Total Maximum Daily Load Document
Pocotaligo River and Tributaries
Stations: RS-03345, PD-202, RS-07192, PD-115, RS-08232, RS-03347, PD-098, PD-040, and PD-239
(Hydrologic Unit Codes 030402050301 - 303, and 030402050401 - 407)
Escherichia coli Bacteria, Indicator for Pathogens

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Prepared for:

Bureau of Water

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Photographs on Title Page

Photographs, counterclockwise, beginning with the top left photograph: **a)** proximity of the South Carolina Department of Health and Environmental Control's (SCDHEC) Water Quality Monitoring Station PD-115 in the Pocotaligo River at U.S. Route 301 near the City of Manning in Clarendon County, SC (date of photography: October 31, 2012); **b)** proximity of the SCDHEC's Water Quality Monitoring Station RS-08232 in an unammed tributary to Juneburn Branch at County Route S-14-123 in Clarendon County, SC (date of photography: October 31, 2012); and, **c)** proximity of the SCDHEC's Water Quality Monitoring Station RS-03347 in Deep Creek at County Route S-14-25 near the Town of Bloomville in Clarendon County, SC (date of photography: October 31, 2012)

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 included on the §303(d) list of impaired waters. 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 waste load 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). Fecal coliform (FC) TMDLs were developed for impaired stations RS-03345, PD-202, RS-07192, PD-115, RS-08232, and RS-03347 in the Pocotaligo River and tributaries located in Sumter County and Clarendon County, SC. These stations along the Pocotaligo River and tributaries are included as impaired on the State's draft 2012 §303(d) list due to excessive fecal FC bacteria. In addition, revisions were made to three existing FC bacteria TMDLs approved by the USEPA, Region IV in September 2005 to address other locations in tributaries of the Pocotaligo River (impaired sites PD-098, PD-040, and PD-239). At least eleven (11) percent of the samples collected between January 1999 and December 2008 at the impaired monitoring stations exceeded the water quality standards. Because South Carolina has recently adopted a change from FC bacteria to Escherichia coli *(E. coli)* bacteria as a recreational use standard in all freshwaters, the aforementioned sites will be will be included on future §303(d) lists due to exceedances of the current *E. coli* WQS until such time such that sufficient *E. coli* data are collected and demonstrate the standard is attained or such time that TMDLs are developed and approved to address the parameter of concern. In addition to addressing FC bacteria impairments, this TMDL document also includes converted *E. coli* TMDLs for the purposes of implementation of the current recreational use standard.

Probable sources of fecal contamination include direct loading by livestock, failing septic systems, surrounding wildlife, and other agricultural activities. 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 for the Pocotaligo River and tributaries, the following reductions in the existing loads at the respective stations will be necessary: **a)** up to 39% at RS-03345; **b)** up to 60% at PD-202; **c)** up to 81% at RS-07192; **d)** up to 7% at PD-115; **e)** up to 86% at RS-08232; **f)** up to 18% at RS-03347; **g)** up to 81% at PD-098; **h)** up to 88% at PD-040; and, **i)** up to 35% at PD-239. For the South Carolina Department of Transportation (SCDOT), existing and future NPDES MS4 permittees, compliance with terms and conditions of its NPDES permit is effective implementation of the WLA to the Maximum Extent Practicable (MEP) and demonstrates consistency with the assumptions and requirements of the TMDLs. For existing and future NPDES construction and Industrial stormwater permittees, compliance with terms and conditions of its permit is effective implementation of the WLA. Required load reductions in the LA portion of these TMDLs can be implemented through voluntary measures and are eligible for CWA §319 grants.

The Department recognizes that **adaptive management/implementation** of these TMDLs might be needed to achieve the water quality standard and we are committed towards targeting the load reductions to improve water quality in the Pocotaligo River and tributaries watersheds. As additional data and/or information become available, it may become necessary to revise and/or modify these TMDLs targets accordingly.

Table Ab-1. Total Maximum Daily Loads for the Pocotaligo River and Tributaries Watersheds
Loads are expressed as FC bacteria or *E. coli* count/day

	Existing FC Load (count/day)	TMDL (count/day)		Margin of Safety (MOS) (count/day)		Waste Load Allocation (WLA)				Load Allocation (LA)		
						Continuous Source[1] (count/day)		Non-Continuous Sources[2,3] (% Reduction)	Non-Continuous SCDOT[3] (% Reduction)	Load Allocation (count/day)		% Reduction to Meet LA[3]
June 2013 Total Maximum Daily Loads												
Station	FC (CFU/day)	FC (CFU/day)	*E. coli* (MPN/day)[6]	FC (CFU/day)	*E. coli* (MPN/day)[6]	FC (CFU/day)	*E. coli* (MPN/day)[6]	(Percent)	(Percent)	FC (CFU/day)	*E. coli* (MPN/day)[6]	(Percent)
RS-03345	2.51E+10	1.60E+10	*1.39E+10*	7.98E+08	*6.78E+08*	See Note Below	See Note Below	39	0[4]	1.52E+10	*1.32E+10*	39
PD-202	2.22E+12	1.03E+12	*8.96E+11*	5.14E+10	*4.37E+10*	2.35E+11	*2.05E+11*	67	67[5]	7.41E+11	*6.18E+11*	67
RS-07192	2.62E+11	5.23E+10	*4.56E+10*	2.62E+09	*2.22E+09*	See Note Below	See Note Below	81	81[5]	4.97E+10	*4.34E+10*	81
PD-115	2.97E+12	2.99E+12	*2.61E+12*	1.49E+11	*1.27E+11*	See Note Below	See Note Below	4	4[5]	2.84E+12	*2.48E+12*	4
RS-08232	2.47E+10	3.59E+09	*3.13E+09*	1.79E+08	*1.53E+08*	See Note Below	See Note Below	86	86[5]	3.41E+09	*2.98E+09*	86
RS-03347	6.89E+10	5.94E+10	*5.18E+10*	2.97E+09	*2.53E+09*	See Note Below	See Note Below	18	0[4]	5.64E+10	*4.93E+10*	18
September 2005 Total Maximum Daily Loads Revised June 2013												
Station	FC (CFU/day)	FC (CFU/day)	*E. coli* (MPN/day)[6]	FC (CFU/day)	*E. coli* (MPN/day)[6]	FC (CFU/day)	*E. coli* (MPN/day)[6]	(Percent)	(Percent)	FC (CFU/day)	*E. coli* (MPN/day)[6]	(Percent)
PD-098	9.57E+10	1.91E+10	*1.67E+10*	9.57E+08	*8.13E+08*	See Note Below	See Note Below	81	81[5]	1.82E+10	*1.59E+10*	81
PD-040	3.57E+11	4.38E+10	*3.82E+10*	2.19E+09	*1.86E+09*	See Note Below	See Note Below	88	88[5]	4.16E+10	*3.63E+10*	88
PD-239	6.38E+10	4.37E+10	*3.81E+10*	2.19E+09	*1.86E+09*	See Note Below	See Note Below	35	0[4]	4.15E+10	*3.63E+10*	35

Table Notes:

1. WLAs are expressed as a daily maximum. Existing and future continuous discharges are required to meet the prescribed loading for the pollutant of concern. For the purposes of NPDES permitting, continuous discharges may be required to meet a loading equivalent of FC bacteria, based upon permitted flow and an allowable permitted maximum FC bacteria concentration of 400 cfu/100ml, until such time that *E. coli* limits are incorporated into individual permits. *E. coli* limits will be developed based upon permitted flow and an allowable permitted maximum *E. coli* concentration of 349 MPN/100ml.
2. Percent reduction applies to all NPDES-permitted stormwater discharges, including current and future municipal separate storm sewer system (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 FC bacteria or *E. coli.*
4. As long as the conditions within the SCDOT MS4 area remain the same the Department deems the current contributions from SCDOT negligible and no reduction of FC bacteria or *E. coli* is necessary. SCDOT must continue to comply with the provisions of its approved NPDES stormwater permit.
5. By implementing the best management practices that are prescribed in either the SCDOT annual SWMP or the SCDOT MS4 Permit to address fecal coliform or *E. coli,* the SCDOT will comply with these TMDLs and its applicable WLA to the maximum extent practicable (MEP) as required by its MS4 permit.
6. Expressed as *E. coli* (MPN/day). Loadings are developed by applying a conversion factor to values calculated for FC bacteria. This conversion is derived from an established relationship between FC bacteria and *E. coli* water quality standards in freshwaters.

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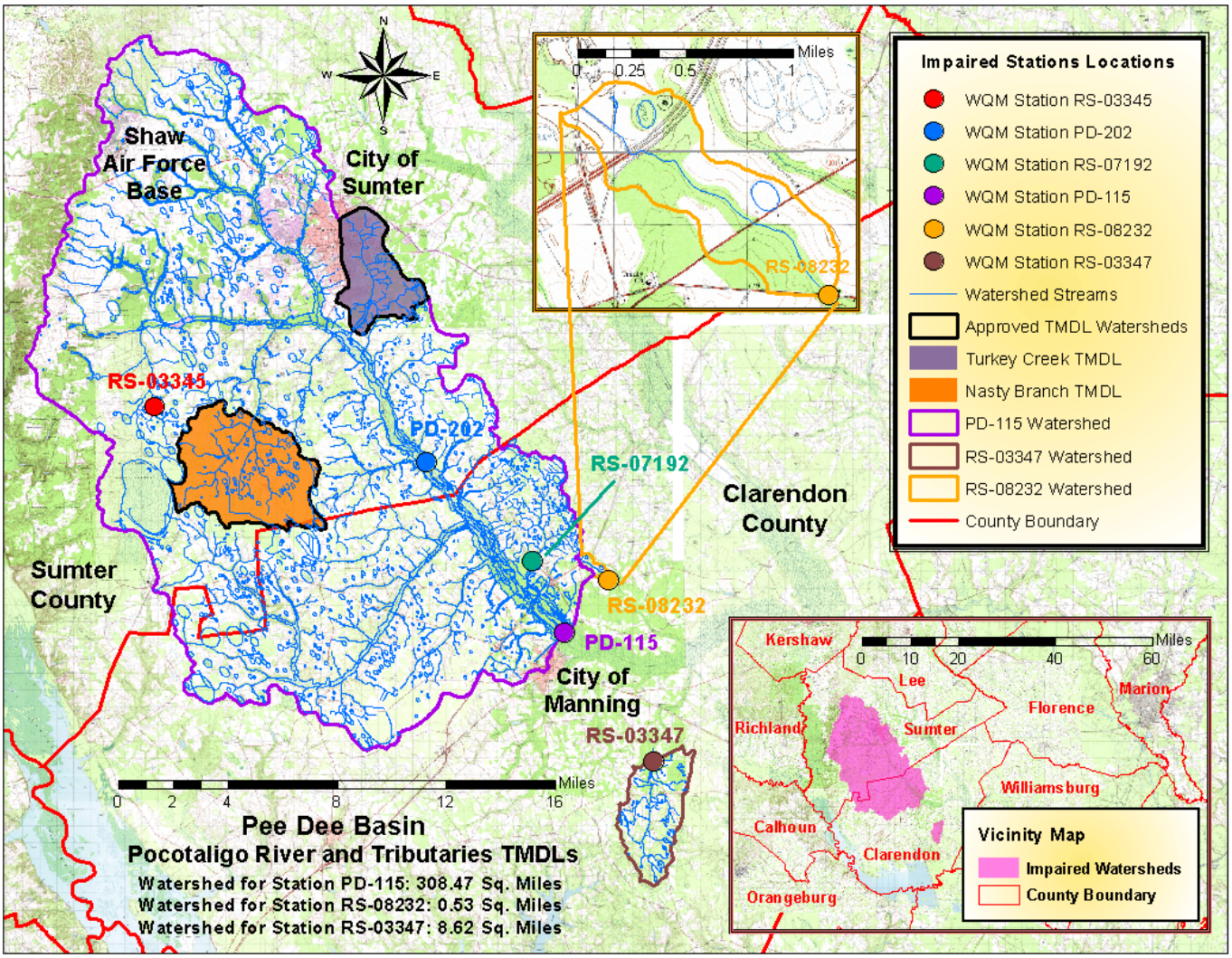
1.0 Introduction

1.1 Background

The Federal Clean Water Act (CWA) directs each state to review the quality of its waters every two years to determine if water quality standards are being met. If it is determined that the water quality is not being met, the states are to list the impaired water bodies under §303(d) of the CWA. South Carolina Department of Health and Environmental Health (SCDHEC) has included six monitoring stations in the Pocotaligo Swamp watershed(s) on South Carolina's draft 2012 §303(d) list for impairment due to FC bacteria exceedances. These stations are RS-03345, PD-202, RS-07192, PD-115, RS-08232, and RS-03347, and are identified in Figure 1a and Table 1.

Figure 1a. Location of Water Quality Monitoring Stations RS-03345, PD-202, RS-07192, PD-115, RS-08232, and RS-03347 Impaired with Excessive FC Numbers



A Total Maximum Daily Load (TMDL) is a written plan and analysis to determine the maximum pollutant load a waterbody can receive and still meet applicable water quality standards. The TMDL process includes estimating pollutant loadings from all sources, linking pollutant sources to their impacts on water quality, allocation of pollutant sources to each source and establishment of control mechanisms to achieve water quality standards (US EPA, 1999). All TMDLs include a wasteload allocation (WLA) for all National

Pollutant Discharge Elimination System (NPDES) permitted discharges, a load allocation (LA) for all unregulated nonpoint sources, and an explicit and/or implicit margin of safety (MOS). TMDLs are required to be developed for each waterbody and pollutant combination on the States' §303(d) lists by 40 CFR 130.31(a) (US EPA, 1999).

Table 1. Pocotaligo River and Tributaries Watersheds FC Impaired Waters

Waterbody	Station Number	Description
Brunson Swamp Creek	RS-03345	Brunson Swamp Creek at County Route S-43-251, 1.3 miles west of SC 120 and 9.25 miles southwest of the City of Sumter in Sumter County
Pocotaligo River	PD-202	Brunson Swamp Creek at County Route S-43-251, 1.3 miles west of SC 120 and 9.25 miles southwest of the City of Sumter in Sumter County
Big Branch	RS-07192	Big Branch at the intersection of US 521 and Main Street in the Town of Alcolu in Clarendon County
Pocotaligo River	PD-115	Pocotaligo River at the third bridge north of the City of Manning on US 301 in Clarendon County
Juneburn Branch Tributary	RS-08232	Tributary to Juneburn Branch at culvert on County Route S-14-123 (Alderman Camp Road) in Clarendon County
Deep Creek	RS-03347	Deep Creek at County Route S-14-25, 1.2 miles northeast of the Town of Bloomville in Clarendon County

Escherichia coli *(E. coli)* bacteria are members of the FC group of bacteria and are part of the normal flora of the gastrointestinal tract of warm-blooded animals including humans. These harmless bacteria play an important role in preventing the growth of harmful bacteria, vitamin K production, and lactose digestion as well as producing compounds necessary for fat metabolism (Starr and Taggart, 1992; Wolfson and Harrigan, 2010). Some verotoxin producing strains of *E. coli*, such as 0157:H7, a major cause of foodborne illnesses, can cause gastrointestinal illnesses, kidney failure and death (Nadakavukaren, 1995; Wolfson and Harrigan, 2010).

E. coli bacteria in surface waters are indicators of recent human or animal waste contamination and originate from failing septic systems, agricultural runoff, leaking sewers among other sources. 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).

This TMDL document includes TMDLs for the aforementioned six (6) monitoring stations in the Pocotaligo Swamp on South Carolina's draft 2012 §303(d) list for impairment due to FC bacteria exceedances. In September 2005, the U.S. Environmental Protection Agency (USEPA), Region IV developed TMDLs for three (3) other monitoring stations in the Pocotaligo Swamp listed as impaired due to FC bacteria exceedances (sites PD-098, PD-040, and PD-239) (USEPA, Region IV, 2005). Revisions to these three TMDLs are also included in this document. Beginning in Section 4.0, this TMDL document addresses the revision of those three TMDLs.

1.2 Watershed Descriptions

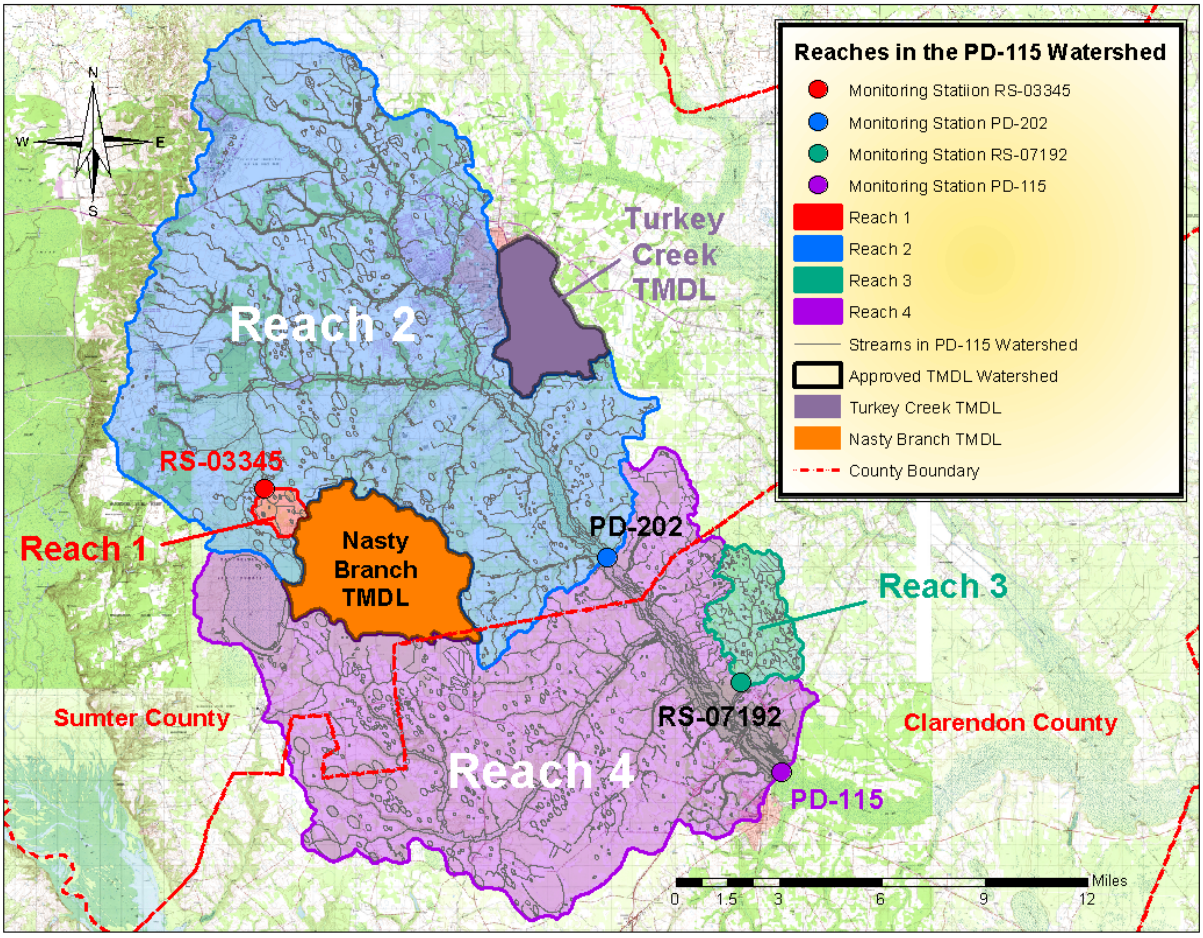
The six (6) water quality monitoring (WQM) stations placed on South Carolina's draft 2012 §303(d) list for impairment due to FC bacteria and addressed in this TMDL document are located in three (3) separate and distinct Pocotaligo River and tributaries watersheds. The three distinct watersheds are referred to in this

document as: **a)** the Pocotaligo River Watershed; **b)** the Juneburn Branch Tributary Watershed; and, **c)** the Deep Creek Watershed. There are no hydrologic connections between these three distinct watersheds.

1.2.1 Pocotaligo River Watershed; Terminal WQM Station PD-115

The Pocotaligo Swamp Watershed consists of the Pocotaligo River and its tributaries, including Brunson Swamp Creek, and Big Branch; and, is located in both Sumter and Clarendon Counties, South Carolina. The watershed occupies 308.47 mi^2 (197,436.02 acres) of the Southeastern Plains ecoregion of the state. There are four (4) impaired WQM stations in the watershed, and each will be addressed as its own reach in this document. The reaches of the Pocolatigo River Watershed are shown in Figure 1b.

Figure 1b. Location of Pocotaligo River Watershed Station Reaches (Terminal WQM Station PD-115)

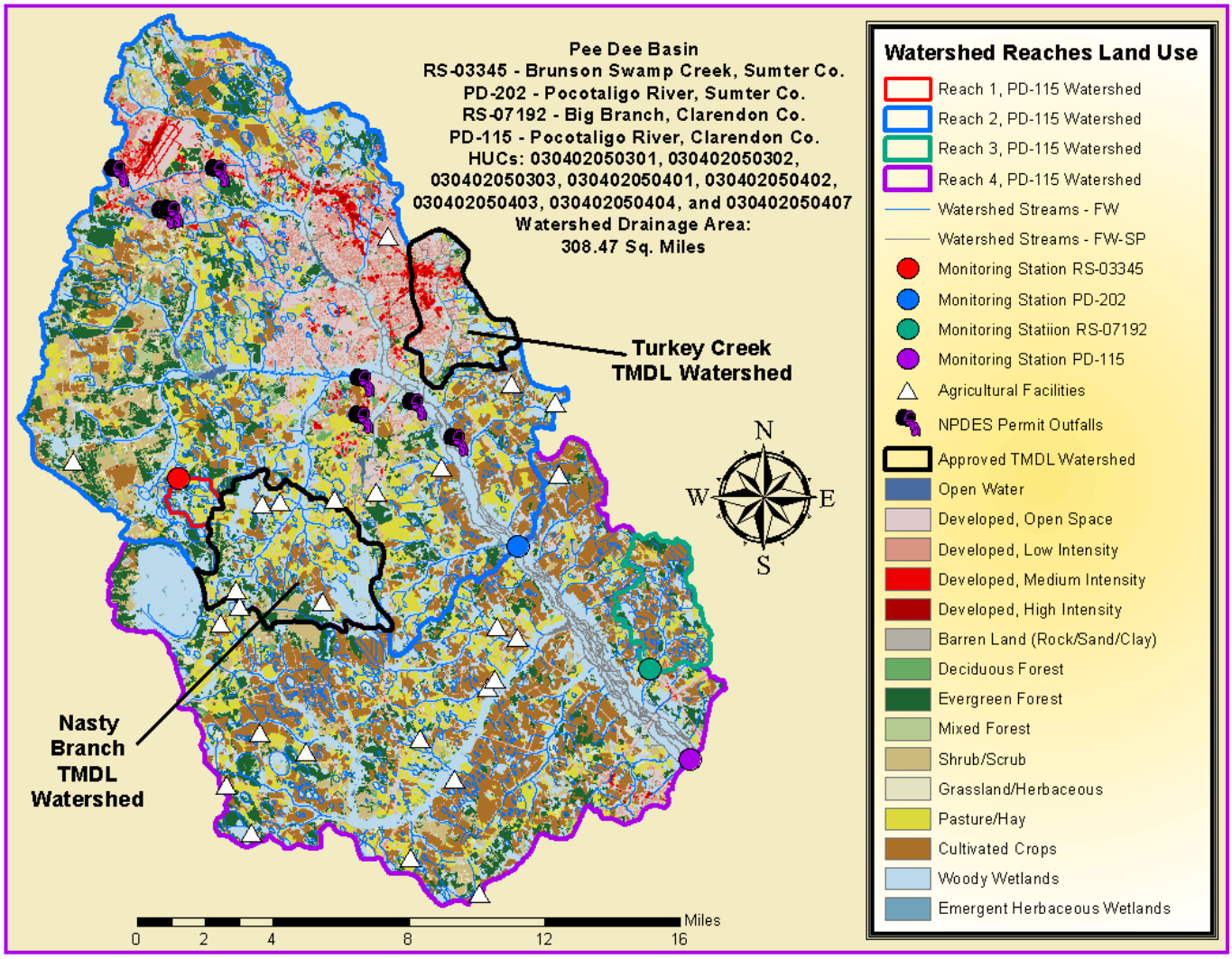


In addition to the four impaired WQM stations, there are two USEPA-approved TMDL drainage areas in the Pocotaligo River Watershed. These are the Turkey Creek TMDL Watersheds and the Nasty Branch TMDL Watershed. The Turkey Creek TMDL Watershed (Technical Report No.: 029-05) is 8.60 mi^2 in size, and is located at the City of Sumter on the northeastern edge of the Pocotaligo River Watershed. The Nasty Branch TMDL Watershed (Technical Report No.: 029-05) is 17.76 mi^2 in size, and is located at the Privateer community near the center of the Pocotaligo River Watershed. From the PD-115 WQM station, the Pocotaligo River drains into the Black River Swamp 8.5 miles east of the Town of Manning, SC.

