Load-Duration plot of Cattle Creek at E-108. Based on 1996 – 2002 fecal coliform data.

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:

$$\mathbf{TMDL = \Sigma\ WLA + \Sigma\ LA + MOS}$$

The TMDL is the total amount of pollutant that can be assimilated by the receiving water body while still achieving water quality standards. 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 (#), cfu, or organism counts (or resulting concentration), in accordance with 40 CFR 130.2(l).

5.1 Critical Conditions

Critical conditions for Cattle Creek occur when a long period of low flow is followed by rainfall event that produces runoff. At low flow rates, the continual sources which include cattle in streams and failing septic systems cause the concentration of the fecal coliform in the creek to rise as dilution decreases. During the long dry period, fecal coliform bacteria build up on the land surface. Rainfall flushes much of this accumulation into the creek with runoff, which causes the already high concentrations to increase further.

Standard violations occurred over much of the total range of flows. The inclusion of all flow conditions in the load-duration curve analysis insures that the critical conditions are protected. Existing loads were calculated from the 10 – 80 % flow exceedence intervals; TMDL loads were calculated from the 10 – 90 % flow exceedence intervals.

5.2 Existing Load

The existing load was calculated from the trend line of observed values that exceeded the water quality standard and were between and including 4 and 82 % recurrence limits. Loadings from all sources are included in this figure: failing septic systems, cattle-in-streams, and loading from runoff. The total existing load for E-108 is 5.95×10^{11} cfu/day.

5.3 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 counts per 100 mL. For E-108 this is equivalent to 1.08×10^{10} cfu/day**.** Through the use of conservative assumptions in the model the margin of safety also has an implicit component.

5.4 Total Maximum Daily Load

The Total Maximum Daily Load (TMDL) represents the maximum load the stream may carry and meet the water quality standard for the pollutant of interest. For this TMDL the load will be expressed as cfu/day (colony forming units/day). The TMDL is presented in fecal coliform counts to be protective of both the instantaneous, per day, and geometric mean, per 30-day, criteria.

There is no Waste Load Allocation for this TMDL because this watershed has no NPDES facilities or MS4 areas that are a significant source of fecal coliform Bacteria.

The Load Allocation (LA) was determined from the TMDL load by subtracting out the margin of safety. The load allocation for Cattle Creek at E-108 is 2.05×10^{11} cfu/day (Table 2).

The required reduction is the difference between the existing load and the target load expressed as a percentage. The target load to the creek is the TMDL minus the MOS and for Cattle Creek is equivalent to the LA. The target loading for Cattle Creek at E-108 requires a reduction of 66 % from the current load of 5.95×10^{11} cfu/day.

Table 2. TMDL components for Cattle Creek.

Impaired Station	WLA cfu/day	LA cfu/day	MOS cfu/day	TMDL cfu/day	% Reduction
E-108	N/A	2.05E+11	1.08E+10	2.16E+11	66 %

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 nonpoint source TMDL. Specifically, SCDHEC's animal agriculture permitting program addresses animal operations and land application of animal wastes. There are also a number of *voluntary* measures available to interested parties. SCDHEC will work with the existing agencies in the area to provide nonpoint source education in the Cattle Creek Watershed. Local sources of nonpoint source education and assistance include Clemson Extension Service, the Natural Resource Conservation Service (NRCS), the Orangeburg and Dorchester County Soil and Water Conservation Services, and the South Carolina Department of Natural Resources. 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 agricultural nonpoint source problems. NRCS can provide cost share money to land owners installing BMPs.

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 watershed groups, etc.) may apply for section 319 grants to install BMPs that will reduce fecal coliform loading to Cattle Creek. TMDL implementation projects are given highest priority for 319 funding.

In addition to the resources cited above for the implementation of this TMDL in the Cattle Creek watershed, Clemson Extension has developed a Home-A-Syst handbook that can help urban or 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 who can assist with distribution of these tools as well as provide additional BMP information.

Using existing authorities and *voluntary* mechanisms, these measures will be implemented in the Cattle Creek watershed in order to bring about a 66 % reduction in fecal coliform bacteria loading to Cattle Creek. DHEC will continue to monitor, according to the basin monitoring schedule, the effectiveness of implementation measures and evaluate stream water quality as the implementation strategy progresses.

7.0 REFERENCES

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APPENDIX A   Flow, Fecal Coliform and Precipitation Data