Reach 1 of the Pocotaligo River Watershed covers a drainage area 1.59 mi^2 (1015.46 acres) in size that drains into Brunson Swamp Creek and its tributaries from the northwestern border of the Nasty Branch TMDL Watershed in a general northwestern fashion to impaired station RS-03345 in Brunson Swamp Creek at county route S-43-251 in Sumter County.

Land use within Reach 1 of the Pocotaligo River Watershed is predominately Pasture/Hay (37.11%), and Woody Wetlands (36.29%) (Figure 2, Table 2a). Developed lands (residential, commercial, industrial, or open urban space) only comprise approximately 3.77% of the reach (Table 2e). At the time of the development of these TMDLs, there were no active animal feeding operations in the reach.

Figure 2. Land Use Diagram for the Pocotaligo River Watershed (Terminal WQM Station PD-115)



There are approximately 4.3 stream miles within Reach 1 of the Pocotaligo River Watershed. The streams are all classified as freshwater (FW).

Reach 2 of the Pocotaligo River Watershed covers a drainage area 155.52 mi^2 (99,549.76 acres) in size that drains into Pocotaligo River and its tributaries from the Dazell Community in a general south-southeastern fashion to impaired station PD-202 in the Pocotaligo River at county route S-43-32 in Sumter County.

Land use within Reach 2 of the Pocotaligo River Watershed is predominately Woody Wetlands (21.61%), and Pasture/Hay (13.36%) (Figure 2, Table 2b). Developed lands comprise approximately 22.05% of the reach (Table 2e). At the time of the development of these TMDLs, there were seven (7) active animal feeding operations in the reach (Figure 2, Table 10).

There are approximately 563.1 stream miles within Reach 2 of the Pocotaligo River Watershed. The streams are all classified as freshwater (FW or FW-SP).

Table 2a. Land Use in Reach 1 of the Pocotaligo River Watershed (WQM Station RS-03345) (Derived from National Land Cover Database (NLCD) 2006)

Description	Area (Acres)	Area (Mile^2)	Percent
Pasture/Hay	376.74	0.59	37.11%
Woody Wetlands	368.51	0.58	36.29%
Evergreen Forest	116.31	0.18	11.45%
Shrub/Scrub	72.72	0.11	7.16%
Cultivated Crops	30.47	0.05	3.00%
Developed, Open Space	29.80	0.05	2.94%
Mixed Forest	15.35	0.02	1.51%
Developed, Low Intensity	4.00	0.01	0.39%
Emergent Herbaceous Wetlands	1.56	0.00	0.15%
Totals	1015.46	1.59	100.00%

Table 2b. Land Use in Reach 2 of the Pocotaligo River Watershed (WQM Station PD-202) (Derived from National Land Cover Database (NLCD) 2006)

Description	Area (Acres)	Area (Mile^2)	Percent
Woody Wetlands	21,511.72	33.60	21.61%
Pasture/Hay	13,294.49	20.77	13.36%
Developed, Open Space	12,957.34	20.24	13.02%
Evergreen Forest	12,783.43	19.97	12.84%
Cultivated Crops	12,326.63	19.26	12.38%
Shrub/Scrub	10,893.52	17.02	10.94%
Developed, Low Intensity	6302.64	9.85	6.33%
Developed, Medium Intensity	2131.42	3.33	2.14%
Grassland/Herbaceous	1927.49	3.01	1.94%
Deciduous Forest	1526.29	2.38	1.53%
Mixed Forest	1317.02	2.06	1.32%
Open Water	850.66	1.33	0.85%
Emergent Herbaceous Wetlands	844.21	1.32	0.85%
Developed, High Intensity	558.43	0.87	0.56%
Barren Land (Rock/Sand/Clay)	324.47	0.51	0.33%
Totals	99,549.76	155.52	100.00%

Reach 3 of the Pocotaligo River Watershed covers a drainage area 7.59 mi^2 (4852.41 acres) in size that drains into Big Branch and its tributaries from the Sumter and Clarendon border 6 miles east of the Lakewood Community in a general southern fashion to impaired station RS-07192 in Big Branch at intersection of US 521 and Main Street in the Town of Alcolu in Clarendon County.

Land use within Reach 3 of the Pocotaligo River Watershed is predominately Cultivated Crops (39.95%), and Woody Wetlands (21.39%) (Figure 2, Table 2c). Developed lands comprise approximately 6.46% of the reach (Table 2e). At the time of the development of these TMDLs, there were no active animal feeding operations in the reach.

There are approximately 30.4 stream miles within Reach 3 of the Pocotaligo River Watershed. The streams are all classified as freshwater (FW).

Table 2c. Land Use in Reach 3 of the Pocotaligo River Watershed (WQM Station RS-07192) (Derived from National Land Cover Database (NLCD) 2006)

Description	Area (Acres)	Area (Mile^2)	Percent
Cultivated Crops	1938.61	3.03	39.95%
Woody Wetlands	1038.14	1.62	21.39%
Evergreen Forest	571.55	0.89	11.78%
Pasture/Hay	554.43	0.87	11.43%
Developed, Open Space	280.22	0.44	5.77%
Shrub/Scrub	215.05	0.34	4.43%
Grassland/Herbaceous	142.55	0.22	2.94%
Deciduous Forest	33.80	0.05	0.70%
Developed, Low Intensity	29.58	0.05	0.61%
Emergent Herbaceous Wetlands	24.24	0.04	0.50%
Mixed Forest	23.80	0.04	0.49%
Developed, Medium Intensity	0.44	0.00	0.01%
Totals	4852.41	7.59	100.00%

And, Reach 4 of the Pocotaligo River Watershed, located on the Sumter and Clarendon border, covers a drainage area 117.40 mi^2 (75,139.58 acres) in size that drains into the Pocotaligo River and its tributaries from the Manchester State Forest, and from impaired station PD-202 in the Pocotaligo River in a general southeastern fashion to impaired station PD-115 in the Pocotaligo River at the third bridge north of the City of Manning on US 301 in Clarendon County.

Land use within Reach 4 of the Pocotaligo River Watershed is predominately Woody Wetlands (31.06%), and Cultivated Crops (29.10%) (Figure 2, Table 2d). Developed lands comprise approximately 6.03% of the reach (Table 2e). At the time of the development of these TMDLs, there were fifteen (15) active animal feeding operations in the reach (Figure 2, Table 10).

There are approximately 758.8 stream miles within Reach 4 of the Pocotaligo River Watershed. The streams are all classified as freshwater (FW or FW-SP).

1.2.2 Juneburn Branch Tributary Watershed; Terminal WQM Station RS-08232

The Juneburn Branch Tributary Watershed consists of the tributary to Juneburn Branch and its tributaries, is contiguous to the southeastern border of the Pocotaligo River Watershed, and is located 3 miles north-northeast of the City of Manning in Clarendon County, South Carolina. The watershed occupies 0.53 mi^2 (334.04 acres) of the Southeastern Plains ecoregion of the state. From the RS-08232 WQM station, the tributary drains into Juneburn Branch 2.5 miles east of the intersection of Interstate 95 and US 521. The RS-08232 WQM station is the only impaired station in the watershed.

Land use within the Juneburn Branch Tributary Watershed is predominately Cultivated Crops (43.40%), and Woody Wetlands (26.41%) (Figure 3, Table 3). Developed lands comprise approximately 15.09% of the watershed (Table 5). At the time of the development of these TMDLs, there were no active animal feeding operations in the watershed.

There are approximately 1.7 stream miles in the Juneburn Branch Tributary Watershed. The streams are all classified as freshwater (FW).

Table 2d. Land Use in Reach 4 of the Pocotaligo River Watershed (WQM Station PD-115) (Derived from National Land Cover Database (NLCD) 2006)

Description	Area (Acres)	Area (Mile^2)	Percent
Woody Wetlands	23,338.91	36.46	31.06%
Cultivated Crops	21,865.11	34.16	29.10%
Pasture/Hay	9420.39	14.72	12.54%
Evergreen Forest	8184.76	12.79	10.89%
Shrub/Scrub	5112.61	7.99	6.81%
Developed, Open Space	3721.10	5.81	4.95%
Grassland/Herbaceous	1149.33	1.80	1.53%
Developed, Low Intensity	672.07	1.05	0.89%
Mixed Forest	461.02	0.72	0.61%
Deciduous Forest	450.35	0.70	0.60%
Emergent Herbaceous Wetlands	429.22	0.67	0.57%
Open Water	164.57	0.26	0.22%
Developed, Medium Intensity	107.42	0.17	0.15%
Barren Land (Rock/Sand/Clay)	32.47	0.05	0.04%
Developed, High Intensity	30.25	0.05	0.04%
Totals	75,139.58	117.40	100.00%

Table 2e. Developed Area from Reach to Reach in the Pocotaligo River Watershed

Reach	Reach Description	Total Drainage Area of Station Reach (Sq. Miles)	Total Developed Area (Sq. Miles)	Percent Developed Area (%)
1	From the Nasty Branch the Nasty Branch TMDL Watershed to the WQM Station RS-03345 in Brunson Swamp Creek	1.59	0.06	3.77%
2	From the Dazell Community to the WQM Station in the Pocotaligo River	155.52	34.29	22.05%
3	From the Sumter/Clarendon border near the Lakewood Community to the WQM Station RS-07192 in Big Branch	7.59	0.49	6.46%
4	From the Manchester State Forest, and from the WQM Station PD-202 to the WQM Station PD-115 in the Pocotaligo River near the City of Manning	117.40	7.08	6.03%
All	Whole Pocotaligo River Watershed	282.10*	41.92*	14.86%*

*Total Drainage area excludes estimates for approved Nasty Branch and Turkey Creek FC TMDL drainage areas located upstream (a combined approved TMDL area of 26.4 Sq. miles total).

Figure 3. Land Use Diagram for the Juneburn Branch Watershed (WQM Station RS-08232)

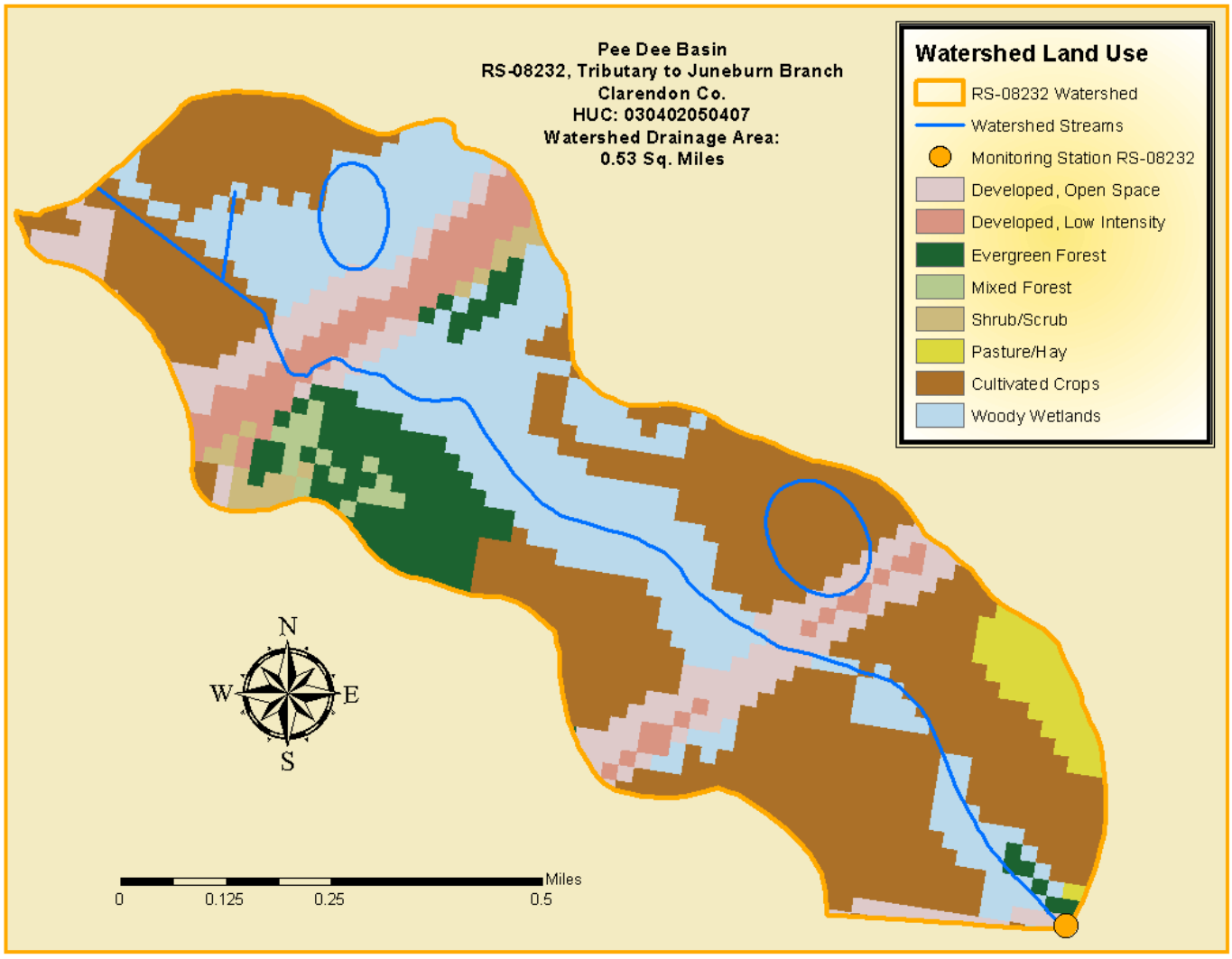


Table 3. Land Use in the Juneburn Branch Tributary Watershed (WQM Station RS-08232) (Derived from National Land Cover Database (NLCD) 2006)

Description	Area (Acres)	Area (Mile^2)	Percent
Cultivated Crops	148.11	0.23	43.40%
Woody Wetlands	89.40	0.14	26.41%
Developed, Open Space	34.92	0.05	9.43%
Evergreen Forest	24.24	0.04	7.55%
Developed, Low Intensity	19.57	0.03	5.66%
Pasture/Hay	9.79	0.02	3.77%
Shrub/Scrub	4.23	0.01	1.89%
Mixed Forest	3.78	0.01	1.89%
Totals	334.04	0.53	100.00%

1.2.3 Deep Creek Watershed; Terminal WQM Station RS-03347

The Deep Creek Watershed consists of the Deep Creek and its tributaries, and is located 4.3 miles southeast of the City of Manning in Clarendon County, South Carolina. The watershed is 8.62 mi^2 (5513.37 acres). The western two-thirds of the watershed is located in the Southeastern Plains ecoregion of the state; and, the eastern third of the watershed is located in the Middle Atlantic Coastal Plains ecoregion. From the RS-03347 WQM station, Deep Creek drains into the Pocotaligo River 4.6 miles east of Manning. The RS-03347 WQM station is the only impaired station in the watershed.

Land use within the Deep Creek Watershed is predominately Woody Wetlands (26.10%), and Evergreen Forest (25.29%) (Figure 4, Table 4). Developed lands only comprise approximately 4.18% of the watershed (Table 5). At the time of the development of these TMDLs, there were three (3) active animal feeding operations in the watershed (Figure 4, Table 10).

There are approximately 29.8 stream miles in the Deep Creek Watershed. The streams are all classified as freshwater (FW).

Figure 4. Land Use Diagram for the Deep Creek Watershed (WQM Station RS-03347)

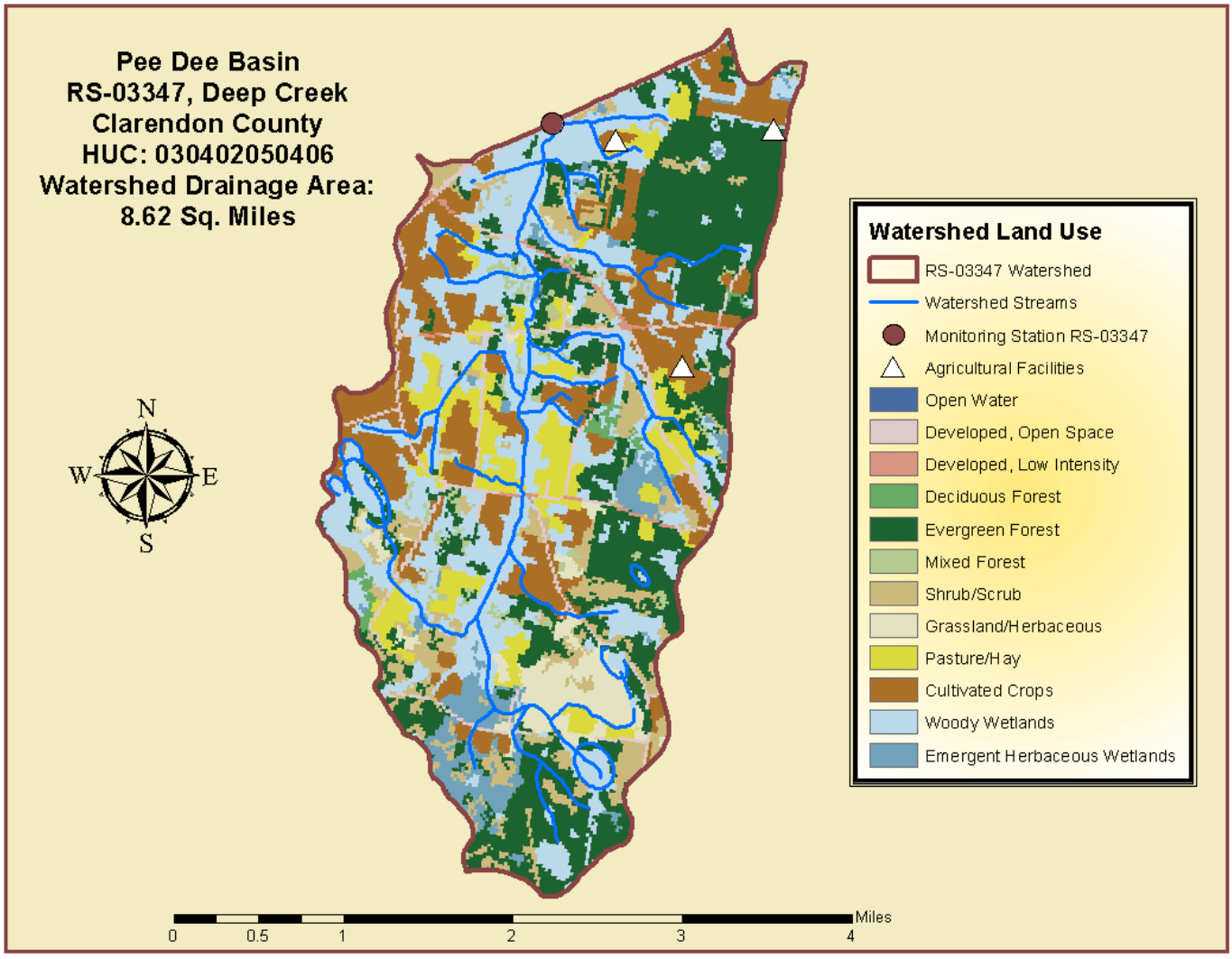


Table 4. Land Use in the Deep Creek Watershed (WQM Station RS-03347) (Derived from National Land Cover Database (NLCD) 2006)

Description	Area (Acres)	Area (Mile^2)	Percent
Woody Wetlands	1438.67	2.25	26.10%
Evergreen Forest	1397.30	2.18	25.29%
Cultivated Crops	920.71	1.44	16.71%
Shrub/Scrub	501.50	0.78	9.05%
Pasture/Hay	449.24	0.70	8.12%
Emergent Herbaceous Wetlands	240.63	0.38	4.41%
Grassland/Herbaceous	222.39	0.35	4.06%
Developed, Open Space	198.15	0.31	3.59%
Mixed Forest	76.28	0.12	1.39%
Deciduous Forest	36.70	0.06	0.70%
Developed, Low Intensity	30.69	0.05	0.58%
Open Water	1.11	0.00	0.00%
Totals	5513.37	8.62	100.00%

Table 5. Developed Areas in the Juneburn Branch Tributary and Deep Creek Watersheds

Watershed	Total Drainage Area of Station Reach (Sq. Miles)	Total Developed Area (Sq. Miles)	Percent Developed Area (%)
Juneburn Branch Tributary	0.53	0.08	15.09%
Deep Creek	8.62	0.36	4.18%

1.3 Water Quality Standard

The impaired stream segments of the Pocotaligo River and tributary basins are designated as Class Freshwater (FW or FW-SP), which is defined in SC Regulation 61-69 (2012) as:

> "Freshwaters are 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 aquatic community of fauna and flora. Suitable also for industrial and agricultural uses."

South Carolina's current water quality standard (WQS) for recreational use in freshwater is *E. coli* (R.61-68):

> "Not to exceed a geometric mean of 126/100 ml based on at least four samples collected from a given sampling site over a 30 day period, nor shall a single sample maximum exceed 349/100 ml (SCDHEC, 2012)."

Prior to February 28, 2013, South Carolina's WQS for recreational use in freshwaters was FC bacteria (R.61-68):

> "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 and secondary 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. Essentially all perennial streams should therefore be protected from pathogen impairment.

2.0 WATER QUALITY ASSESSMENT

In 1986, the USEPA documented that *E. coli* and *Enterococcus* bacteria are better indicators than FC bacteria group in predicting the presence of human gastroenteritis (upset stomach, nausea, diarrhea, vomiting) causing pathogenic bacteria in fresh waters. The USEPA study was based on data collected when swimmers were directly exposed in freshwater lakes with established public swimming areas. In almost all cases of water-borne illnesses, pathogens come from inadequately treated waste of humans or other warm-blooded animals. Also, *Enterococcus* and *E. coli* are more specific to sewage and fecal sources than the FC bacteria group. In light of this information, USEPA has recommended the use of either *E. coli* or *Enterococcus* as the pathogen indicator for fresh waters.

In order to determine which pathogen indicator bacteria is better suited in South Carolina as the recreational use water quality standard in fresh waters, SCDHEC designed a Pathogen Indicator Study (PIS) and conducted the study during 2009. Weekly water samples were collected from 73 stations statewide and analyzed for *E. coli, Enterococcus* and for FC bacteria group. PIS results showed *E. coli* (a member of the FC bacteria group) is a better indicator for predicting the presence of pathogens in South Carolina freshwaters.

During 2012 and following the public participation, public comment period and legislative processes, DHEC submitted a proposed amendment to EPA to change the pathogen indicator from FC bacteria to *E. coli* in R. 61-68. Details of this process as well as PIS raw data can be found at: http://www.scdhec.gov/environment/water/fwater.htm. The proposed amendment was approved by EPA on February 28, 2013 and *E. coli* has been promulgated in R. 61-68. *E. coli* is the applicable water quality standard for recreational use in fresh waters.

Beginning with 2014 §303(d) list of impaired waters, sites included as impaired for recreational use FC bacteria on the 2012 §303(d) lists will be listed as impaired for *E. coli.* Once sufficient *E. coli* data are collected from impaired stations, future TMDLs will be calculated based on *E. coli* data. Until sufficient data are collected, TMDLs for currently FC impaired stations can be calculated using FC data. Then, these FC TMDLs can be converted to *E. coli* TMDLs by multiplying the FC TMDL number by 0.8725. A 0.8725 ratio was derived by dividing the current single sample maximum WQS for *E. coli*, 349 MPN/100ml by former single sample maximum WQS for FC bacteria, 400 cfu/100 ml.

The SCDHEC currently has several monitoring locations within the watersheds described earlier in this document. Six of the monitoring sites have been included in the State's draft 2012 §303(d) list for FC bacteria due to the exceedances of the previous WQS for pathogens in freshwaters (SCDHEC, 2012). 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 former freshwater FC bacteria recreational use WQS. Waters with more than 10% of samples greater than 400 cfu/100 ml are considered impaired for FC bacteria and were placed on South Carolina's §303(d) list[1]. These stations will be included on future §303(d) lists due to exceedances of the current *E. coli* WQS until such time such time that sufficient *E. coli* data are collected and demonstrate the WQS is attained or such time that TMDLs are

[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% FC bacteria standard (400/100 mL).

developed and approved to address the parameter of concern. Table 6 provides a summary of number of samples collected, number of exceedences and exceedence percentage.

Table 6. FC WQS Exceedence Summary for Impaired Stations (1999-2008)

Station	Waterbody	Number of Samples	Number of Samples >400/100mL	% Samples Exceed WQS
RS-03345	Brunson Swamp Creek	10	4	40%
PD-202	Pocotaligo River	45	5	11%
RS-07192	Big Branch	7	3	43%
PD-115	Pocotaligo River	34	4	12%
RS-08232	Juneburn Branch Tributary	5	3	60%
RS-03347	Deep Creek	9	3	33%

Figure 5 illustrates precipitation and FC by data and date for Monitoring Station PD-115. The graph and Table 7 show that there is little or no correlation between the amount of precipitation and the temporal FC exceedences of water quality standards (r = -0.051). The graphs for precipitation and FC by data and date for the other five WQM stations are shown in Appendix A.

Table 7. Correlations Between Rainfall and FC in the Pocotaligo River and Tributaries Watersheds

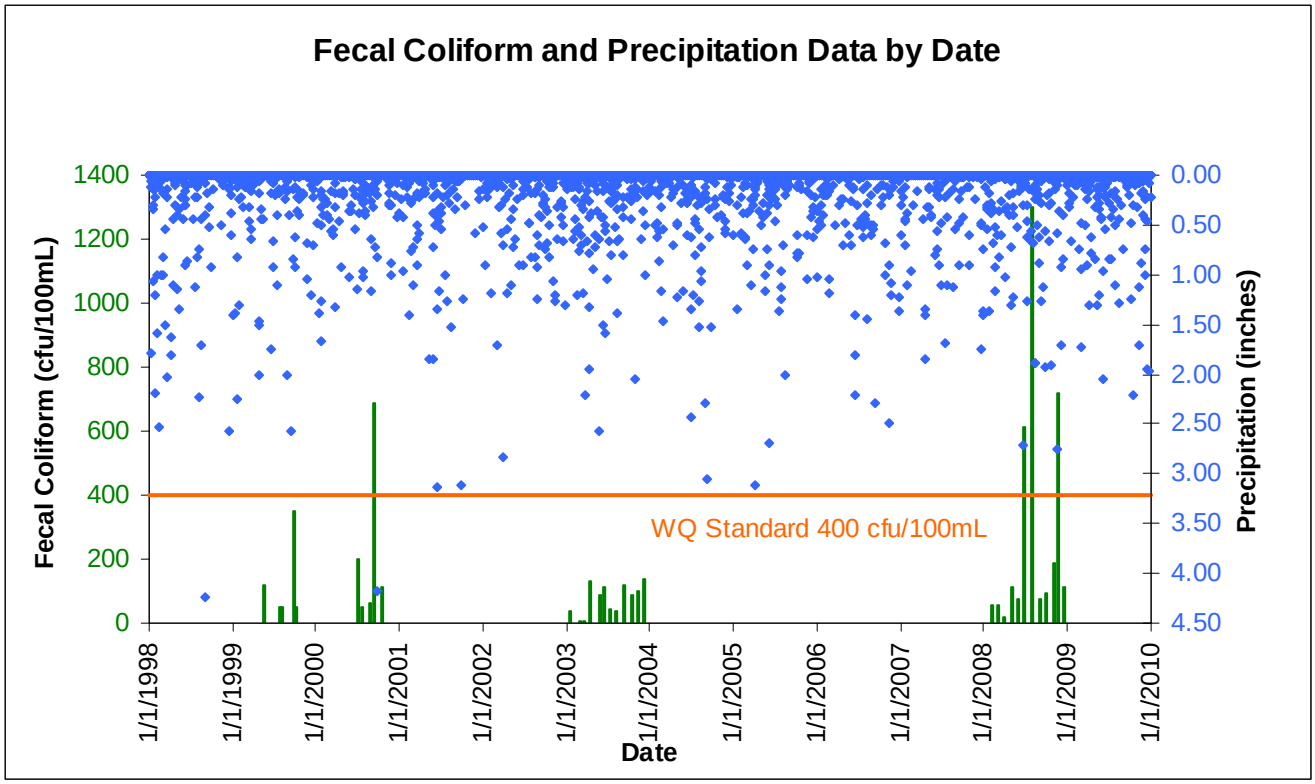
Station	Waterbody	Correlation Coefficient (r)	Coefficient of Determination (r^2)
RS-03345	Brunson Swamp Creek	0.266	0.071
PD-202	Pocotaligo River	0.205	0.042
RS-07192	Big Branch	-0.087	0.007
PD-115	Pocotaligo River	-0.051	0.003
RS-08232	Juneburn Branch Tributary	0.696	0.485
RS-03347	Deep Creek	-0.344	0.118

For WQM Station RS-08232 (Juneburn Branch Tributary Watershed), there was a strong positive correlation between precipitation and temporal FC exceedences of water quality standards (r = 0.696) (Table 7 and Appendix A). For WQM Station RS-03347, there was a moderate negative correlation between these two variables. For Stations RS-03345 and PD-202, there was a weak positive correlation between these variables. And for Stations RS-07192 and PD-115, the correlation between these variables was negligible.

3.0 SOURCE ASSESSMENT AND LOAD ALLOCATION

E. coli is 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 illness.

Figure 5. Precipitation and FC Data by Date for Water Quality Monitoring Station PD-115



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 (CWA) to obtain a NPDES permit. In South Carolina NPDES permits require that dischargers of sanitary wastewater must meet the state standard for the relevant pathogen indicator at the point of discharge. Municipal and private sanitary wastewater treatment facilities may occasionally be sources of pathogens. 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 MS4s and stormwater discharges from construction or industrial sites. MS4s may require NPDES discharge permits for industrial and 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 6 of this TMDL document and required in their MS4 permits, they should not be causing or contributing to an instream pathogen impairment.

3.1 Point Sources

Point sources are defined as pollutant loads discharged at a specific location from pipes, outfalls, and conveyance channels from either municipal wastewater treatment plants, industrial waste treatment facilities, or regulated stormwater discharges. Point sources can also include pollutant loads contributed by tributaries to the main receiving water stream or river. Point sources can be further broken down into continuous and non-continuous.

3.1.1 Continuous Point Sources

There are eight (8) continuous FC-bacteria point sources in the Pocotaligo River and tributaries watersheds authorized under NPDES permits (Figure 6 and Table 8). All eight of the NPDES permitted continuous sources are located in Reach 2 of the Pocotaligo River Watershed (WQM Station PD-202). WQM Station PD-202 and WQM Station PD-115 are the only monitoring stations located downstream of these eight continuous point sources. There are no NPDES permitted continuous point sources of FC in the Juneburn Branch Tributary and Deep Creek Watersheds.

Figure 6. NPDES Permitted FC Discharges in the Pocotaligo River Watershed

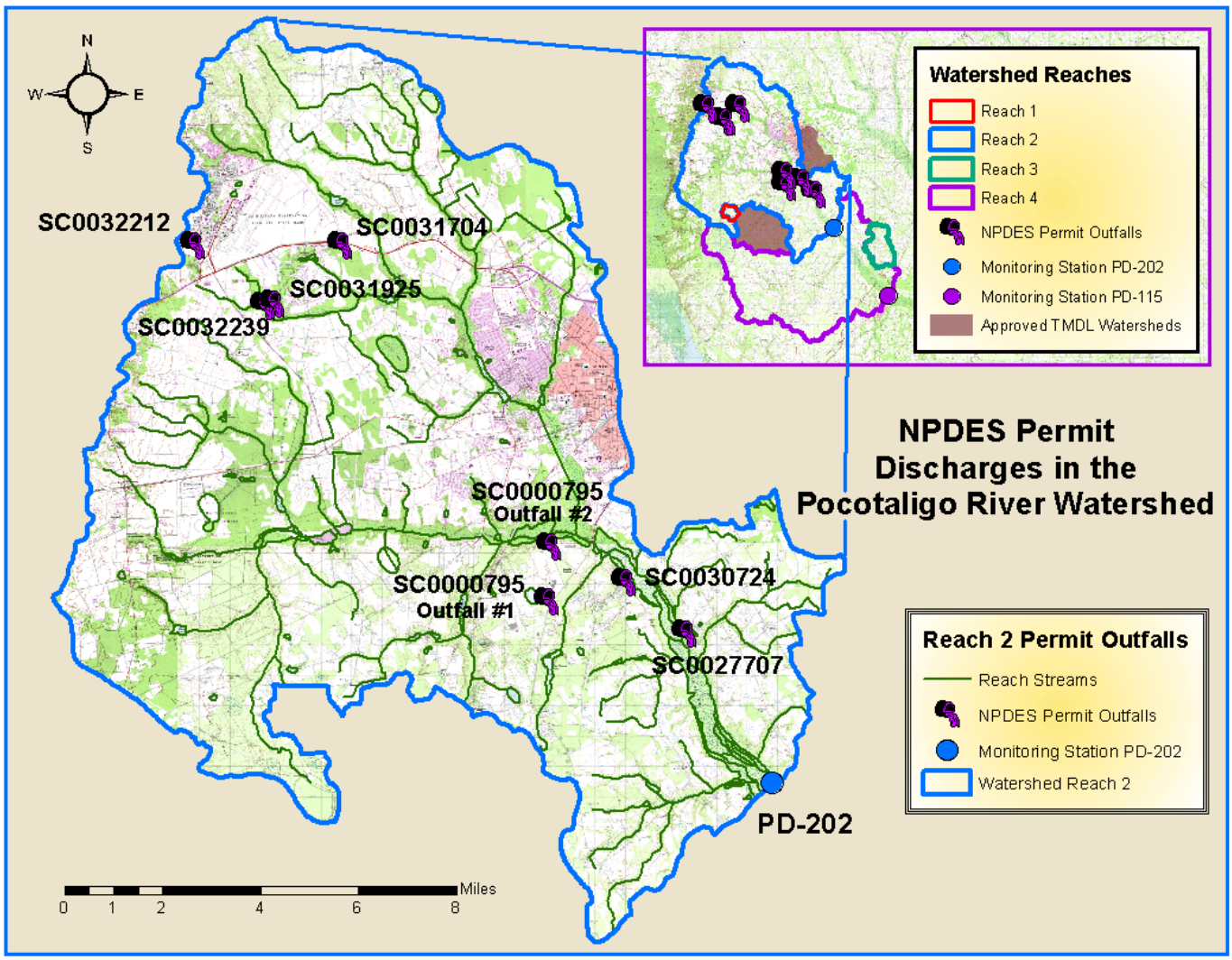


Table 8. NPDES Permitted FC Discharges in the Pocotaligo River Watershed

Impaired Station Watershed	Permitted Facility	Permit Number	Permit Type	Permitted Flow (MGD)	Outfall Stream
PD-202, PD-115	City of Sumter, Pocotaligo River WWTP	SC0027707	Major	15.0	Pocotaligo River
PD-202, PD-115	Pilgrim's Pride Corporation, Sumter SC Processing Plant	SC0000795[1]	Minor	0.25[3]	Pocalla Creek to Pocotaligo River
PD-202, PD-115	Carolina Water Services, Inc., Pocalla Village – Belk SD	SC0030724	Minor	0.104	Pocotaligo River
PD-202, PD-115	Pilgrim's Pride Corporation, Sumter SC Processing Plant	SC0000795[2]	Minor	0.086[3]	Cane Savannah Creek to Pocotaligo River
PD-202, PD-115	Carolina Mobile Home Court	SC0032212	Minor	0.03	Ditch to Mush Branch to Long Branch to Green Swamp
PD-202, PD-115	Burgess Glenn Mobile Home Park I	SC0031925	Minor	0.018	Mush Branch
PD-202, PD-115	Burgess Glenn Mobile Home Park II	SC0032239	Minor	0.018	Mush Branch
PD-202, PD-115	High Hills Rural Water Company, Inc., Harwood Mobile Home Park	SC0031704	Minor	0.0072	Unnamed tributary to Bluffhead Branch to Mush Branch to Pocotaligo River
Total FC NPDES Permitted Flows in the Pocotaligo River Watershed:				**15.513**	

1. Outfall Number 1 in Permit No. SC0000795
2. Outfall Number 2 in Permit No. SC0000795
3. Based on long term average discharge flows (as reported in discharge monitoring reports from December 1, 2006 to March 31, 2011)

While each of these continuous points sources contain FC bacteria, they are also expected to contain *E. coli* bacteria. As NPDES are reissued in the future, they may include *E. coli* limitations in lieu of FC bacteria limitations. For the purposes of developing these TMDLs, they are considered potential sources both pathogen indicators.

Six domestic dischargers and one industrial discharger have been issued NPDES permits for the eight (8) continuous FC point source discharges in Reach 2 of the Pocotaligo River Watershed. The City of Sumter's Pocotaligo River Waste Water Treatment Plant (WWTP) is the only major discharger (permitted flow > 1.0 million gallons per day (MGD)). The other six dischargers are minor dischargers (permitted flow < 1.0 MGD).

The City of Sumter's Pocotaligo River WWTP, located off of US Highway 521 South 2.2 miles south of the city in Sumter County, is a domestic facility authorized under the SCDHEC's NPDES Permit No. SC0027707 to discharge into the Pocotaligo River (Figure 6). The facility is a major discharger, and is the largest of the six domestic dischargers in the Pocotaligo River Watershed. Under the terms and conditions of the permit, the facility has a final discharge limit to discharge a monthly average of up to 15.0 MGD. The permit had an expiration date of September 30, 2011; however, the permit continues in force since the SCDHEC received an application to renew the permit prior to the expiration date.

Carolina Water Service, Inc.'s facility at 54 Lakeside Drive off Old Manning Road near the City of Sumter in Sumter County is a domestic WWTP for the Pocalla Village – Belk Subdivision. The facility is authorized under the SCDHEC's NPDES Permit No. SC0030724 to discharge into the Pocotaligo River (Figure 6). Under the terms and conditions of the permit, the facility is authorized to discharge a monthly average of up to 0.104 MGD. The permit will expire on May 31, 2016.

The Carolina Mobile Home Court has a domestic WWTP off SC Highway 441 about 1.25 miles north of the junction of US. 378 and US 76 near Shaw Air Force Base in Sumter County. The facility is authorized under the SCDHEC's NPDES Permit No. SC0032212 to discharge into a ditch to Mush Branch to Long Branch to Green Swamp (Figure 6). Under the terms and conditions of the permit, the facility is authorized to discharge a monthly average of up to 0.03 MGD. The permit will expire on September 30, 2016.

The Burgess Glen Mobile Home Park I has a domestic WWTP approximately 1 mile off of US 378/76 on Furman Drive in Sumter County. The facility is authorized under the SCDHEC's NPDES Permit No. SC0031925 to discharge into Mush Branch (Figure 6). Under the terms and conditions of the permit, the facility has a final discharge limit to discharge a monthly average of up to 0.018 MGD. The permit had an expiration date of September 30, 2011; however, the permit continues in force since the SCDHEC received an application to renew the permit prior to the expiration date.

The Burgess Glen Mobile Home Park II has a domestic WWTP approximately 1 mile off of US 378/76 on Furman Drive in Sumter County. The facility is authorized under the SCDHEC's NPDES Permit No. SC0032239 to discharge into Mush Branch (Figure 6). Under the terms and conditions of the permit, the facility has a final discharge limit to discharge a monthly average of up to 0.018 MGD. The permit had an expiration date of September 30, 2011; however, the permit continues in force since the SCDHEC received an application to renew the permit prior to the expiration date.

The High Hills Rural Water Company, Inc.'s facility on US Highway 76 West in Sumter County is a domestic WWTP for the Harwood Mobile Home Park. The facility is authorized under the SCDHEC's NPDES Permit No. SC0031704 to discharge into an unnamed tributary to Bluffhead Branch to Mush Branch to the Pocotaligo River (Figure 6). Under the terms and conditions of the permit, the facility is authorized to discharge a monthly average of up to 0.0072 MGD. The permit had an expiration date of September 30, 2011; however, the permit continues in force since the SCDHEC received an application to renew the permit prior to the expiration date.

The Pilgrim's Pride Corporation's Sumter SC Processing Plant has an industrial WWTP at 2050 US Highway 15 South in Sumter County. The facility is authorized under the SCDHEC's NPDES Permit No. SC0000795 to discharge through two outfalls (Figure 6). Through Outfall #1, the facility is authorized to discharge into Pocalla Creek to the Pocotaligo River; and, through Outfall #2, the facility is authorized to discharge into Cane Savannah Creek to the Pocotaligo River. Under the terms and conditions of the permit, the facility is required to monitor and report discharge flows. Based on discharge monitoring reports submitted to the SCDHEC from December 1, 2006 to March 31, 2011, long term average discharge flows from the facility are as follows: **a)** 0.25 MGD from Outfall #1; and, **b)** 0.086 MGD from Outfall #2. The permit will expire on May 31, 2016.

Future NPDES-permitted discharges of *E.coli* and other FC bacteria in the Pocotaligo River and tributaries watersheds are required to implement the WLAs and demonstrate consistency with the assumptions and requirements of the TMDLs in this document.

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/or regulated under South Carolina Water Pollution Control Permits: R61-9, §122.26(b)(4),(7),(14) - (21) (SCDHEC, 2011). All regulated MS4 entities have the potential to contribute *E. coli* and other FC bacteria pollutant loadings in the delineated drainage area used in the development of this TMDL.

There are four MS4s in the Pocotaligo River and tributaries watersheds: **a)** The SCDOT; **b)** Sumter County; **c)** The City of Sumter; and, **d)** Shaw Air Force Base. The SCDOT is the only large MS4 in the watersheds. There are no medium MS4s in the watersheds. The other three designated MS4s are small MS4s. The SCDOT operates under the SCDHEC's NPDES MS4 Permit SCS040001 and owns and operates roads within all of the Pocotaligo River and tributaries watersheds (Figure 7 and Table 9). 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.