Date	E-108 24Hr Q (cfs)*	FECCOLI**	Precipitation (in)+
22-May-92	No Measurement	560	0.00
1-Jun-92	No Measurement	1100	0.00
24-Jul-92	No Measurement	220	0.00
12-Aug-92	No Measurement	200	0.00
1-Sep-92	No Measurement	200	0.00
21-Oct-92	No Measurement	160	0.00
16-Jan-97	30.4	760	0.31
06-Feb-97	17.1	140	0.00
06-Mar-97	38.6	150	0.01
03-Apr-97	18.5	260	0.00
01-May-97	46.9	10	0.00
19-Jun-97	21.8	640	0.17
22-Jul-97	9.1	130	0.00
19-Aug-97	3.6	120	0.00
07-Oct-97	8.8	220	0.00
03-Nov-97	44.2	400	0.00
01-Dec-97	129.8	1200	0.00
12-Jan-98	157.4	90	0.00
03-Feb-98	339.6	260	2.41
19-Mar-98	850.3	1600	0.02
02-Apr-98	60.7	140	0.08
9-Jan-01	35.9	180	N/A
7-Feb-01	23.7	120	N/A
5-Mar-01	201.5	600	N/A
3-Apr-01	82.8	150	N/A
13-Feb-02	6.3	600	N/A
7-Mar-02	10.2	430	N/A
3-Apr-02	14.6	150	N/A
8-May-02	3.9	600	N/A

*Based on USGS 02174250, Cow Castle Creek, and a 2.76 cfs/mi^2 generation coefficient.
** Based on E-108 Water Quality Data
+Based on Branchville 6S Precipitation Data (1996-2000)

APPENDIX B Calculations

Meeting Standard

Rank	%Exceeded	Load
381	84.5%	1.05E+10
941	61.8%	4.75E+10
958	61.1%	2.90E+10
1343	45.5%	5.37E+10
1413	42.7%	5.86E+10
1449	41.2%	1.18E+11
1604	34.9%	6.97E+10
1882	23.7%	1.58E+11
1897	23.0%	1.42E+11
1967	20.2%	4.32E+11
1995	19.1%	1.15E+10
2097	14.9%	2.08E+11
2206	10.5%	3.04E+11
2335	5.3%	3.46E+11
2422	1.7%	2.16E+12

Not Meeting Standard

Rank	%Exceeded	Load
438	82.2%	4.07E+10
748	69.7%	9.32E+10
1063	56.9%	1.50E+11
1750	29.0%	8.92E+11
2293	7.0%	1.90E+12
2368	3.9%	3.16E+12
2374	3.7%	3.75E+12
2456	***0.4%***	***3.33E+13***

Not used for trendline calculation; flow and value combination considered too extreme.

Load Allocation

TargetFCCon		**380**
%Exceeded	**Flow (cfs)**	
10.0%	88.34	8.21E+11
15.0%	60.74	5.65E+11
20.0%	44.17	4.11E+11
25.0%	33.13	3.08E+11
30.0%	27.61	2.57E+11
35.0%	23.74	2.21E+11
40.0%	19.32	1.80E+11
45.0%	15.18	1.41E+11
50.0%	12.70	1.18E+11
55.0%	11.04	1.03E+11
60.0%	9.39	8.73E+10
65.0%	8.01	7.44E+10
70.0%	6.35	5.90E+10
75.0%	5.25	4.88E+10
80.0%	4.42	4.11E+10
85.0%	3.31	3.08E+10
90.0%	2.18	2.03E+10
	Average	2.05E+11

Existing Load Eqn:
Y=4E+12e^-5.469x

UsingEquation, Calculation of
Existing Load for E-108:

%Exceeded	Load
10.0%	2.32E+12
15.0%	1.76E+12
20.0%	1.34E+12
25.0%	1.02E+12
30.0%	7.75E+11
35.0%	5.90E+11
40.0%	4.49E+11
45.0%	1.41E+11
50.0%	1.18E+11
55.0%	1.03E+11
60.0%	8.73E+10
65.0%	7.44E+10
70.0%	5.90E+10
75.0%	4.88E+10
80.0%	4.11E+10
	5.95E+11

Margin of Safety
TargetFCConc: 20

%Exceeded	Flow (cfs)	
10.0%	88.34	4.32E+10
15.0%	60.74	2.97E+10
20.0%	44.17	2.16E+10
25.0%	33.13	1.62E+10
30.0%	27.61	1.35E+10
35.0%	23.74	1.16E+10
40.0%	19.32	9.46E+09
45.0%	15.18	7.43E+09
50.0%	12.70	6.21E+09
55.0%	11.04	5.40E+09
60.0%	9.39	4.59E+09
65.0%	8.01	3.92E+09
70.0%	6.35	3.11E+09
75.0%	5.25	2.57E+09
80.0%	4.42	2.16E+09
85.0%	3.31	1.62E+09
90.0%	2.18	1.07E+09
	Average	1.08E+10

TMDL = Σ WLA + Σ LA + MOS

2.16E+11 cfu/day = 0 + 2.05E+11 + 1.08E+10 or a 66% reduction from existing loading is required.