Figure 7. SCDOT Owned and Maintained Roads in the Pocotaligo River and Tributaries Watersheds

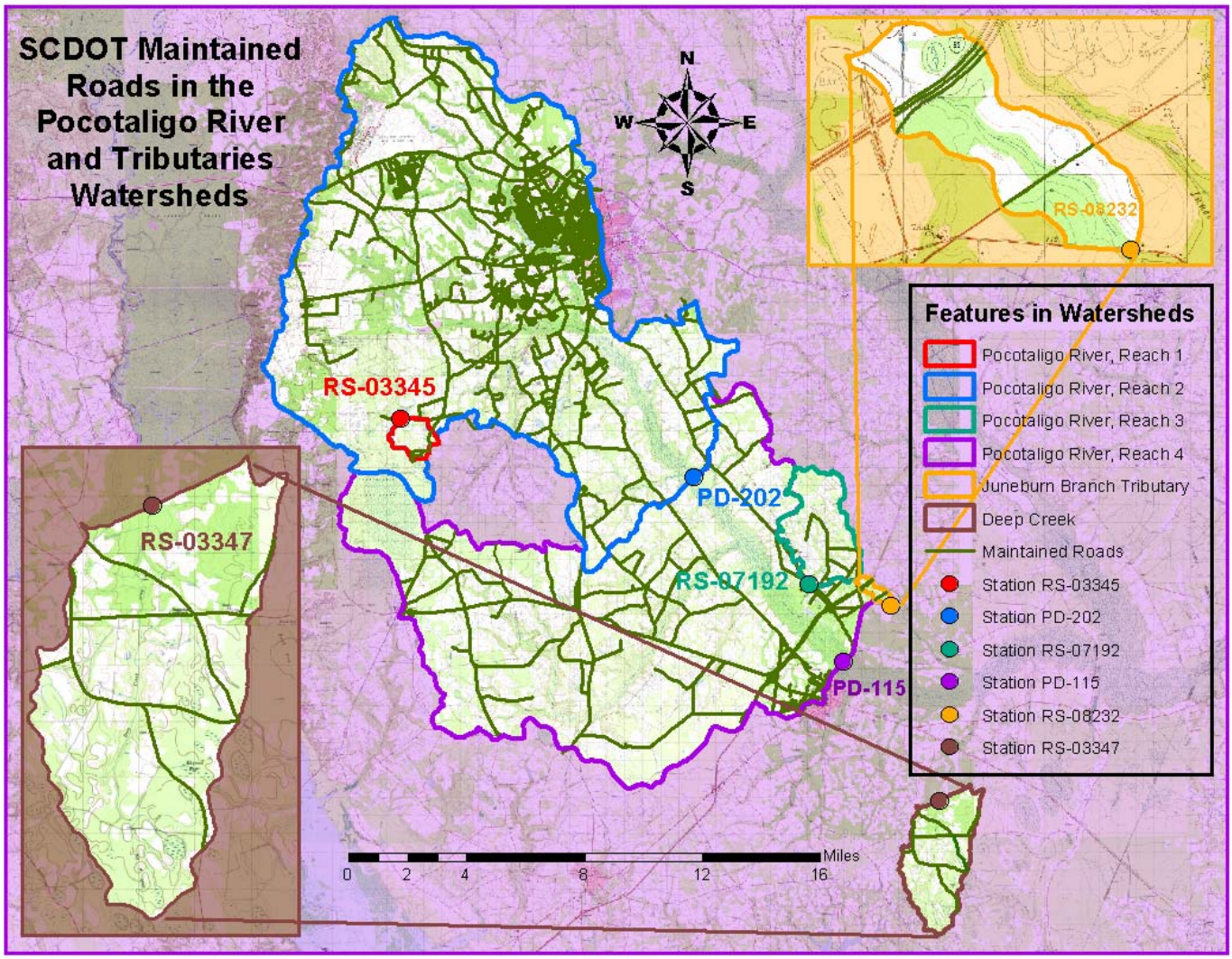


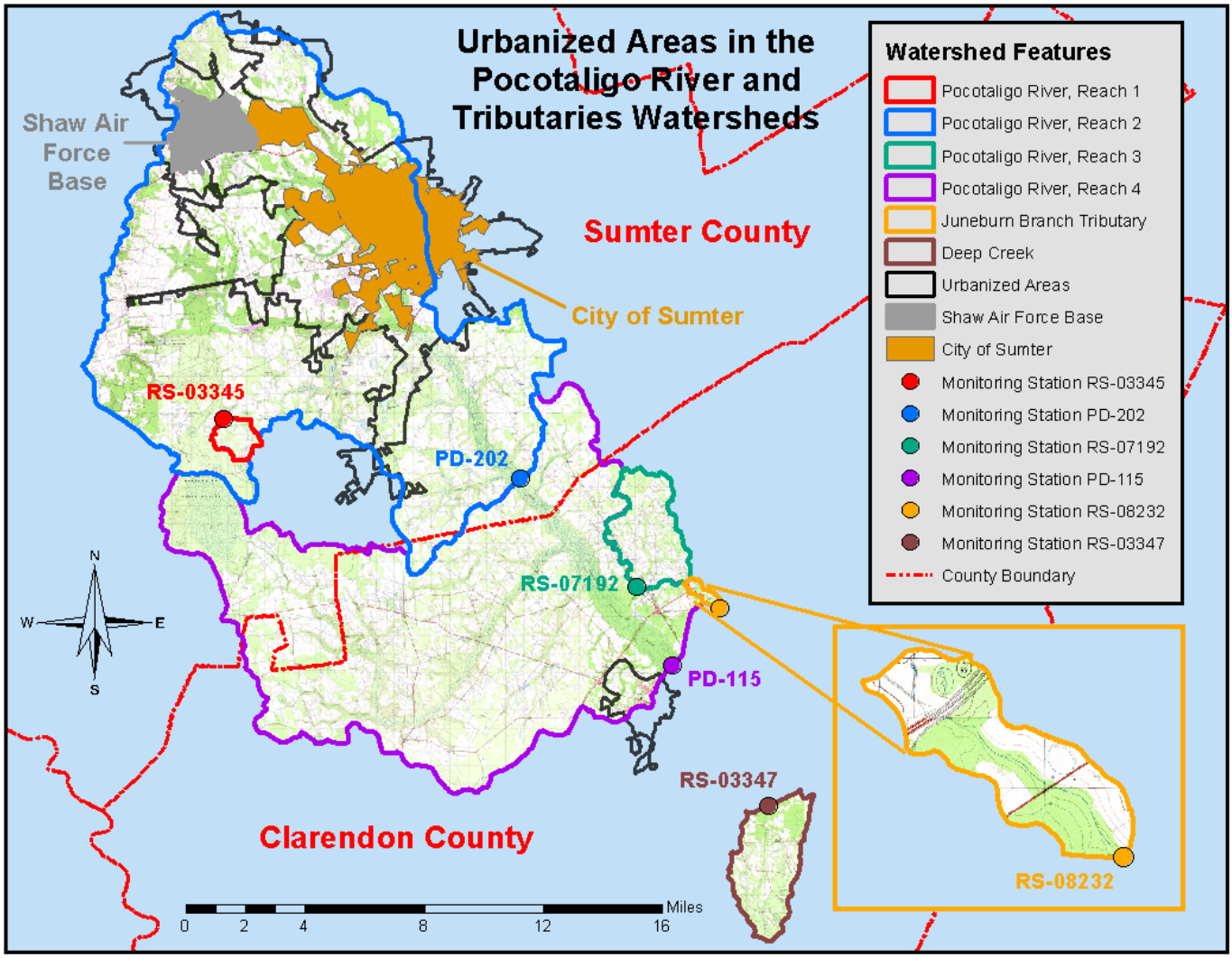
Table 9. SCDOT Maintained Road Miles in the Pocotaligo River and Tributaries Watersheds

Watershed	Station	Road Miles
Pocotaligo River, Reach 1	RS-03345	3.1
Pocotaligo River, Reach 2	PD-202	396.0
Pocotaligo River, Reach 3	RS-07192	10.3
Pocotaligo River, Reach 4	PD-115	176.6
Total Miles in the Pocotaligo River Watershed:		586.0
Juneburn Branch Tributary	RS-08232	2.4
Deep Creek	RS-03347	12.3

Current Developed land use for the Pocotaligo River and tributaries watersheds range from 3.77% to 22.05% (Tables 2e and 5). Based on current Geographic Information System (GIS) information (available at time of TMDL development) there are currently no SCDOT facilities located in the Pocotaligo River and tributaries watersheds. And, based on information provided on the SCDOT website, there are no highway rest areas in the watershed areas.

Small MS4s that discharge stormwater in urbanized areas, as designated by the U.S. Bureau of Census, are regulated under South Carolina *Water Pollution Control Permits* Regulation 122.26(b)(16) and 122.32. Urbanized areas in the Pocotaligo River and tributaries watersheds are shown in Figure 8. Sumter County, a small MS4, discharge stormwater in an urbanized area in Reach 2 of the Pocataligo River Watershed (Figure 8). The county operates under the SCDHEC's NPDES MS4 Permit SCR038503.

Figure 8. Urbanized Areas in the Pocotaligo River and Tributaries Watersheds as Designated by the U.S. Bureau of Census



The City of Sumter and Shaw Air Force Base, the other two small MS4s in the Pocotaligo River and tributaries watershed, also discharge stormwater in an urbanized area in Reach 2 of the Pocataligo River Watershed (Figure 8). The city operates under the SCDHEC's NPDES MS4 Permit SCR038502, and the

air force base operates under NPDES MS4 Permit SCR038501. At the time of the development of these TMDLs, there were no regulated small MS4 discharges in the other five watersheds in the Pocotaligo River and tributaries watersheds.

Other than the above-mentioned MS4 owned and/or operated storm sewer systems, there are currently no permitted stormwater systems that discharge in these watersheds. Future permitted sanitary sewer or stormwater systems in the referenced watersheds will be required to comply with the load reductions prescribed in the WLA and demonstrate consistency with the assumptions and requirements of these TMDLs.

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 Stormwater Construction General Permit from the SCDHEC (SCR100000). Where the construction has 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 waste load allocations in the TMDLs. Note that there may be other stormwater discharges not covered under permits numbered SCS and SCR that occur in the referenced watersheds. These activities are not subject to the WLA portion of the TMDLs.

Similar to regulated MS4s, potentially designated MS4 entities (as listed in 64 FR, 235, P.68837) or other unregulated MS4 communities located in the aforementioned watershed and surrounding watersheds may have the potential to contribute *E. coli* and other FC bacteria in stormwater runoff. These unregulated entities are subject to the LA for the purposes of this TMDL.

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. Currently no parts of the Pocotaligo River, Juneburn Branch Tributary, or Deep Creek watersheds are serviced by a community collection system.

The Department acknowledges that progress with the assumptions and requirements of the TMDLs by MS4s is expected to take one or more permit iteration. Progress towards achieving the WLA reduction for the TMDLs 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

Nonpoint source pollution is defined as pollution that is not released through pipes but rather originates from multiple sources over a relatively large area. Nonpoint sources can be divided into source activities related either to land or water use including failing septic tanks, improper animal-keeping practices, agriculture, forestry practices, wildlife and urban and rural runoff.

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 of NPDES permitted area) of the Pocotaligo River and tributaries watersheds. Nonpoint sources located in unregulated areas are subject to the load allocation (LA) and not the WLA of the TMDL document.

3.2.1 Wildlife

Resident and migrant wildlife (mammals and birds) can be a significant contributor of *E. coli* and other 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. Reach 1 and Reach 2 of the Pocotaligo River Watershed (i.e., the drainage areas discharging through the RS-03345 WQM station and PD-202 WQM station, respectively) lie predominantly

in Sumter County. According to a study conducted by the SCDNR in 2008, there are an estimated 15 to 30 deer per square mile in Sumter County in the vicinity of these two reaches (SCDNR 2008).

Reach 3 of the Pocotaligo River Watershed (i.e., the drainage areas discharging through the RS-07192 WQM station) lie in Clarendon County. Approximately 25 percent of Reach 4 of the Pocotaligo River Watershed (i.e., the drainage areas discharging through the PD-115 WQM station) lie in Sumter County, and approximately 75 percent lie in Clarendon County. And, the drainage areas discharging through RS-08232 WQM station and RS-03347 WQM station both lie in Clarendon County. According to the SCDNR study, there are 30 to 45 deer per square mile in Sumter and Clarendon Counties in the vicinity of these four drainage areas. The study estimated deer density based on suitable habitat (forests, croplands, and pastures). The FC production rate for deer has been shown to be 347 x 10^6 cfu/head-day in a study conducted by Yagow (1999), of which only a portion will enter the Pocotaligo River and tributaries watersheds. Wildlife may contribute a significant portion of the overall *E. coli* and other FC bacteria load within the watersheds.

3.2.2 Agricultural Activities

Agricultural activities that involve livestock or animal wastes are potential sources of pathogen contamination of surface waters. Fecal matter can enter the waterway via runoff from the land or by direct deposition into the stream. Unstabilized soil directly adjacent to surface waters can contribute to pollutant loading during periods of runoff after rain events. During these events, fertilizer and wildlife wastes can be transported into the creek and carried downstream. Agricultural activities may represent a contributing source in the Pocotaligo River and tributaries watersheds where agricultural activities constitute a greater portion of the land use.

3.2.2.1 Agricultural Animal Facilities

Owners/operators of most commercial animal growing operations are required by South Carolina 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 the SCDHEC.

There are currently twenty-five (25) active AFOs with regulated structures or activities in the Pocotaligo River and tributaries watersheds (Figures 2 and 4, and Table 10). These facilities consist of thirteen (13) swine facilities, eight (8) poultry facilities, two (2) turkey facilities, and two (2) pigeon facilities. Seven (7) of the AFOs are located in Reach 2 of the Pocotaligo River Watershed (terminal WQM station PD-202) (Figure 2); fifteen (15) of the AFOs are located in Reach 4 of the Pocotaligo River Watershed (terminal WQM station PD-115) (Figure 2); and, three (3) of the AFO's are located in Deep Creek Watershed (terminal WQM station RS-03347) (Figure 4). The two turkey operations are considered AFOs and the eight poultry operations are considered according to Section 122.23 of SC Regulation 61-9, *Water Pollution Control Permits*. There may also be land application sites associated with these facilities. 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.

3.2.2.2 **Grazing Animals**

Livestock, especially cattle, are frequently major contributors of FC bacteria or *E. coli* 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 or *E. coli* indirectly by runoff from pastures or directly

by defecating into streams and ponds. Direct loading by cattle or other livestock to surface waters within the Pocotaligo River and tributaries watersheds is likely to be a contributing source of *E. coli* and other FC bacteria. However, the grazing of unconfined livestock (in pastures) is not regulated by the SCDHEC.

Table 10. Active Animal Feeding Operations with Regulated Structures or Activities Within the Pocotaligo River and Tributaries Watersheds

Downstream Impaired Station	AFO Permit	Facility	Type of Livestock	Number of Permitted Animals
PD-202	ND0072036	Black Crest Farm	Swine	1,200
PD-202	ND0073920	Collins Allen Roost	Poultry (Broilers)	66,000
PD-202	ND0000779	Hill Swine Farm	Swine	50
PD-202	ND0085782	Newman Poultry Farm #2	Turkey (Brooders)	26,000
PD-202	ND0066842	Palmetto Pigeon Processing Plant	Pigeons	55,000
PD-202	ND0068292	Steel Farm	Swine	1,500
PD-202	ND0079049	Thompson Grow-Out Turkey Facility	Turkey	45,000
PD-115	ND0007048	A&J Farms	Swine	370
PD-115	ND0071897	A&J Farms	Swine	3,256
PD-115	ND0002526	Allan Livestock	Swine	250
PD-115	ND0009636	Allan Livestock	Swine	160
PD-115	ND0005550	Dale & Pam's Hog Farm	Swine	1,000
PD-115	ND0070971	Dale & Pam's Hog Farm	Swine	3,570
PD-115	ND0065471	Eadon Swine Facility	Swine (Farrow to Wean)	5,000
PD-115	ND0072362	Hicks Swine Facility	Swine	2,800
PD-115	ND0071765	Howard Broiler Facility	Poultry (Broilers)	200,000
PD-115	ND0006882	Jenkinson Hog Facility	Swine	250
PD-115	ND0074560	Kim's Pinewood Farm	Poultry (Broilers)	174,000
PD-115	ND0085251	Paul Newman Farms	Poultry (Broilers)	232,000
PD-115	ND0074535	Prosser Broiler Facility	Poultry (Broilers)	116,000
PD-115	ND0077798	Quarter S Farm	Swine	2,800
PD-115	ND085952	Willow Leaf Farms	Pigeons	7,760
RS-03347	ND0073806	Tad C Graham Poultry	Poultry (Broilers)	150,000
RS-03347	ND0080578	Wells Farm Poultry Facility	Poultry (Broilers)	88,000
RS-03347	ND0073831	WG Rogers Broiler Facility	Poultry (Broilers)	200,000

The United States Department of Agriculture's (USDA) National Agricultural Statistics Service reported 5634 and 4833 cattle and calves in Sumter County and Clarendon County, respectively, in 2007 (USDA 2009). According to the NLCD 2006, there are 41,591.90 and 39,085.74 acres of pastureland in Sumter County and Clarendon County, respectively. This relates to 0.14 and 0.12 cattle per acre of pastureland in Sumter County and Clarendon County, respectively, assuming an even distribution of cattle across pastureland in the counties. Table 11 shows the number of acres of pastureland and, based on this acreage, an estimate of the number of cattle in the Pocotaligo River and tributaries watersheds. And, based on the number of cattle, the table shows an average of cfu/day of FC bacteria produced by cattle in the watersheds. Based

on the table, an estimated 3151.65 cattle and calves within the Pocotaligo River Watershed (terminal WQM station PD-115) combine to produce an average of 3.15E+14 cfu/day of FC bacteria; an estimated 1.17 cattle and calves within the Juneburn Branch Tributary Watershed (terminal WQM station RS-08232) combine to produce an average of 1.17E+11 cfu/day of FC bacteria; and, an estimated 53.91 cattle and calves within the Deep Creek Watershed (terminal WQM station RS-03347) combine to produce an average of 5.39E+12 cfu/day of FC bacteria.

Table 11. Cattle FC per Day in the Pocotaligo River and Tributaries Watersheds

Downstream Impaired Station	County	Pasture Area (Acre) per Watershed	Cattle per Watershed	Cattle Fecal Coliform, cfu/day
RS-03345	Sumter	376.74	52.74	5.27E+12
PD-202	Sumter	13,167.06	1843.39	1.84E+14
	Clarendon	127.21	15.27	1.53E+12
RS-07192	Clarendon	554.43	66.53	6.65E+12
PD-115	Sumter	2112.29	295.76	2.96E+13
	Clarendon	7316.32	877.96	8.78E+13
RS-08232	Clarendon	9.79	1.17	1.17E+11
RS03347	Clarendon	449.24	53.91	5.39E+12

3.2.3 Land Application of Industrial, Domestic Sludge or Treated Wastewater

NPDES-permitted industrial and domestic wastewater treatment processes may generate solid waste bi-products, also know as sludge. In some cases, facilities may be permitted to land apply sludge at designated locations and under specific conditions. There are also some NPDES-permitted facilities authorized to land apply treated effluent at designated locations and under specific conditions. Land application permits for industrial and domestic wastewater facilities may be covered under SC Regulation 61-9, Sections 503, 504, or 505 (SCDHEC, 2011). It is recognized that there may be operating, regulated land application sites located in the Pocotaligo River and tributaries watersheds. If properly managed, waste is applied at a rate that ensures pollutants will be incorporated into the soil or plants and pollutants will not enter streams. Land applications sites can be a source of pathogen loadings and stream impairment if not properly managed. Similar to AFO land application sites, the permitted land application sites described in this section are not allowed to directly discharge to Pocotaligo River and its tributaries. Direct discharges from land applications sites to surface waters of the State are illegal and are subject to enforcement actions by SCDHEC.

3.2.4 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.

Illicit sewer connections into storm drains result in direct discharges of sewage via the storm drainage system outfalls. Monitoring of storm drain outfalls during dry weather is needed to document the presence or absence of sewage in the drainage systems. Besides the SCDOT, Sumter County, The City of Sumter, and the Shaw Air Force Base, there are currently no entities subject to an NPDES MS4 permit within or with impact to the Pocotaligo River and tributaries watersheds.

3.2.5 Failing Septic Systems

Failing, leaking or non-conforming septic systems, however, can be a major contributor of *E. coli* and other FC bacteria to the Pocotaligo River and tributaries watersheds. 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.

3.2.5.1. Septic Systems in Reach 1 of the Pocotaligo River Watershed (Station RS-03345)

According to GIS information, there are no community sewer systems serving Reach 1 of the Pocotaligo River Watershed. And, based on the 2010 U.S. population census, there are 315 households within the 1015.5-acre watershed. Therefore, assuming one septic tank per household, it is estimated that there are approximately 315 septic tanks within this reach. This translates into 0.31 septic tanks per watershed acre. At the time of the development of these TMDLs, their status in relation to function was unknown.

3.2.5.2. Septic Systems in Reach 2 of the Pocotaligo River Watershed (Station PD-202)

According to GIS information, sewer lines for the City of Sumter extend into the eastern portion of the 99,549.8-acre Reach 2 of the Pocotaligo River Watershed. Based on current GIS information, 2011 Bing aerial photography of the watershed, and based on the 2010 U.S. population census, there are 12,351 households within the reach not served by the City of Sumter sewer system or any other community sewer system. Therefore, assuming one septic tank per household, it is estimated that there are approximately 12,351 septic tanks within the reach. This translates into 0.12 septic tanks per watershed acre. At the time of the development of these TMDLs, their status in relation to function was unknown.

3.2.5.3. Septic Systems in Reach 3 of the Pocotaligo River Watershed (Station RS-07192)

According to GIS information, sewer lines for the City of Manning extend into the southern portion of the 4852.4-acre Reach 3 of the Pocotaligo River Watershed. Based on GIS information, 2011 Bing aerial photography of the watershed, and based on the 2010 U.S. population census, there are 124 households within the reach not served by the City of Manning sewer system or any other community sewer system. Therefore, assuming one septic tank per household, it is estimated that there are approximately 124 septic tanks within the reach. This translates into 0.03 septic tanks per watershed acre. At the time of the development of these TMDLs, their status in relation to function was unknown.

3.2.5.4. Septic Systems in Reach 4 of the Pocotaligo River Watershed (Station PD-115)

According to GIS information, sewer lines for the City of Pinewood extend into the western edge of the 75,139.6-acre Reach 4 of the Pocotaligo River Watershed. And, sewer lines for the City of Manning extend into the eastern edge of the reach. Based on GIS information, 2011 Bing aerial photography of the watershed, and based on the 2010 U.S. population census, there are 2054 households within the reach not served by the sewer systems for the Cities of Pinewood or Manning, or any other community sewer system. Therefore, assuming one septic tank per household, it is estimated that there are approximately 2054 septic tanks within the reach. This translates into 0.03 septic tanks per watershed acre. At the time of the development of these TMDLs, their status in relation to function was unknown.

3.2.5.5. Septic Systems in the Juneburn Branch Tributary Watershed (Station RS-08232)

According to GIS information, there are no community sewer systems serving the Juneburn Branch Tributary Watershed. And, based on the 2010 U.S. population census, there are 7 households within the 334.0-acre watershed. Therefore, assuming one septic tank per household, it is estimated that there are

approximately 7 septic tanks within the watershed. This translates into 0.02 septic tanks per watershed acre. At the time of the development of these TMDLs, their status in relation to function was unknown.

3.2.5.6. Septic Systems in the Deep Creek Watershed (Station RS-03347)

According to GIS information, there are no community sewer systems serving the Deep Creek Watershed. And, based on the 2010 U.S. population census, there are 126 households within the 5513.4-acre watershed. Therefore, assuming one septic tank per household, it is estimated that there are approximately 126 septic tanks within the watershed. This translates into 0.02 septic tanks per watershed acre. At the time of the development of these TMDLs, their status in relation to function was unknown.

3.2.6 Urban and Suburban Runoff

Dogs, cats, and other domesticated pets are the primary source of *E. coli* and other FC bacteria deposited on the urban landscape. There are also 'urban' wildlife, squirrels, raccoons, pigeons, and other birds, all of which contribute to the FC bacteria or *E. coli* load. Urban runoff is considered to be negligible within the Pocotaligo River and tributaries watersheds, except for Reach 2 of the Pocotaligo River Watershed (WQM Station PD-202). Based on current GIS information, there are no incorporated areas in Reaches 1 and 3 of the Pocotaligo River Watershed, or in the Juneburn Branch Tributary and Deep Creek Watersheds. Only approximately 2% of Reach 4 of the Pocotaligo River Watershed consists of incorporated areas, including The City of Manning, The City of Pinewood, and the Community of Paxville. However, approximately 36% of the area in Reach 2 of the Pocotaligo River Watershed is incorporated. Incorporated areas in Reach 2 of the watershed include: **a)** the Shaw Air Force Base; **b)** The City of Sumter; **c)** The City of South Sumter; **d)** the community of Dalzell; **e)** the community of Wedgewood; and, **f)** the community of Privateer.

Similar to regulated MS4s, potentially designated MS4 entities (Federal Register, FR 64, Appendix 7.) or other unregulated MS4 communities located in the Pocotaligo River and tributaries watersheds may have the potential to contribute pollutant loadings in stormwater runoff. Portions of Reach 2, and a portion of Reach 4 of the Pocotaligo River Watershed lies within the Manchester State Forest and are expected to have a low potential for growth.

4.0 TURKEY CREEK AND NASTY BRANCH REVISED TMDLs

4.1 Background

4.1.1 September 2005 Total Maximum Daily Loads

The SCDHEC placed the following three (3) WQM monitoring stations in the Pocotaligo Swamp watershed(s) on South Carolina's 2004 §303(d) list for impairment due to FC bacteria exceedances: **a)** PD-098 in Turkey Creek; **b)** PD-040 in Turkey Creek; and, **c)** PD-239 in Nasty Branch. Table 12 summarizes the data supporting the decision to place these three WQM stations on the 2004 §303(d) list.

Table 12. FC Bacteria Observed at WQM Stations PD-098, PD-040, PD-239 (1998-2002)[1]

Station	Waterbody	Number of Samples	Maximum Concentration Cfu/100 ml	Number of Samples >400/100mL	% Samples Exceed WQS
PD-098	Turkey Creek	9	1200	6	67%
PD-040	Turkey Creek	8	1900	6	75%
PD-239	Nasty Branch	9	710	2	22%

[1]Source: United States Environmental Protection Agency (USEPA), Region IV. 2005

As a result of listing WQM stations PD-098, PD-040, and PD-239 on the 2004 §303(d) list, FC bacteria TMDLs were developed for these stations by Parson Corporation under a USEPA contract (SCDHEC Technical Report No.: 029-05) (Table 13). These TMDLS were approved by USEPA, Region IV in September 2005. The referenced TMDLs established the following percent reductions to meet LAs at the following WQM stations based on stream flows during the respective critical conditions: **a)** 94% reduction at PD-098, based on stream flows during moist conditions; **b)** 75% reduction at PD-040, based on stream flows during mid-range conditions; and, **c)** 5% reduction at PD-239, based on stream flows during moist conditions.

Table 13. Total Maximum Daily Loads for Nasty Branch and Turkey Creek, September 2005[1]

Station	Existing FC Load (CFU/day)[2]	TMDL (CFU/day)	Margin of Safety (MOS) (CFU/day)	Load Allocation (LA) (CFU/day)	Reduction To Meet LA (Percent)	Reduction to Meet LA (CFU/day)	Critical Conditions
PD-098	4.31E+11 CFU	2.84E+10 CFU	1.42E+09 CFU	2.70E+10 CFU	94	4.03E+11 CFU	Moist
PD-040	1.37E+11 CFU	3.62E+10 CFU	1.81E+09 CFU	3.44E+10 CFU	75	1.03E+11 CFU	Mid-Range
PD-239	1.63E+11 CFU	1.62E+11 CFU	8.13E+09 CFU	1.54E+11 CFU	5	9.00E+09 CFU	Moist

[1]Source: USEPA, Region IV. 2005

[2]Existing FC Load (CFU/day) at the time of TMDL development in September 2005

4.1.2 The Turkey Creek Watershed-Based Plan Development

In 2012 Sumter County, SC was awarded a Section 319 grant from SCDHEC to develop a watershed-based plan for the watersheds draining through WQM stations PD-098 and PD-040 in Turkey Creek (Sumter County, 2012). The Turkey Creek Watershed-Based Plan (TCWBP) designates Sumter County as the lead organization in the development and implementation of the plan, and lists the City of Sumter, USDA Natural Resources Conservation Service, Clemson University Services, business leaders, environmental groups, and homeowners associations as cooperating organizations in the development and implementation of the plan. The TCWBP describes the Turkey Creek watersheds, and outlines strategies for implementing the plan.

According to the TCWBP grant workplan, the goal is to identify current and potential threats to water quality within the Turkey Creek watersheds (Sumter County, 2012). The Sumter County Stormwater Department and the City of Sumter Stormwater Department intend to utilize the TCWBP to identify the locations and types of Best Management Practices (BMPs) and other projects that will be the most effective in reducing FC loading in Turkey Creek. The TCWBP will be completed in Fall 2013.

4.1.3 Watershed Descriptions

Under contract by the USEPA, Parsons Corporation developed FC bacteria TMDLs for the following three (3) WQM stations in the Pocotaligo Swamp, Sumter County, South Carolina in September 2005: **a)** PD-098 in Turkey Creek; **b)** PD-040 in Turkey Creek; and, **c)** PD-239 in Nasty Branch (SCDHEC Technical Report Number: 029-05) (USEPA, Region IV, 2005). These stations are identified in Figure 9 and Table 14.

Portions of the watersheds for the Turkey Creek WQM stations are located within the Cities of Sumter, East Sumter and South Sumter, and are hydrologically connected. Flows through WQM Station PD-098 eventually flow through WQM Station PD-040 in Turkey Creek. Therefore, in this TMDL document the watershed for station PD-098 will be referred to as Reach 1 of the Turkey Creek Watershed, and the watershed for station PD-040 will be referred to as Reach 2 of the Turkey Creek Watershed. A portion of the Nasty Branch watershed is located in the community of Privateer. The Nasty Branch watershed is not hydrologically connected to the Turkey Creek watersheds. However, all three watersheds are located within the watershed of Reach 2 of the Pocotaligo River Watershed (with terminal WQM Station PD-202). And, flows from all three watersheds penultimately flow through WQM Station PD-202, and ultimately through WQM Station PD-115. All three watersheds are located in the Southeastern Plains ecoregion of the State.

Figure 9. Water Quality Monitoring Stations PD-098, PD-040, and PD-239 With TMDLs Developed for FC Impaired Waters in September 2005

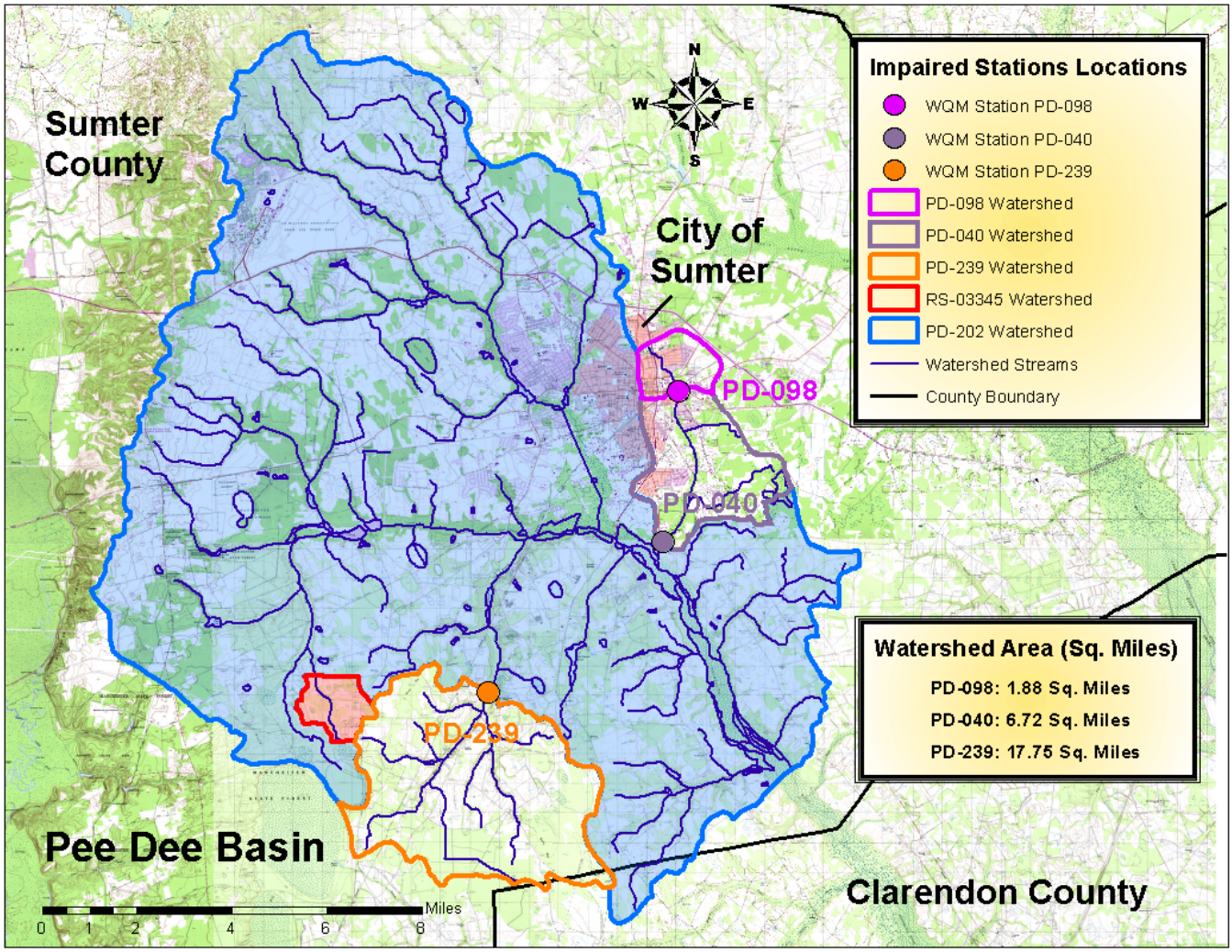


Table 14. Water Quality Monitoring Stations PD-098, PD-040, and PD-239 With FC Impaired Waters

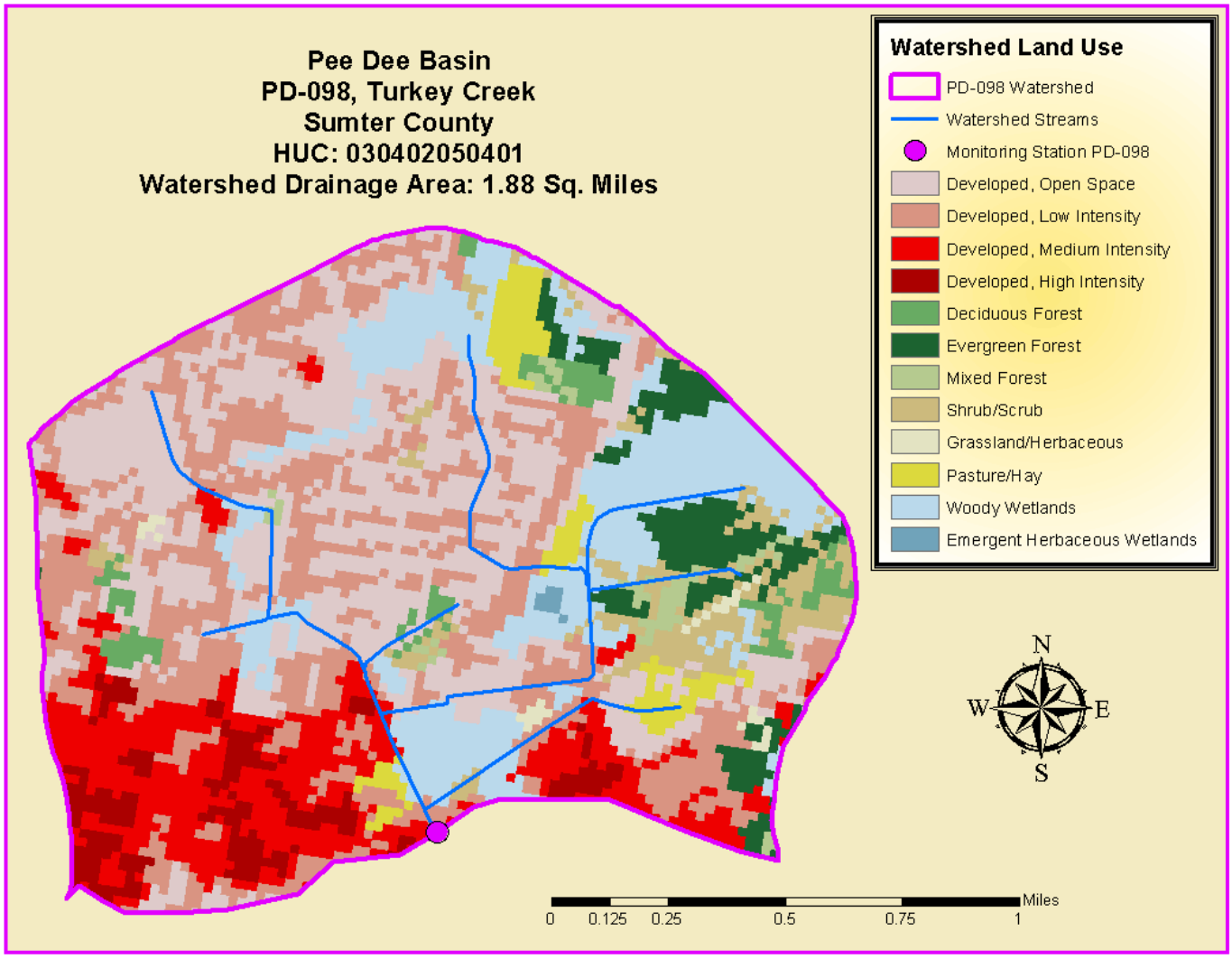
Waterbody	Station Number	Description
Turkey Creek	PD-098	Turkey Creek at Liberty Street in the City of Sumter above Santee Print Works
Turkey Creek	PD-040	Turkey Creek at U.S. Route 521 in the City of South Sumter
Nasty Branch	PD-239	Nasty Branch at County Route S-43-251 7.5 miles southwest of the City of Sumter in Sumter County

Reach 1 of the Turkey Creek Watershed (Terminal WQM Station PD-098). This watershed covers a drainage area of 1.88 mi^2 (1203.66 acres) that drains into Turkey Creek and its tributaries from near the intersection of Lee Street and Colonial Drive in the City of Sumter in a general southern fashion to the WQM Station PD-098 in Turkey Creek at Liberty Street in the city above Santee Print Works. According to the

TCWBP grant workplan, the headwaters of Turkey Creek begin in an urbanized area in this watershed, with large volumes of urban runoff flowing into the creek (Sumter County, 2012). There are approximately 4.5 stream miles in this reach. The streams are all classified as freshwater (FW-SP).

Land use within Reach 1 of the Turkey Creek Watershed is predominately Open Space Development (27.34%), and Low Intensity Development (23.94%) (Figure 10, Table 15). Developed lands (residential, commercial, industrial, or open urban space) comprise the majority (i.e., 68.49%) of the reach (Table 15). At the time of the development of these TMDLs, there were no active animal feeding operations in the reach.

Figure 10. Land Use Use Diagram for Reach 1 of the Turkey Creek Watershed (WQM Station PD-098)



Reach 2 of the Turkey Creek Watershed (Terminal WQM Station PD-040). This watershed covers a drainage area of 6.72 mi^2 (4303.15 acres) that drains into Turkey Creek and its tributaries from WQM Station PD-098 in Turkey Creek at Liberty Street in the City of Sumter in a general southern fashion to the WQM Station PD-040 in Turkey Creek at U.S. Route 521 in the City of South Sumter. There are approximately 17.5 stream miles in this reach. The streams are all classified as freshwater (FW or FW-SP).

Table 15. Land Use in Reach 1 of the Turkey Creek Watershed (WQM Station PD-098) (Derived from National Land Cover Database (NLCD) 2006)

Description	Area (Acres)	Area (Mile^2)	Percent
Developed, Open Space	329.14	0.51	27.34%
Developed, Low Intensity	288.22	0.45	23.94%
Woody Wetlands	174.58	0.27	14.50%
Developed, Medium Intensity	153.23	0.24	12.73%
Evergreen Forest	59.60	0.09	4.95%
Shrub/Scrub	56.49	0.09	4.69%
Developed, High Intensity	54.04	0.08	4.49%
Pasture/Hay	36.03	0.06	2.99%
Deciduous Forest	29.13	0.05	2.42%
Mixed Forest	14.46	0.02	1.20%
Grassland/Herbaceous	7.12	0.01	0.59%
Emergent Herbaceous Wetlands	2.00	0.00	0.17%
Totals	**1204.04**	**1.88**	**100.00%**

Land use within Reach 2 of the Turkey Creek Watershed is predominately Woody Wetlands (26.19%), and Open Space Development (20.13%) (Figure 11, Table 16). Developed lands (residential, commercial, industrial, or open urban space) comprise approximately 43.42% of the reach (Table 16). At the time of the development of these TMDLs, there were no active animal feeding operations in the reach.

According to the TCWBP, the Turkey Creek watersheds (including Reach 1 and Reach 2 described in this TMDL document) are a primary stormwater conveyance channel for much of the City of Sumter and urbanized Sumter County (Sumter County, 2012).

From WQM Station PD-040, Turkey Creek drains into the Pocotaligo River approximately 0.5 mile south of the City of South Sumter.

The Nasty Branch Watershed (Terminal WQM Station PD-239). This watershed covers a drainage area of 17.76 mi^2 (11,368.78 acres) that drains into Nasty Branch and its tributaries from near the intersection of SC Route 120 and Transmission Lane north of the Privateer community in a general northeastern fashion to the WQM Station PD-239 in Nasty Branch at County Route S-43-251 southwest of the City of Sumter. There are approximately 47.1 stream miles in the Nasty Branch Watershed. The streams are all classified as freshwater (FW).

Land use within the Nasty Branch Watershed is predominately Woody Wetlands (37.95%), and Pasture/Hay (21.70%) (Figure 12, Table 17). Developed lands only comprise approximately 3.97% of the watershed (Table 17). At the time of the development of these TMDLs, there were four (4) active animal feeding operations in the watershed (Table 18).

From the PD-239 WQM station, Nasty Branch drains into Cane Savannah Creek approximately 2 miles north of the Privateer community.

Figure 11. Land Use Use Diagram for Reach 2 of the Turkey Creek Watershed (WQM Station PD-040)

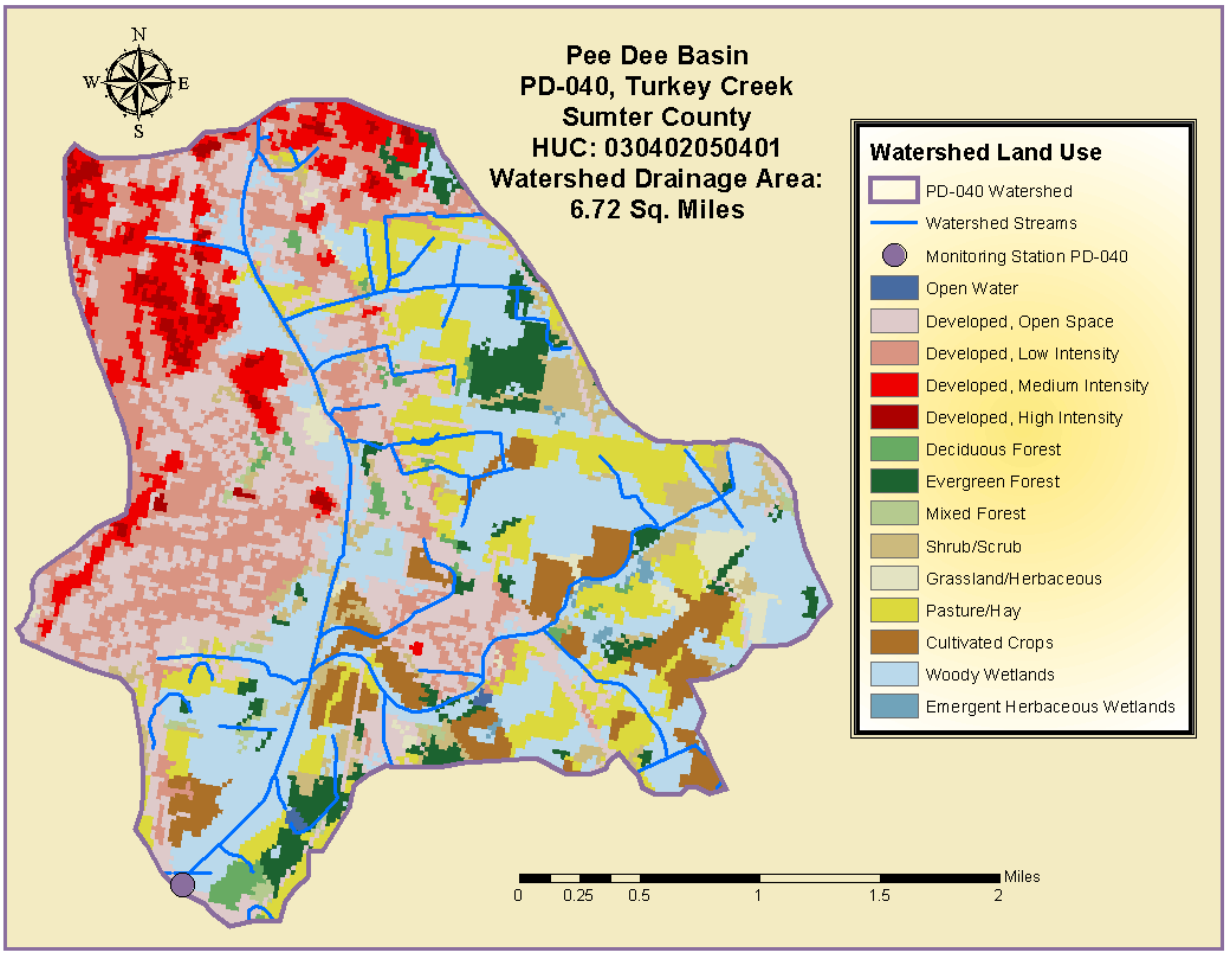


Table 16. Land Use in Reach 2 of the Turkey Creek Watershed (WQM Station PD-040) (Derived from National Land Cover Database (NLCD) 2006)

Description	Area (Acres)	Area (Mile^2)	Percent
Woody Wetlands	1127.31	1.76	26.19%
Developed, Open Space	866.45	1.35	20.13%
Developed, Low Intensity	668.74	1.04	15.54%
Pasture/Hay	478.15	0.75	11.11%
Developed, Medium Intensity	273.77	0.43	6.36%
Cultivated Crops	265.98	0.42	6.18%
Shrub/Scrub	206.60	0.32	4.80%
Evergreen Forest	192.59	0.30	4.47%
Grassland/Herbaceous	69.83	0.11	1.62%
Developed, High Intensity	60.05	0.09	1.40%
Deciduous Forest	49.59	0.08	1.15%
Mixed Forest	26.46	0.04	0.61%
Emergent Herbaceous Wetlands	12.01	0.02	0.28%
Open Water	6.45	0.01	0.15%
Totals	**4303.99**	**6.72**	**100.00%**

Figure 12. Land Use Use Diagram for the Nasty Branch Watershed (WQM Station PD-239)