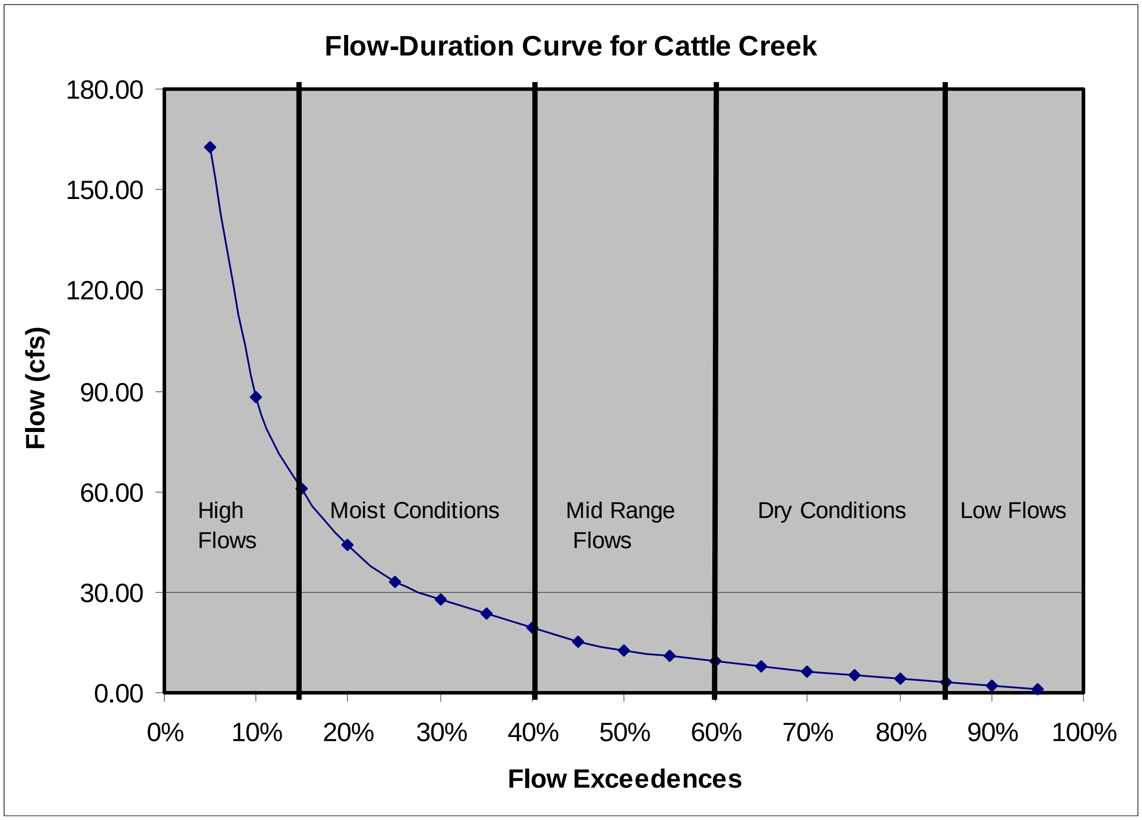

Figure B-1: Flow Duration Curve for Cattle Creek

APPENDIX C Public Participation

PUBLIC NOTICE

U.S. Environmental Protection Agency, Region 4
Water Management Division
61 Forsyth Street, S.W.
Atlanta, GA 30303-8960

NOTICE OF AVAILABILITY
TOTAL MAXIMUM DAILY LOAD (TMDL)
FOR WATER AND POLLUTANT IN THE STATE OF SOUTH CAROLINA

Section 303(d)(1)(C) of the Clean Water Act (CWA), 33 U.S.C. §1313(d)(1)(C), and the U.S. Environmental Protection Agency's implementing regulation, 40 CFR §130.7(c)(1), require the establishment of Total Maximum Daily Loads (TMDLs) for waters identified by states as not meeting water quality standards under authority of §303(d)(1)(A) of the CWA. These TMDLs are to be established levels necessary to implement applicable water quality standards with seasonal variations and a margin of safety, accounting for lack of knowledge concerning the relationship between pollutant loading and water quality.

The waterbody impairment on South Carolina's 303(d) list that will be addressed by the TMDL is listed below. This impaired waterbody is located in the Edisto Basin in Dorchester and Orangeburg Counties.

Waterbody Name	Station ID	§303(d) List Pollutants
Cattle Creek, headwaters to S-18-19	SC-E-108	Fecal Coliform Bacteria

Persons wishing to comment on the proposed TMDL or to offer new data or information regarding the proposed TMDL are invited to submit the same in writing no later than August 16, 2004 to the U.S. Environmental Protection Agency, Region 4, Water Management Division, 61 Forsyth Street, S.W., Atlanta, Georgia 30303-8960, ATTENTION: Ms. Sibyl Cole, Standards, Monitoring, and TMDL Branch.

A copy of the proposed TMDL can be obtained through the Internet or by contacting Ms. Cole at (404) 562-9437 or via electronic mail at cole.sibyl@epa.gov. The URL address for the proposed TMDL is: http://www.epa.gov/region4/water/tmdl/tennessee/index.htm#sc.
The proposed TMDL and supporting documents, including technical information, data, and analyses, may be reviewed at 61 Forsyth Street, S.W., Atlanta, Georgia, between the hours of 8 AM and 4:30 PM, Monday through Friday. Persons wishing to review this information should contact Ms. Cole to schedule a time for that review.

http://www.epa.gov/region4

/s/

James D. Giattina, Director Date
Water Management Division
Region 4
U.S. Environmental Protection Agency

NO COMMENTS RECEIVED