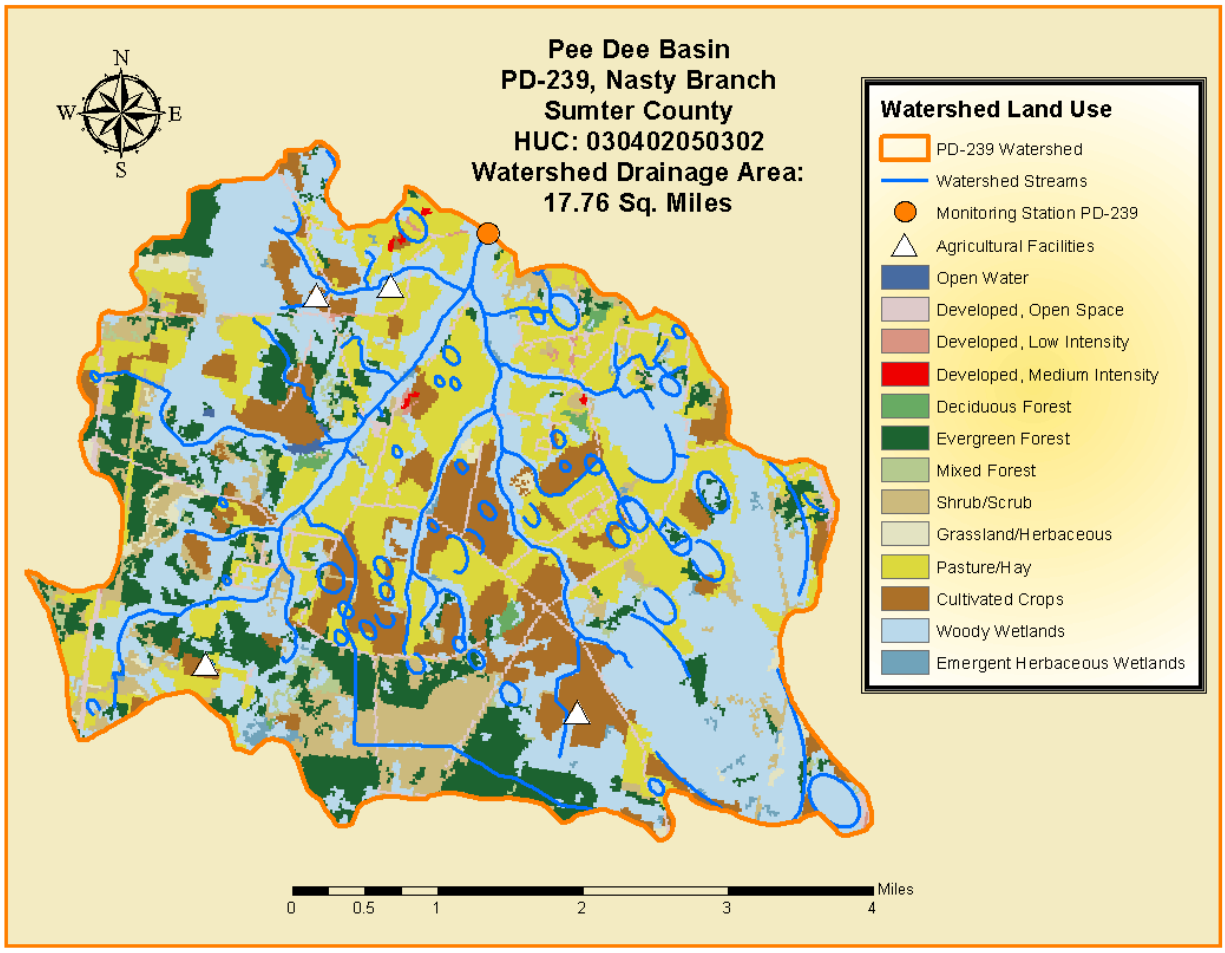


Table 17. Land Use in the Nasty Branch Watershed (WQM Station PD-239)
(Derived from National Land Cover Database (NLCD) 2006)

Description	Area (Acres)	Area (Mile^2)	Percent
Woody Wetlands	4314.00	6.74	37.95%
Pasture/Hay	2466.79	3.85	21.70%
Cultivated Crops	1470.02	2.30	12.93%
Evergreen Forest	1414.43	2.21	12.44%
Shrub/Scrub	915.15	1.43	8.05%
Developed, Open Space	415.65	0.65	3.66%
Grassland/Herbaceous	108.75	0.17	0.96%
Mixed Forest	102.75	0.16	0.90%
Emergent Herbaceous Wetlands	63.38	0.10	0.56%
Deciduous Forest	46.04	0.07	0.40%
Developed, Low Intensity	24.46	0.04	0.22%
Open Water	16.46	0.03	0.14%
Developed, Medium Intensity	10.90	0.02	0.10%
Totals	**11,368.78**	**17.76**	**100.00%**

Table 18. Active Animal Feeding Operations with Regulated Structures or Activities Within the Nasty Branch Watershed

Downstream Impaired Station	AFO Permit	Facility	Type of Livestock	Number of Permitted Animals
PD-239	ND0071188	Bayview Farms	Poultry (Broilers)	140,000
PD-239	ND0068101	Poole Swine Facility (A&J Farm #3)	Swine	1000
PD-239	ND0070106	Sumter Provisions	Swine	12
PD-239	ND0071196	Triple B Poultry	Poultry (Broilers)	68,000

4.1.4 Water Quality Standard

The impaired streams segments in Turkey Creek at WQM Stations PD-098 and PD-040 are designated as Class Freshwater (FW-SP) in SC Regulation 61-69 (2012). The impaired stream segment in Nasty Branch at WQM Station PD-239 is designated as Class Freshwater (FW). (See Section 1.3 of this TMDL document for the description, uses, and the FC standards applicable to waters with these classifications.)

4.2 Water Quality Assessment and Total Maximum Daily Load Revision

Water Quality Assessment: Water Quality Monitoring Data. Additional monitoring data has been compiled for WQM stations PD-098, PD-040, and PD-239 in the Pocotaligo Swamp since the USEPA, Region IV approved the September 2005 TMDLs for those stations. An examination of that monitoring data from 1999 through 2008 shows that South Carolina's WQS for recreational use in freshwaters for FC bacteria continue to be exceeded (see Section 1.3 of this TMDL document for WQS). Table 19 provides a summary of the number of samples collected, number of exceedences and exceedence percentage for these three stations from 1999 through 2008.

Table 19. FC WQS Exceedence Summary for Impaired Stations PD-098, PD-040, PD-239 (1999-2008)

Station	Waterbody	Number of Samples	Number of Samples >400/100mL	% Samples Exceed WQS
PD-098	Turkey Creek	29	23	79%
PD-040	Turkey Creek	23	14	61%
PD-239	Nasty Branch	32	8	25%

Water Quality Assessment: Correlation Between Fecal Coliform Bacteria and Rainfall. Table 20 below, and graphs in Appendix A illustrate the relationship between precipitation and FC by data and date for WQM Stations PD-098, PD-040, and PD-239. The graphs and Table 20 show that there is a weak positive correlation between the amount of precipitation and the temporal FC exceedences of water quality standards for station PD-098 (r = 0.236) and station PD-239 (r = 0.217). There is little or no correlation between the amount of precipitation and the temporal FC exceedences for station PD-040 (r = 0.168).

Table 20. Correlations Between Rainfall and FC in the Turkey Creek and Nasty Branch Watersheds

Station	Waterbody	Correlation Coefficient (r)	Coefficient of Determination (r^2)
PD-098	Turkey Creek	0.236	0.056
PD-040	Turkey Creek	0.168	0.028
PD-239	Nasty Branchy	0.217	0.047

Total Maximum Daily Load Revision. Stream flows through WQM stations PD-098, PD-040, and PD-239 flow through two (2) WQM stations for which TMDLs are developed in this TMDL document, flowing penultimately through station PD-202, and ultimately through station PD-115 (see Figure 1b in Section 1.2 of this TMDL document). And, as mentioned earlier in this TMDL document, South Carolina has recently adopted a change from FC bacteria to *E. coli* as a recreational use standard in all freshwaters. Because activities in the watersheds for WQM monitoring stations PD-098, PD-040, and PD-239 may affect the attainment of WQS at stations PD-202 and PD-115, the September 2005 TMDLs for stations PD-098, PD-040, and PD-239 have been revised based on the 1999 through 2008 monitoring data at these three stations (Table 26). In addition to revising the September 2005 TMDLs for FC bacteria impairments at these three stations, this TMDL document also includes converted *E. coli* TMDLs for these stations for the purposes of implementation of the current recreational use standard.

4.3 Source Assessment and Load Allocation

4.3.1 Point Sources

Continuous Point Sources. See Section 3.1 of this TMDL document for a detailed discussion on point sources. There are no NPDES permitted continuous point sources of FC in the Turkey Creek and Nasty Branch Watersheds. Future NPDES-permitted discharges of *E.coli* and other FC bacteria in the Turkey Creek and Nasty Branch watersheds are required to implement the WLAs and demonstrate consistency with the assumptions and requirements of the TMDLs in this document.

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/or regulated under South Carolina Water Pollution Control Permits: R61-9, §122.26(b)(4),(7),(14) - (21) (SCDHEC, 2011). Section 3.1.2 in this TMDL document discusses the potential for MS4s and other non-continuous point sources to contribute *E. coli* and other FC bacteria pollutant loading to impaired water segments, and the responsibilities of NPDES permitted non-continuous point sources in complying with the TMDLs in this document. The only purpose of this section is to identify MS4s and other non-continuous point sources in the Turkey Creek and Nasty Branch Watersheds.

There are three MS4s in the Turkey Creek and Nasty Branch watersheds: **a)** The SCDOT; **b)** Sumter County; and, **c)** The City of Sumter (Figure 13). The SCDOT is the only large MS4 in the watersheds. There are no medium MS4s in the watersheds. The other two designated MS4s are small MS4s.

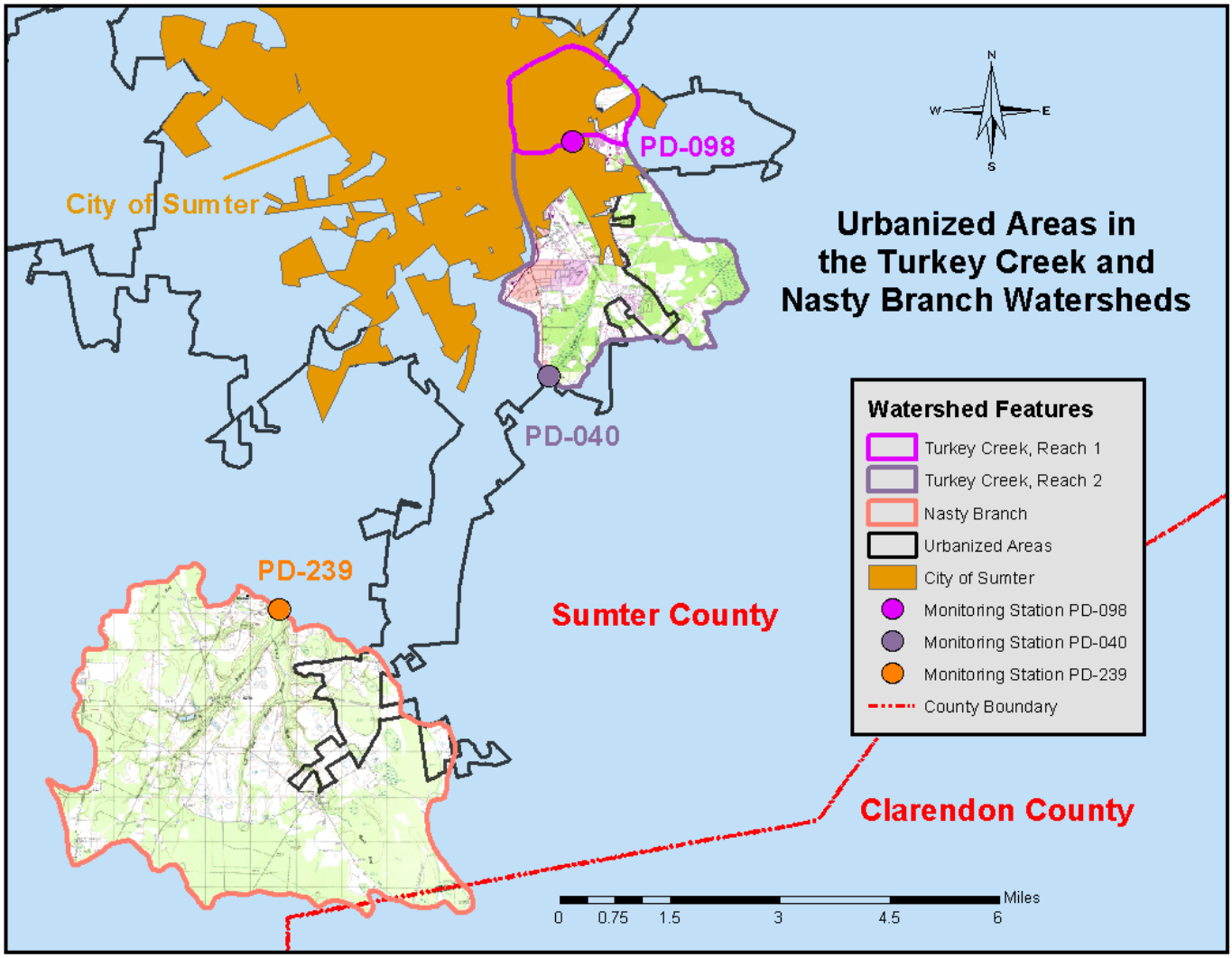
The SCDOT operates under the SCDHEC's NPDES MS4 Permit SCS040001 and owns and operates roads within Turkey Creek and Nasty Branch watersheds. Based on current GIS information (available at the time of TMDL development), Table 21 gives the miles of SCDOT roads within the watersheds. Also, based on GIS information, there are currently no SCDOT facilities located in the watersheds. And, based on information provided on the SCDOT website, there are no highway rest areas in the watershed areas.

Table 21. SCDOT Maintained Road Miles in the Turkey Creek and Nasty Branch Watersheds

Watershed	Station	Road Miles
Turkey Creek, Reach 1	PD-098	21.9
Turkey Creek, Reach 2	PD-040	45.7
Nasty Branch	PD-239	27.6

Sumter County, a small MS4, discharge stormwater in urbanized areas in the Turkey Creek and Nasty Branch watersheds (Figure 13). The county operates under the SCDHEC's NPDES MS4 Permit SCR038503. The City of Sumter, the other small MS4, discharge stormwater in urbanized areas in the Turkey Creek watersheds (Figure 13). The city operates under the SCDHEC's NPDES MS4 Permit SCR038502.

Figure 13. Urbanized Areas in the Turkey Creek and Nasty Branch Watersheds as Designated by the U.S. Bureau of Census



Industrial facilities covered by the SCDHEC's NPDES Storm Water Industrial General Permit (SCR000000), and construction activities covered by the SCDHEC's NPDES Stormwater Construction General Permit (SCR100000) in the Turkey Creek and Nasty Branch watersheds, and where the regulated stormwater discharges from these industrial and construction activities may have the potential to affect water quality of a water body with a TMDL in this document, the Storm Water Pollution Prevention Plan (SWPPP) for the site must address any pollutants of concern and adhere to any waste load allocations in the TMDLs.

The Department acknowledges that progress with the assumptions and requirements of the TMDL by MS4s is expected to take one or more permit iteration. Progress towards 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.

4.3.2 Nonpoint Sources

Section 3.2 in this TMDL document discusses the various types of non-point sources, and the potential for those sources to contribute *E. coli* and other FC bacteria pollutant loading to impaired water segments.

That section specifies that non-point sources located in unregulated areas (outside of NPDES permitted areas) are subject to the LAs and not the WLAs in this TMDL document. The only purpose of this section is to identify such non-point sources in the Turkey Creek and Nasty Branch Watersheds.

Wildlife. According to the 2008 SCDNR study, there are an estimated 15 to 30 deer per square mile in Sumter County in the vicinity of the Turkey Creek and Nasty Branch watersheds (SCDNR 2008) (see Section 3.2.1 of this TMDL document). The study estimated deer density based on suitable habitat (forests, croplands, and pastures). The FC production rate for deer has been shown to be 347 x 10^6 cfu/head-day in a study conducted by Yagow (1999), of which only a portion will enter the Turkey Creek and Nasty Branch watersheds.

Agricultural Activities: Agricultural Animal Facilities. There are currently four (4) active AFOs with regulated structures or activities in the Nasty Branch Watershed (Figure 12 and Table 18). These facilities consist of two (2) poultry facilities and two (2) swine facilities, two (2) turkey facilities. There may also be land application sites associated with these facilities. There are no regulated AFOs in the Turkey Creek watersheds.

Agricultural Activities: Grazing Animals. Based on the USDA's National Agricultural Statistics Service and the NLCD 2006, there are 0.14 cattle per acre of pastureland in Sumter County (see Section 3.2.2.2 of this TMDL document). Assuming an even distribution of cattle across pastureland in Sumter County, and based on the acreage of pastureland in the Turkey Creek and Nasty Branch watersheds, Table 22 gives an estimate of the number of cattle in the watersheds. (**Note:** According to the NLCD 2006, there is no pastureland in the Clarendon County portion of the Nasty Branch Watershed). Cattle on average produce some 1.0E+11 cfu/day per animal of FC bacteria (ASAE 1998). Accordingly, Table 22 gives the average count for FC bacteria produced each day by cattle in the watersheds.

Table 22. Cattle FC per Day in the Turkey Creek and Nasty Branch Watersheds

Downstream Impaired Station	County	Pasture Area (Acre) per Watershed	Cattle per Watershed	Cattle Fecal Coliform, cfu/day
PD-098	Sumter	36.03	5.04	5.04E+11
PD-040	Sumter	478.15	66.94	6.69E+12
PD-239	Sumter	2466.79	345.35	3.45E+13

Land Application of Industrial, Domestic Sludge or Treated Wastewater. It is recognized that there may be operating, regulated land application sites located in the Turkey Creek and Nasty Branch watersheds. If properly managed, waste is applied at a rate that ensures pollutants will be incorporated into the soil or plants and pollutants will not enter streams.

Leaking Sanitary Sewers and Illicit Discharges. Illicit sewer connections into storm drains result in direct discharges of sewage via the storm drainage system outfalls. Besides the SCDOT, Sumter County, and the City of Sumter, there are currently no entities with an NPDES MS4 permit within the Turkey Creek and Nasty Branch watersheds, and which are subject to illicit sewer connections into storm drains.

Failing Septic Systems. Failing, leaking or non-conforming septic systems can be a major contributor of *E. coli* and other FC bacteria to the Turkey Creek and Nasty Branch watersheds. According to the TCWBP, there are 0.03 septic tanks per watershed acre in Reach 1 of the Turkey Creek Watershed; and there are 0.11 septic tanks per watershed acre in Reach 2 of the Turkey Creek Watershed (Sumter County, 2012).

According to GIS information, sewer lines for the City of Sumter extend into the northern portion of the 11,368.8-acre Nasty Branch Watershed. Based on GIS information, 2011 Bing aerial photography of the watershed, and based on the 2010 U.S. population census, there are 1043 households within the watershed

not served by the City of Sumter sewer system or any other community sewer system. Therefore, assuming one septic tank per household, it is estimated that there are approximately 1043 septic tanks within the watershed. This translates into 0.09 septic tanks per watershed acre.

However, at the time of the development of these TMDLs, the status of the septic tanks in the Turkey Creek and Nasty Branch watersheds in relation to function was unknown.

Urban Runoff. Domesticated pets are the primary source of *E. coli* and other FC bacteria deposited on the urban landscape. 'Urban' wildlife may also contribute to the FC bacteria or *E. coli* load (see Section 3.2.6 of this TMDL document). According to the TCWBP, the majority of the Turkey Creek watersheds is urbanized (Sumter County, 2012). Based on current GIS information, approximately 93% of Reach 1 of the Turkey Creek Watershed consists of incorporated areas, including areas in the City of Sumter, and the City of East Sumter. Approximately 45% of Reach 2 of the Turkey Creek Watershed consists of incorporated areas, including areas in the Cities of Sumter, East Sumter, and South Sumter. And, approximately 31% of the Nasty Branch Watershed consists of incorporated areas in the Privateer community.

5.0 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. Three (3) United States Geological Survey (USGS) gages were used for collecting "real-time" flow data for the Pocotaligo River and tributaries TMDLs, based primarily on the size of the drainage area to the downstream gage, and secondarily on the general land use in the drainage area. The USGS gage used for collecting flow data for Reach 2 and Reach 4 of the Pocotaligo River Watershed (WQM Stations PD-202 and PD-115) was the North Fork Edisto River gage at Orangeburg, SC (Gage Number: 02173500). This gage has a drainage area of 683 square miles, and began recording daily flows in 1938 and provides the flow data required to establish flow duration curves for these two impaired stations.

For example, flow data for an 11-year period (January 1, 1999 to December 31, 2009) from the USGS Orangeburg gage was used to establish flow duration curve for Reach 4 of the Pocotaligo River Watershed. The records for this period were complete (i.e., no missing dates). The drainage area of the sampling station was delineated using USGS topographic maps using 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 gage. For example, the Orangeburg gage records flow from 683 square miles (sq mi). The cumulative drainage area for the Reach 4 of the Pocotaligo River Watershed at monitoring station PD-115 (in the Pocotaligo River at the City of Manning) is approximately 308.4 sq mi, or 45.2% of the area drained at the Orangeburg gage. Mean daily flow for the PD-115 monitoring location was assumed to be 45.2% of the daily flow at the Orangeburg gage. Figure 1.a provides an illustration of monitoring and gage locations along with a summary of drainage area statistics used to establish flows at un-gaged monitoring stations.

Additional adjustment was necessary in order more accurately estimate stream flow at sites PD-115 and PD-202. The City of Sumter Pocotaligo WWTP (NPDES SC0027707) is a major domestic wastewater treatment plant located upstream of the two water quality monitoring sites. It is believed that flow contributions from this facility may be large enough to influence downstream flow estimates, particularly dry conditions. To better establish existing instream conditions, long-term average SC0027707 facility flow data were added to the estimated time series described in the previous paragraph.

The USGS gage used for collecting flow data for Reach 1 and Reach 3 of the Pocotaligo River Watershed, and for the Juneburn Branch Tributary and Deep Creek Watersheds (WQM Stations RS-03345, RS-07192, RS-08232, and RS-03347) was the McTier Creek (Rd 209) gage near Monetta, SC (Gage Number: 02172300). This gage has a drainage area of 15.6 square miles, and began recording daily flows in 1995 and provides the flow data required to establish flow duration curves for these four impaired stations. The method described above was used to establish the flow duration curves for these four watersheds. Flow data for a 10-year period (January 1, 2002 to December 31, 2011) was used to establish the curves.

And, the USGS gage used for collecting flow data for the Nasty Branch and Turkey Creek Watersheds (WQM Stations PD-098, PD-040, and PD-239) was the Gills Creek at Columbia, SC gage (Gage Number: 02169570). This gage has a drainage of 59.6 square miles, and began recording daily flows in 1966. Flow data for a 10-year period (January 1, 1999 to December 31, 2008) was used to establish the curves.

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. The 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, former 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 former water quality criterion 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 PD-115 is presented in Figure 14 as an example. The load-duration curves for the other five stations are presented in Appendix B.

Because SC has recently adopted a change from FC bacteria to *Escherichia coli (E. coli)* bacteria as a recreational use standard in all freshwaters, this TMDL document also includes converted *E. coli* TMDLs for the purposes of implementation of the current recreational use standard. For these calculations, the daily flow and a unit conversion factor were used and the water quality target was set at 332 MPN/100ml for the instantaneous criterion, which is five percent lower than the water quality criteria of 349 MPN/100ml. A five percent explicit Margin of Safety (MOS) was reserved from the water quality criteria in developing target load-duration curves.

Target loads in freshwaters impaired for *E. coli* may alternatively be calculated as the ratio of *E.coli* MPN/100 ml to FC bacteria cfu/100 ml or (349/400=0.8725). This conversion is derived from an established relationship between FC bacteria and *E. coli* WQS in freshwaters determined during the 2009 Pathogen Indicator Study (PIS).

At the time of TMDL development, there were no *E. coli* data available to consider for determining percent reductions necessary to meet the calculated TMDLs. Therefore, all percent reductions recommended in this document are based on existing FC bacteria data. For the purposes of establishing these TMDLs, FC bacteria percent reductions should also be representative of reductions necessary to meet the *E. coli* WQS.

For all curves, including Figure 14, 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 RS-03345, RS-07192, RS-08232 and RS-03347, 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 PD-202 and PD-115, existing and target loadings were calculated using the following equations.

Existing Load = (Mid-Point Flow in Each Hydrologic Category + NPDES SC0027707 Long-Term Average Discharge Monitoring Report Monthly Average Flow) x 90th Percentile FC Concentration x 10000

Target Load = (Mid-Point Flow in Each Hydrologic Category + NPDES SC0027707 Permitted Flow (15MGD = 23.21 cfs)) x 380 (WQ criterion minus a 5% MOS) x 10000

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

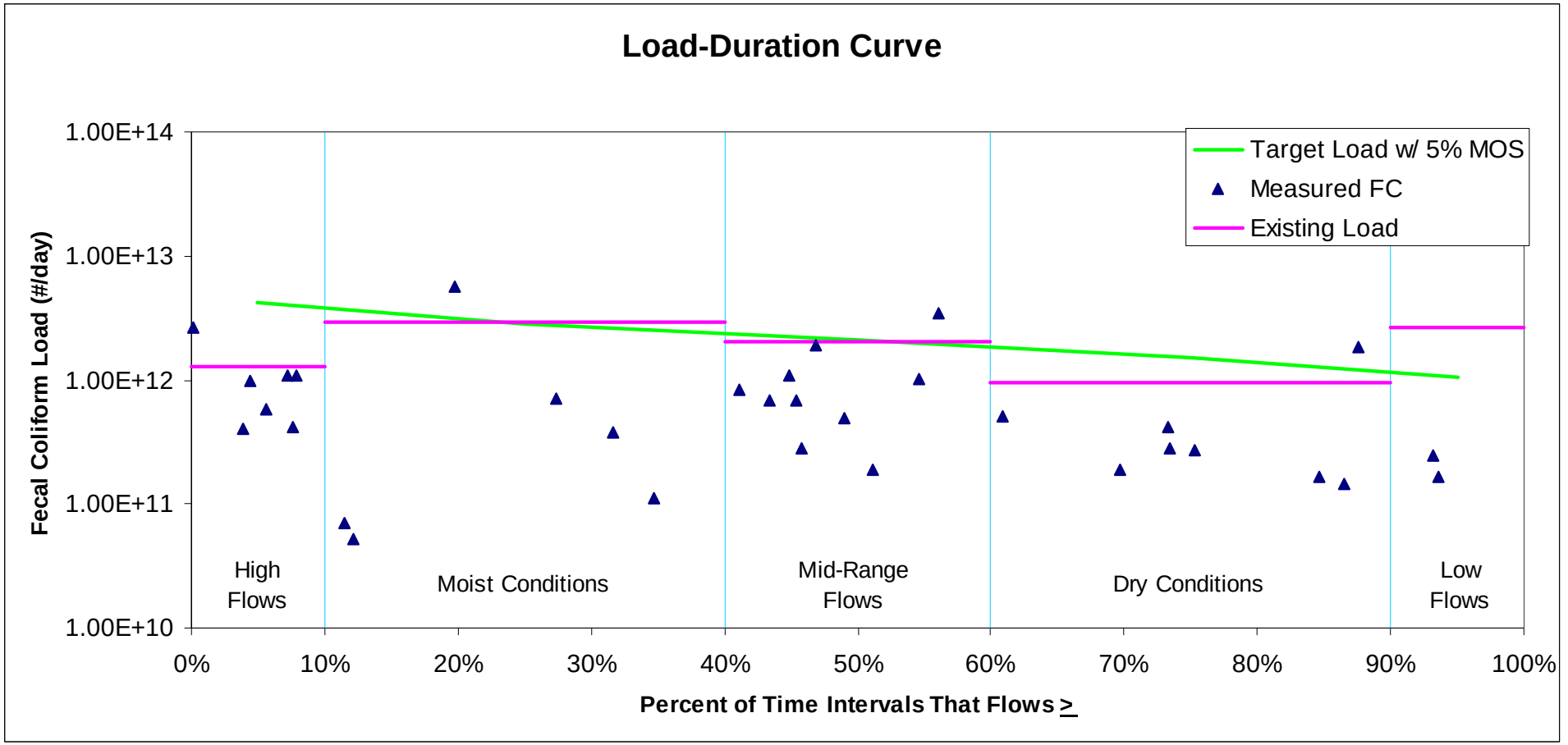
Instantaneous loads for each of the impaired stations were calculated. Measured FC concentrations from 1999 through 2008 were multiplied by measured (or estimated flow based on drainage area) flow on the day of sampling and a unit conversion factor. These data were plotted on the load-duration graph 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 14). Only the instantaneous water quality criterion was targeted because there is insufficient data to evaluate against the 30-day geometric mean.

An existing load was determined for each hydrologic category for the TMDL calculations. For stations RS-03345, RS-07192, RS-08232, RS-03347, PD-098, PD-040, and PD-239, 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 PD-202 and PD-115, 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 SC0027707. Due to the proportion of flow from SC0027707 to the flow from Pocotaligo River, this adjustment was made to account for SC0027707's large contribution to the overall stream flow in the Pocotaligo River.

Existing loads are plotted on the load-duration curves presented in Appendix A as well as the example for station PD-115 in Figure 14. 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.

Figure 14. Load Duration Curve for Reach 4 of the Pocotaligo River Watershed, Water Quality Monitoring Station PD-115



6.0 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 waste load 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, in accordance with 40 CFR 130.2(l).

6.1 Critical Conditions

These TMDLs are 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 14 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 Pocotaligo River and tributaries watersheds pathogen impaired segments are listed in Table 23. This data indicates that for station RS03345, moist conditions result in larger bacteria loads and is therefore the critical condition for that station. The following flow conditions result in larger bacteria loads, and is therefore the critical conditions, for the eight (8) other respective stations: **a)** dry conditions for PD-202; **b)** mid-range conditions for RS-07192; **c)** moist conditions for PD-115; **d)** mid-range conditions for RS-08232; **e)** mid-range conditions for RS-03347; **f)** moist conditions for PD-098; **g)** mid-range conditions for PD-040; and, **h)** dry conditions for PD-239.

Table 23. Percent Reduction Necessary to Achieve Target Load by Hydrologic Category

Station	Waterbody	Moist Conditions	Mid-Range Flow	Dry Conditions
June 2013 Total Maximum Daily Loads				
RS-03345	Brunson Swamp Creek	39	39	N/A
PD-202	Pocotaligo River	NRN	NRN	67
RS-07192	Big Branch	NRN	81	49
PD-115	Pocotaligo River	4	NRN	NRN
RS-08232	Juneburn Branch Tributary	55	86	N/A
RS03347	Deep Creek	13	18	N/A
September 2005 Total Maximum Daily Loads Revised June 2013				
PD-098	Turkey Creek	81	66	79
PD-040	Turkey Creek	81	88	81
PD-239	Nasty Branch	4	NRN	35

Highlighted cells indicate critical condition
NRN = no reduction needed. Existing load below target load
N/A = not applicable. No fecal coliform measurements during hydrologic category

6.2 Existing Load

An existing load was determined for each hydrologic category for the TMDL calculations as described in Section 5.0 of this TMDL document. The existing load under the critical condition, described in Section 6.1 above was used in the TMDL calculations. Loadings from all sources are included in this value: cattle-in-streams, failing septic systems as well as wildlife. The existing load for stations RS-03345, PD-202, RS-07192, PD-115, RS-08232, RS-03347, PD-098, PD-040, and PD-239 are provided in Appendix D.

6.3 Waste load Allocation

The waste load allocation (WLA) is the portion of the TMDL allocated to NPDES-permitted point sources (USEPA 1991). Note that all illicit dischargers, including SSOs, are illegal and not covered under the WLA of these TMDLs.

6.3.1 Continuous Point Sources

There are six (6) active permitted domestic dischargers and one (1) industrial discharger discharging FC in the Pocotaligo River and tributaries watersheds (See Table 8). To determine the waste load allocation (WLA) for these seven permitted 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 24. The WLA for the largest sanitary wastewater facility in Reach 2 of the Pocotaligo River Watershed (The City of Sumter's Pocotaligo River WWTP) is 227 billion colony forming units per day (2.27+E11 cfu/day) based on a permitted average monthly flow of 15 MGD until such time that *E. coli* limits are incorporated into individual permits. *E. coli* limits will be developed based upon permitted flow and an allowable permitted maximum *E. coli* concentration of 349 MPN/100ml. The WLAs for the other six dischargers are shown in Table 24. 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, until such time that *E. coli* limits are incorporated into individual permits. *E. coli* limits will be developed based upon permitted flow and an allowable permitted maximum *E. coli* concentration of 349 MPN/100ml.

6.3.2 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 and SCR and/or regulated under South Carolina Water Pollution Control Permits: R61-9, §122.26(b)(4),(7),(14)-(21) (SCDHEC, 2011). 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 Phase II Stormwater Regulations to obtain a permit for the discharge of stormwater. Figures 8 and 13 show the urbanized areas in the Pocotaligo River and tributaries watersheds. 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. All current and future 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 25 presents the reduction needed for each impaired segment. The reduction percentages in these TMDLs also apply to the FC waste load attributable to those areas of the watershed that are covered or will be covered under NPDES MS4 permits.

Table 24. Average Monthly Permitted Flow and FC Bacteria WLAs for the NPDES Wastewater Discharges in the Pocotaligo River and Tributaries Watersheds

Impaired Station Watershed	Permitted Facility	Permit Number	Permitted Flow (MGD)	WLA (#/Day)
PD-202, PD-115	City of Sumter, Pocotaligo River WWTP	SC0027707	15.0	2.27E+11
PD-202, PD-115	Pilgrim's Pride Corporation, Sumter SC Processing Plant	SC0000795[1]	0.25[3]	3.79E+09
PD-202, PD-115	Carolina Water Services, Inc., Pocalla Village – Belk SD	SC0030724	0.104	1.57E+09
PD-202, PD-115	Pilgrim's Pride Corporation, Sumter SC Processing Plant	SC0000795[2]	0.086[3]	1.30E+09
PD-202, PD-115	Carolina Mobile Home Court	SC0032212	0.03	4.54E+08
PD-202, PD-115	Burgess Glenn Mobile Home Park I	SC0031925	0.018	2.73E+08
PD-202, PD-115	Burgess Glenn Mobile Home Park II	SC0032239	0.018	2.73E+08
PD-202, PD-115	High Hills Rural Water Company, Inc., Harwood Mobile Home Park	SC0031704	0.0072	1.09E+08
Total WLA (#/Day) in the Pocotaligo River and Tributaries Watersheds:				**2.35E+11**

1. Outfall Number 1 in Permit No. SC0000795
2. Outfall Number 2 in Permit No. SC0000795
3. Based on long term average discharge flows (as reported in discharge monitoring reports from December 1, 2006 to March 31, 2011)

Table 25. Percent Reduction Necessary to Achieve Target Load

Station	Waterbody	% Reduction
June 2013 Total Maximum Daily Loads		
RS-03345	Brunson Swamp Creek	39
PD-202	Pocotaligo River	67
RS-07192	Big Branch	81
PD-115	Pocotaligo River	4
RS-08232	Juneburn Branch Tributary	86
RS03347	Deep Creek	18
September 2005 Total Maximum Daily Loads Revised June 2013		
PD-098	Turkey Creek	81
PD-040	Turkey Creek`	88
PD-239	Nasty Branch	35

As appropriate information is made available to further define the pollutant contributions for the permitted MS4, an effort can be made to revise these TMDLs. This effort will be initiated as resources permit and if deemed appropriate by the Department. For the Department to revise these TMDLs the following information should be provided, but not limited to:

1. An inventory of service boundaries of the MS4 covered in the MS4 permit, provided as ARCGIS compatible shape files.
2. An inventory of all existing and planned stormwater discharge points, conveyances, and drainage areas for the discharge points, provided as ARCGIS compatible shape files. If drainage areas are not known, any information that would help estimate the drainage areas should be provided. The percentage of impervious surface within the MS4 area should also be provided.
3. Appropriate and relevant data should be provided to calculate individual pollutant contributions for the MS4 permitted entities. At a minimum, this information should include precipitation, water quality, and flow data for stormwater discharge points.

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

6.4 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 is listed in Table 26. There may be other unregulated MS4s located in the Pocotaligo River and tributaries watersheds that are subject to the LA components of these TMDLs. At such time that the referenced entities, or other future unregulated entities become regulated NPDES MS4 entities and are subject to applicable provisions of SC Regulation 61-68D, they will be required to meet load reductions prescribed in the WLA component of the TMDLs. This also applies to future discharges associated with industrial and construction activities that will be subject to SC R.61-9. §122.26(b)(4),(7),(14) -(21) (SCDHEC, 2011).

6.5 Seasonal Variability

Federal regulations require that TMDLs take into account the seasonal variability in watershed loading. The variability in these TMDLs is accounted for by using a 10-year hydrological and water quality sampling data set.

6.6 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 6.1 and is the difference between the TMDL and the sum of the WLA and LA.

A 5% MOS in freshwaters impaired for *E. coli* may be calculated as the ratio of *E.coli* MPN/100 ml to FC bacteria cfu/100 ml or 20*0.8725 = 17 MPN/100 ml of the instantaneous *E. coli* criterion of 349 MPN/100 ml (332 MPn/100 ml). This conversion is deemed appropriate by the Department and derived from an established relationship between FC bacteria and *E. coli* WQS in freshwaters determined during the 2009 PIS.

6.7 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(I). Only the instantaneous water quality criterion was targeted for the Pocotaligo River and tributaries watersheds 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.

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 26 indicates the percentage reduction or water quality standard required for each subwatershed in the Pocotaligo River and tributaries watersheds (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 or *E. coli* prescribed load reductions must be targeted from all sources, including NPDES permitted and nonpoint sources.

Based on the available information at this time, the portions of the Pocotaligo River and tributaries watersheds that drain directly to a regulated MS4 and that drain through the unregulated MS4 has not been clearly defined within the MS4 jurisdictional area. Loading from both types of sources (regulated and unregulated) typically occurs 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.

7.0 IMPLEMENTATION

The implementation of both point (WLA) and non-point (LA) source components of the TMDLs are necessary to bring about the required reductions in FC bacteria or *E. coli* loading to Pocotaligo River and tributaries in order to achieve water quality standards. Using existing authorities and mechanisms, an implementation plan providing information on how point and non point sources of pollution are being abated or may be abated in order to meet water quality standards is provided. Sections 7.1.1-7.1.7 presented below correspond with sections 3.1.1-3.2.5 of the source assessment presented in the TMDL document. As the implementation strategy progresses, the SCDHEC will continue to monitor the effectiveness of implementation measures and evaluate water quality where deemed appropriate.

Point sources are discernible, confined, and discrete conveyances of pollutants to a water body including but not limited to pipes, outfalls, channels, tunnels, conduits, man-made ditches, etc. The Clean Water Act's primary point source control program is the National Pollutant Discharge Elimination System (NPDES). Point sources can be broken down into continuous and non-continuous point sources. Some examples of a continuous point source are wastewater treatment facilities (WWTF) and industrial facilities. Non-continuous point sources are related to stormwater and include MS4, construction activities, etc. Current and future NPDES discharges in the referenced watersheds are required to comply with the load reductions prescribed in the waste load allocation (WLA).

Nonpoint source pollution originates from multiple sources over a relatively large area. It is diffuse in nature and indistinct from other sources of pollution. It is generally caused by the pickup and transport of pollutants from rainfall moving over and through the ground. Nonpoint sources of pollution may include, but are not limited to: wildlife, agricultural activities, illicit discharges, failing septic systems, and urban runoff. Nonpoint sources located in unregulated portions of the Pocotaligo River and tributaries watersheds are subject to the load allocation (LA) and not the WLA of the TMDL document.

Table 26. Total Maximum Daily Loads for the Pocotaligo River and Tributaries Watersheds
Loads are expressed as FC bacteria or *E. coli* count/day

	Existing FC Load (count/day)	TMDL (count/day)		Margin of Safety (MOS) (count/day)		Waste Load Allocation (WLA)				Load Allocation (LA)		
						Continuous Source[1] (count/day)		Non-Continuous Sources[2,3] (% Reduction)	Non-Continuous SCDOT[3] (% Reduction)	Load Allocation (count/day)		% Reduction to Meet LA[3]
June 2013 Total Maximum Daily Loads												
Station	FC (CFU/day)	FC (CFU/day)	*E. coli* (MPN/day)[6]	FC (CFU/day)	*E. coli* (MPN/day)[6]	FC (CFU/day)	*E. coli* (MPN/day)[6]	(Percent)	(Percent)	FC (CFU/day)	*E. coli* (MPN/day)[6]	(Percent)
RS-03345	2.51E+10	1.60E+10	*1.39E+10*	7.98E+08	*6.78E+08*	See Note Below	See Note Below	39	0[4]	1.52E+10	*1.32E+10*	39
PD-202	2.22E+12	1.03E+12	*8.96E+11*	5.14E+10	*4.37E+10*	2.35E+11	*2.05E+11*	67	67[5]	7.41E+11	*6.18E+11*	67
RS-07192	2.62E+11	5.23E+10	*4.56E+10*	2.62E+09	*2.22E+09*	See Note Below	See Note Below	81	81[5]	4.97E+10	*4.34E+10*	81
PD-115	2.97E+12	2.99E+12	*2.61E+12*	1.49E+11	*1.27E+11*	See Note Below	See Note Below	4	4[5]	2.84E+12	*2.48E+12*	4
RS-08232	2.47E+10	3.59E+09	*3.13E+09*	1.79E+08	*1.53E+08*	See Note Below	See Note Below	86	86[5]	3.41E+09	*2.98E+09*	86
RS-03347	6.89E+10	5.94E+10	*5.18E+10*	2.97E+09	*2.53E+09*	See Note Below	See Note Below	18	0[4]	5.64E+10	*4.93E+10*	18
September 2005 Total Maximum Daily Loads Revised June 2013												
Station	FC (CFU/day)	FC (CFU/day)	*E. coli* (MPN/day)[6]	FC (CFU/day)	*E. coli* (MPN/day)[6]	FC (CFU/day)	*E. coli* (MPN/day)[6]	(Percent)	(Percent)	FC (CFU/day)	*E. coli* (MPN/day)[6]	(Percent)
PD-098	9.57E+10	1.91E+10	*1.67E+10*	9.57E+08	*8.13E+08*	See Note Below	See Note Below	81	81[5]	1.82E+10	*1.59E+10*	81
PD-040	3.57E+11	4.38E+10	*3.82E+10*	2.19E+09	*1.86E+09*	See Note Below	See Note Below	88	88[5]	4.16E+10	*3.63E+10*	88
PD-239	6.38E+10	4.37E+10	*3.81E+10*	2.19E+09	*1.86E+09*	See Note Below	See Note Below	35	0[4]	4.15E+10	*3.63E+10*	35

Table Notes:

1. WLAs are expressed as a daily maximum. Existing and future continuous discharges are required to meet the prescribed loading for the pollutant of concern. For the purposes of NPDES permitting, continuous discharges may be required to meet a loading equivalent of FC bacteria, based upon permitted flow and an allowable permitted maximum FC bacteria concentration of 400 cfu/100ml, until such time that *E. coli* limits are incorporated into individual permits. *E. coli* limits will be developed based upon permitted flow and an allowable permitted maximum *E. coli* concentration of 349 MPN/100ml.
2. Percent reduction applies to all NPDES-permitted stormwater discharges, including current and future municipal separate storm sewer system (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 FC bacteria or *E. coli.*
4. As long as the conditions within the SCDOT MS4 area remain the same the Department deems the current contributions from SCDOT negligible and no reduction of FC bacteria or *E. coli* is necessary. SCDOT must continue to comply with the provisions of its approved NPDES stormwater permit.
5. By implementing the best management practices that are prescribed in either the SCDOT annual SWMP or the SCDOT MS4 Permit to address fecal coliform or *E. coli,* the SCDOT will comply with these TMDLs and its applicable WLA to the maximum extent practicable (MEP) as required by its MS4 permit.
6. Expressed as *E. coli* (MPN/day). Loadings are developed by applying a conversion factor to values calculated for FC bacteria. This conversion is derived from an established relationship between FC bacteria and *E. coli* water quality standards in freshwaters.

South Carolina has several tools available for implementing the non-point source components of these TMDLs. The *Implementation Plan for Achieving Total Maximum Daily Load Reductions From Nonpoint Sources for the State of South Carolina* (SCDHEC 1998) document is one example. Another key component for interested parties to control pollution and prevent water quality degradation in the Pocotaligo River and tributaries watersheds would be the establishment and administration of a program of BMPs. BMPs may be defined as a practice or a combination of practices that have been determined to be the most effective, practical means used in the prevention and/or reduction of pollution. Sumter County, an MS4 permitted under the SCDHEC's NPDES Permit No.: SCR038503 to discharge stormwater in urbanized areas in Sumter County, is developing the TCWBP for the Turkey Creek watersheds (Sumter County, 2012). The TCWBP will identify BMPs for preventing or reducing FC pollution in the Turkey Creek watersheds.

Interested parties (local stakeholder groups, universities, local governments, etc.) may be eligible to apply for CWA §319 grants to install BMPs that will implement the LA portions of these TMDLs and reduce nonpoint source FC bacteria or *E. coli* loading to Pocotaligo River and tributaries. Congress amended the Clean Water Act (CWA) in 1987 to establish the Section 319 Nonpoint Source Management Program. Under Section 319, States receive grant money to support a wide variety of activities including the restoration of impaired waters. 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 but may be available for the LA component within permitted MS4 jurisdictional boundaries.. Additional resources are provided in Section 8.0 of this TMDL document.

The SCDHEC will also work with the existing agencies in the area to provide nonpoint source education in the Pocotaligo River and tributaries watersheds. Local sources of nonpoint source education and assistance include the Natural Resource Conservation Service (NRCS), the Sumter and Clarendon County Soil and Water Conservation Services, the Clemson University Cooperative Extension Service, and the South Carolina Department of Natural Resources. While Sumter County is listed as the lead organization in the TCWBP development, the plan lists NRCS and the university's extension service, and the City of Sumter (an MS4 permitted under the SCDHEC's NPDES Permit No.: SCR038502 to discharge stormwater in urbanized areas in the city), among others, as cooperating organizations in the development and implementation of the plan (Sumter County, 2012).

The Department recognizes that **adaptive management/implementation** of these TMDLs might be needed to achieve the water quality standard and we are committed towards targeting the load reductions to improve water quality in the Pocotaligo River and tributaries watersheds. As additional data and/or information become available, it may become necessary to revise and/or modify the TMDL targets accordingly.

7.1 Implementation Strategies

The strategies presented in this document for implementation of the referenced TMDLs are not inclusive and are to be used only as guidance. The strategies are informational suggestions that may lead to the required load reductions being met for the referenced watersheds while demonstrating consistency with the assumptions and requirements of the TMDLs. Application of certain strategies provided within may be voluntary and are not a substitute for actual NPDES permit conditions.

7.1.1 Continuous Point Sources

Continuous point source WLA reductions will be implemented through NPDES permits. Existing and future continuous discharges are required to meet the prescribed loading for the pollutant of concern and demonstrate consistency with the assumptions and requirements of the TMDLs. FC Loadings are developed based upon permitted flow and an allowable permitted maximum concentration of 400 cfu/100ml. *E. coli* loadings are developed based upon permitted flow and an allowable permitted maximum *E. coli* concentration of 349 MPN/100ml.

7.1.2 Non-Continuous Point Sources

An iterative BMP approach as defined in the general stormwater NPDES MS4 permit is expected to provide significant implementation of the WLA. 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.

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 these TMDLs with an acceptable schedule and activities for their permit compliance. As it pertains to the Turkey Creek watersheds, according to the TCWBP, Sumter County and the City of Sumter, both MS4s, have extensive data from their MS4 programs relating to the upper reaches of the Turkey Creek watershed (Sumter County, 2012). According to the TCWBP, the county will conduct pollutant source assessment, locate stormwater outfalls, and perform dry weather field screening for illicit discharges in non-MS4 areas of the Turkey Creek watersheds. 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 C which provides additional information as it relates to evaluating the effectiveness of an MS4 Permit as it related to compliance with approved TMDLs. For SCDOT, existing and future NPDES MS4 permittees, compliance with terms and conditions of its NPDES permit is effective implementation of the WLA to the Maximum Extent Practicable (MEP) and demonstrates consistency with the assumptions and requirements of the TMDLs. For existing and future NPDES construction and Industrial stormwater permittees, compliance with terms and conditions of its permit is effective implementation of the WLA. 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 acknowledges that progress with the assumptions and requirements of the TMDLs by MS4s is expected to take one or more permit iteration. Achieving the WLA reduction for the TMDLs 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.

Regulated MS4 entities are required to develop a SWMP that includes the following: public education, public involvement, illicit discharge detection & elimination, construction site runoff control, post construction runoff control, and pollution prevention/good housekeeping. According to the TCWBP, Sumter County will identify potential human sources of FC throughout the Turkey Creek watershed by reviewing areas of high population density, sanitary sewer overflows and leaking septic tanks (Sumter County, 2012). These measures are not exhaustive and may include additional criterion depending on the type of NPDES MS4 permit that applies. The following examples are recognized as acceptable stormwater practices and may be applied to unregulated MS4 entities or other interested parties in the development of a stormwater management plan.

An informed and knowledgeable community is crucial to the success of a stormwater management plan (USEPA, 2005). MS4 entities may implement a public education program to distribute educational materials to the community, or conduct equivalent outreach activities about the impacts of stormwater discharges on local waterbodies and the steps that can be taken to reduce stormwater pollution. Some appropriate BMPs may be brochures, educational programs, storm drain stenciling, stormwater hotlines, tributary signage, and alternative information sources such as web sites, bumper stickers, etc (USEPA, 2005). According to the TCWBP, Sumter County and the City of Sumter, through education and outreach programs, have already targeted local citizens in an effort to encourage proper disposal of pet waste, which will reduce FC concentrations in stormwater runoff (Sumter County, 2012).

The public can provide valuable input and assistance to a stormwater management program and they may have the potential to play an active role in both the development and implementation of the stormwater program where deemed appropriate by the entity. There are a variety of practices that can involve public participation such as public meetings/citizens panels, volunteer water quality monitoring, volunteer educators, community

clean-ups, citizen watch groups, and “Adopt a Storm Drain” programs which encourage individuals or groups to keep storm drains free of debris and monitor what is entering local waterways through storm drains (USEPA, 2005). In addition to the City of Sumter, the TCWBP identifies business leaders, environmental groups, and homeowners associations as cooperating organizations, among others, in the development and implementation of the plan (Sumter County, 2012). According to the TCWBP, Sumter County and the City of Sumter recognize the need to include stakeholders as part of the overall development of the plan.

Illicit discharge detection and elimination efforts are also necessary. Discharges from MS4s often include wastes and wastewater from non-stormwater sources. These discharges enter the system through either direct connections or indirect connections. The result is untreated discharges that contribute high levels of pollutants, including heavy metals, toxics, oil and grease, solvents, nutrients, viruses, and bacteria to receiving waterbodies (USEPA, 2005). Pollutant levels from these illicit discharges have been shown in EPA studies to be high enough to significantly degrade receiving water quality and threaten aquatic, wildlife, and human health. MS4 entities may have a storm sewer system map which shows the location of all outfalls and to which waters of the US they discharge for instance. If not already in place, an ordinance prohibiting non-stormwater discharges into a MS4 with appropriate enforcement procedures may also be developed. Entities may also have a plan for detecting and addressing non-stormwater discharges. The plan may include locating problem areas through infrared photography, finding the sources through dye testing, removal/correction of illicit connections, and documenting the actions taken to illustrate that progress is being made to eliminate illicit connections and discharges.

A program might also be developed to reduce pollutants in stormwater runoff to the MS4 area from construction activities. An ordinance or other regulatory mechanism may exist requiring the implementation of proper erosion and sediment controls on applicable construction sites. Site plans should be reviewed for projects that consider potential water quality impacts. It is recommended that site inspections should be conducted and control measures enforced where applicable. A procedure might also exist for considering information submitted by the public (USEPA, 2005). For information on specific BMPs please refer to the SCDHEC Stormwater Management BMP Handbook online at: http://www.scdhec.com/environment/ocrm/pubs/docs/SW/BMP_Handbook/Erosion_prevention.pdf

Post-construction stormwater management in areas undergoing new development or redevelopment is recommended because runoff from these areas has been shown to significantly affect receiving waterbodies. Many studies indicate that prior planning and design for the minimization of pollutants in post-construction stormwater discharges is the most cost-effective approach to stormwater quality management (USEPA, 2005). Strategies might be developed to include a combination of structural and/or non-structural BMPs. An ordinance or other regulatory mechanism may also exist requiring the implementation of post-construction runoff controls and ensuring their long term-operation and maintenance. Examples of non-structural BMPs are planning procedures and site-based BMPs (minimization of imperviousness and maximization of open space). Structural BMPs may include but are not limited to stormwater retention/detention BMPs, infiltration BMPs (dry wells, porous pavement, etc.), and vegetative BMPs (grassy swales, filter strips, rain gardens, artificial wetlands, etc.).

Pollution prevention/good housekeeping is also a key element of stormwater management programs. Generally this requires the MS4 entity to examine and alter their programs or activities to ensure reductions in pollution are occurring. It is recommended that a plan be developed to prevent or reduce pollutant runoff from municipal operations into the storm sewer system and it is encouraged to include employee training on how to incorporate and document pollution prevention/good housekeeping techniques. To minimize duplication of effort and conserve resources, the MS4 operator can use training materials that are available from EPA or relevant organizations (USEPA, 2005).

MS4 communities are encouraged to utilize partnerships when developing and implementing a stormwater management program. Watershed associations, educational organizations, and state, county, and city governments are all examples of possible partners with resources that can be shared. While Sumter County and the City of Sumter, both MS4s, are listed as responsible for developing the TCWBP, the plan also lists the Natural Resources Conservation Service, Clemson University Services, business leaders, environmental

groups, and homeowners associations as cooperating organizations in the development and implementation of the plan (Sumter County, 2012). For additional information on partnerships contact the SCDHEC Watershed Manager for the waterbody of concern online at: http://www.scdhec.gov/environment/water/shed/contact.htm For additional information on stormwater discharges associated with MS4 entities please see the SCDHEC's NPDES web page online at http://www.scdhec.gov/environment/water/swnpdes.htm as well as the USEPA NPDES website online at http://cfpub.epa.gov/npdes/home.cfm?program_id=6 for information pertaining to the National Menu of BMPs, Urban BMP Performance Tool, Outreach Documents, etc.

7.1.3 Wildlife

Suggested forms of implementation for wildlife will vary widely due to geographic location and species. There are many forms of acceptable wildlife BMPs in practice and development at the present time. For example, contiguous forested areas could be set up and managed to keep wildlife from bedding down and defecating near surface waters. This management practice relies on concentrating wildlife away from water bodies to minimize their impact to pollutant loading. Additionally, contributions from wildlife could be reduced in protected areas by developing a management plan which would allow hunting access during certain seasons. Although this strategy might not work in all situations, it would decrease FC bacteria or *E. coli* loading from wildlife in areas where wildlife may be a significant contributor to the overall watershed. According to the TCWBP, Sumter County will review land use within the Turkey Creek watersheds and conduct field surveys for other potential FC sources such as wildlife, domestic pets, and agricultural sources (Sumter County, 2012).

Deterrents may also be used to keep wildlife away from docks and lawns in close proximity to surface waters. Non-toxic spray deterrents, decoys, eagles, kites, noisemakers, scarecrows, and plastic owls are a sample of what is currently available. During an SCDHEC source assessment visit in Reach 2 of the Pocotaligo River Watershed in October 2012, a blue heron was seen near an intermittent pond in Sumter County (Figure E-1 in Appendix E); and, ducks were seen in an impoundment in the reach (Figure E-2). Many waterfowl species are deterred by foreign objects on lawns and the planting of a shrub buffer along greenways adjacent to impoundments may also be effective.

In addition, homeowners and the hunting community should be educated on the impacts of feeding wildlife or planting wildlife food plots in close proximity to surface waters. Please check local and federal laws before applying deterrents or harassing wildlife. Additional information may be obtained from the "Managing Pet and Wildlife Waste to Prevent Contamination of Drinking Water" bulletin provided by USEPA (2001).

7.1.4 Agricultural Activities

Suggested forms of implementation for agricultural activities will vary based on the activity of concern. Agricultural BMPs can be vegetative, structural or management oriented. When selecting BMPs, it is important to keep in mind that nonpoint source pollution occurs when a pollutant becomes available, is detached and then transported to nearby receiving waters. Therefore, for BMPs to be effective, the transport mechanism of the pollutant, FC bacteria or *E. coli,* needs to be identified. For livestock in the referenced watersheds, installing fencing along the streams within the watershed and providing an alternative water source where livestock are present would eliminate direct contact with the streams.

During the source assessment visit in October 2012, the SCDHEC found numerous livestock and hobby farms within the Pocotaligo River and tributaries watersheds. Animals found on hobby farms in the watersheds range from horses to donkeys to goats. A horse in a pen was found in Reach 1 of the Pocotaligo River Watershed (Figure E-3). According to GIS information, the pen was located within twenty (20) meters of a stream. A manure pile was also noted in the middle of the pen. During the source assessment visit, the SCDHEC found a horse and cattle in a pasture with a pond in the Deep Creek Watershed (Figure E-4). According to GIS information, the pond is fed by a stream. Pastured horses were found in Reach 3 of the Pocotaligo River Watershed (Figure E-5). In addition to hobby horse farms, there was evidence of horse stables in Reach 2 of the Pocotaligo River Watershed (Figures E-6 and E-7).

During the source assessment visit, the SCDHEC found goat hobby farms in the reaches of the Pocotaligo River Watershed. Goats were found in a pasture in Reach 1 of the watershed (Figure E-8). According to GIS information and 2011 Bing aerial photography, a stream runs through the pasture. And, goats were found in a pasture in Reach 4 of the watershed (Figure E-9). Donkeys were also found within the reaches of the Pocotaligo River Watershed. Donkeys were found in a pasture in Reach 4 of the watershed (Figure E-10). According to GIS and aerial photography, a stream-fed pond is located in the pasture. And, donkeys were found in the same pasture with the goats in Reach 1 of the watershed (Figure E-11).

Again, the SCDHEC found numerous livestock farms in the Pocotaligo River and tributaries watersheds during the source assessment visit in October 2012. As mentioned above, cattle and a horse were found in a pasture with a pond in the Deep Creek Watershed (Figure E-4). Cattle were found in a pasture in the Juneburn Branch Tributary Watershed (Figure E-12). According to GIS information and 2011 Bing aerial photography, a stream runs through the pasture. Cattle were found in pastures in Reach 2 of the Pocotaligo River Watershed (Figures E-13 and E-14). And, cattle were found in pastures in Reach 4 of the watershed (Figures E-15 and E-16).

If fencing is not feasible, it has been shown that installing water troughs within a pasture area reduced the amount of time livestock spent drinking directly from streams by 92% (ASABE 1997). An indirect result of this was a 77% reduction in stream bank erosion by providing an alternative to accessing the stream directly for water supply.

For row crop farms in the referenced watersheds, many common practices exist to reduce FC bacteria or *E. coli* contributions. Unstabilized soil directly adjacent to surface waters can contribute to FC bacteria or *E. coli* loading during periods of runoff after rain events. Agricultural field borders and filter strips (vegetative buffers) can provide erosion control around the border of planted crop fields. These borders can provide food for wildlife, may possibly be harvested (grass and legume), and also provide an area where farmers can turn around their equipment (SCDNR, 1997). 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%.

The agricultural BMPs listed above are a sample of the many accepted practices that are currently available. Many other techniques such as conservation tillage, responsible pest management, and precision agriculture also exist and may contribute to an improvement in overall water quality in the Pocotaligo River and tributaries watersheds. Education should be provided to local farmers on these methods as well as acceptable manure spreading and holding (stacking sheds) practices.

For additional information on accepted agricultural BMPs you can obtain a copy of the “Farming for Clean Water in South Carolina” handbook by contacting Clemson University Cooperative Extension Service at (864) 656-1550. 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. You can access Farm-A-Syst by going onto the Clemson Extension Service website: http://www.clemson.edu/waterquality/FARM.HTM.

NRCS provides financial and technical assistance to help South Carolina landowners address natural resource concerns, promote environmental quality, and protect wildlife habitat on property they own or control. The cost-share funds are available through the Environmental Quality Incentives Program (EQIP). EQIP helps farmers improve production while protecting environmental quality by addressing such concerns as soil erosion and productivity, grazing management, water quality, animal waste, and forestry concerns. EQIP also assists eligible small-scale farmers who have historically not participated in or ranked high enough to be funded in previous sign ups. Please visit www.sc.nrcs.usda.gov/programs/ for more information, including eligibility requirements.

Also available through NRCS, the Grassland Reserve Program (GRP) is a voluntary program offering landowners the opportunity to protect, restore and enhance grasslands on their property. NRCS and the Farm

Service Agency (FSA) coordinate implementation of the GRP, which helps landowners restore and protect grassland, rangeland, pastureland, shrubland and certain other lands and provides assistance for rehabilitating grasslands. The program will conserve vulnerable grasslands from conversion to cropland or other uses and conserve valuable grasslands by helping maintain viable grazing operations. A grazing management plan is required for participants. NRCS has further information on their website for the GRP as well as additional programs such as the Conservation Reserve Program, Conservation Security Program, Farm and Ranch Lands Protection Program, etc. You can visit the NRCS website by going to: www.sc.nrcs.usda.gov/programs/.

7.1.5 Leaking Sanitary Sewers and Illicit Discharges

Leaking sanitary sewers and illicit discharges, although illegal and subject to enforcement, may be occurring in regulated or unregulated portions of the Pocotaligo River and tributaries watersheds at any time. Due to the high concentration of pollutant loading that is generally associated with these discharges, their detection may provide a substantial improvement in overall water quality in the watershed. Detection methods may include, but are not limited to: dye testing, air pressure testing, static pressure testing, and infrared photography.

The SCDHEC recognizes illicit discharge detection and elimination activities are conducted by regulated 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 or *E. coli.* It is the intent of the SCDHEC to work with the MS4 entities to recognize FC bacteria or *E. coli* load reductions as they are achieved. The 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 designated uses are restored, the SCDHEC will recognize efforts of implementers where their efforts can be directly linked to restoration.

7.1.6 Failing Septic Systems

A septic system, also known as an onsite wastewater system, is defined as failing when it is not treating or disposing of sewage in an effective manner. The most common reason for failure is improper maintenance by homeowners. Untreated sewage water contains disease-causing bacteria and viruses, as well as unhealthy amounts of nitrate and other chemicals. Failed septic systems can allow untreated sewage to seep into wells, groundwater, and surface water bodies, where people get their drinking water and recreate. Pumping a septic tank is probably the single most important thing that can be done to protect the system. If the buildup of solids in the tanks becomes too high and solids move to the drainfield, this could clog and strain the system to the point where a new drainfield will be needed.

The SCDHEC's Office of Coastal Resource Management (OCRM) has created a toolkit for homeowners and local governments which includes tips for maintaining septic systems. These septic system Do's and Don't's are as follows:

Do's:

- Conserve water to reduce the amount of wastewater that must be treated and disposed of by your system. Doing laundry over several days will put less stress on your system.
- Repair any leaking faucets or toilets. To detect toilet leaks, add several drops of food dye to the toilet tank and see if dye ends up in the bowl.
- Divert down spouts and other surface water away from your drainfield. Excessive water keeps the soil from adequately cleansing the wastewater.
- Have your septic tank inspected yearly and pumped regularly by a licensed septic tank contractor.

Don'ts:

- Don't drive over your drainfield or compact the soil in any way.
- Don't dig in your drainfield or build anything over it, and don't cover it with a hard surface such as concrete or asphalt.
- Don't plant anything over or near the drainfield except grass. Roots from nearby trees an shrubs may clog and damage the drain lines.
- Don't use your toilet as a trash can or poison your system and the groundwater by pouring harmful chemicals and cleansers down the drain. Harsh chemicals can kill the bacteria that help purify your wastewater.

For additional information on how septic systems work, how to properly plan and maintain a septic system, or to link to the OCRM toolkit mentioned above, please visit the SCDHEC Environmental Health Onsite Wastewater page at the following link: http://www.scdhec.gov/health/envhlth/onsite_wastewater/septic_tank.htm

7.1.7 Urban Runoff

Urban runoff is surface runoff of rainwater created by urbanization outside of regulated areas which may pick up and carry pollutants to receiving waters. Pavement, compacted areas, roofs, reduced tree canopy and open space increase runoff volumes that rapidly flow into receiving waters. This increase in volume and velocity of runoff often causes stream bank erosion, channel incision and sediment deposition in stream channels. In addition, runoff from these developed areas can increase stream temperatures that along with the increase in flow rate and pollutant loads negatively affect water quality and aquatic life (USEPA 2005). This runoff can pick up FC bacteria or *E. coli* along the way. Many strategies currently exist to reduce FC loading from urban runoff and the USEPA nonpoint source pollution website provides extensive resources on this subject, which can be accessed online at: http://www.epa.gov/nps/urban.html.

Some examples of urban nonpoint source BMPs are street sweeping, stormwater wetlands, pet waste receptacles (equipped with waste bags), and educational signs which can be installed adjacent to receiving waters in the watershed such as parks, common areas, apartment complexes, trails, etc. Low impact development (LID) may also be effective. LID is an approach to land development (or re-development) that works with nature to manage stormwater as close to its source as possible. LID employs principles such as preserving and recreating natural landscape features, minimizing effective imperviousness to create functional and appealing site drainage that treats stormwater as a resource rather than a waste product. There are many practices that have been used to adhere to these principles such as bioretention facilities, rain gardens, vegetated rooftops, rain barrels, and permeable pavements (USEPA, 2009).

Some additional urban BMPs that can be adopted in public parks are doggy dooleys and pooch patches. Doggy dooleys are disposal units, which act like septic systems for pet waste, and are installed in the ground where decomposition can occur (USEPA, 2001). This requires that pet owners place the waste into the disposal units. During the SCDHEC source assessment visit in October 2012, numerous dogs were noticed unattended in the Pocotaligo River Watershed. Unrestrained dogs were noticed in Reach 1 of the watershed (Figures E-17 and E-18). And, Unrestrained dogs were noticed in Reach 2 of the watershed (Figures E-19 and E-20).

Although the Pocotaligo River and tributaries watersheds are primarily rural in nature, many of the urban runoff practices discussed in this section can be applied to individual households in the watersheds. Education should be provided to individual homeowners in the referenced watersheds on the contributions to FC bacteria or *E. coli* loading from pet waste. Education to homeowners in the watershed on the fate of substances poured into storm drain inlets should also be provided. For additional information on urban runoff please see the SCDHEC Nonpoint Source Runoff Pollution homepage at http://www.scdhec.gov/environment/water/npspage.htm.

Clemson Extension's Home-A-Syst handbook can also help homeowners reduce sources of NPS pollution on their property. This document guides homeowners through a self-assessment of their property and can be accessed online at: http://www.clemson.edu/waterquality/HOMASYS.HTM

8.0 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.

8.1 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

8.2 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

8.3 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

8.4 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

8.5 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

8.6 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

8.7 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

8.8 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

8.9 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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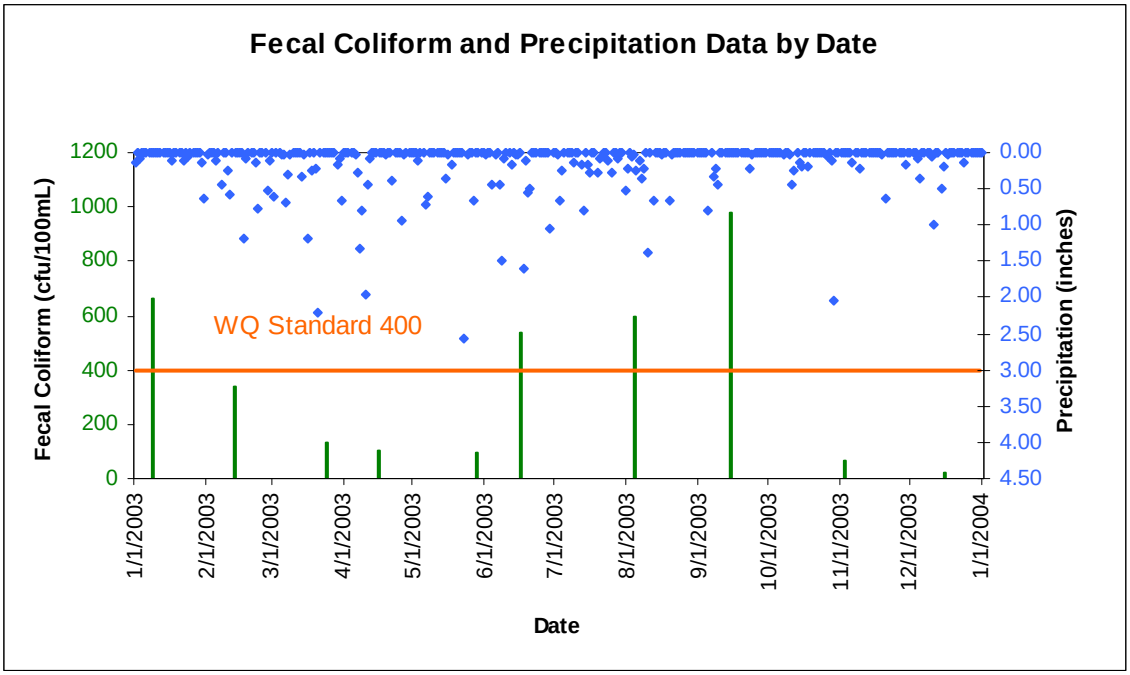
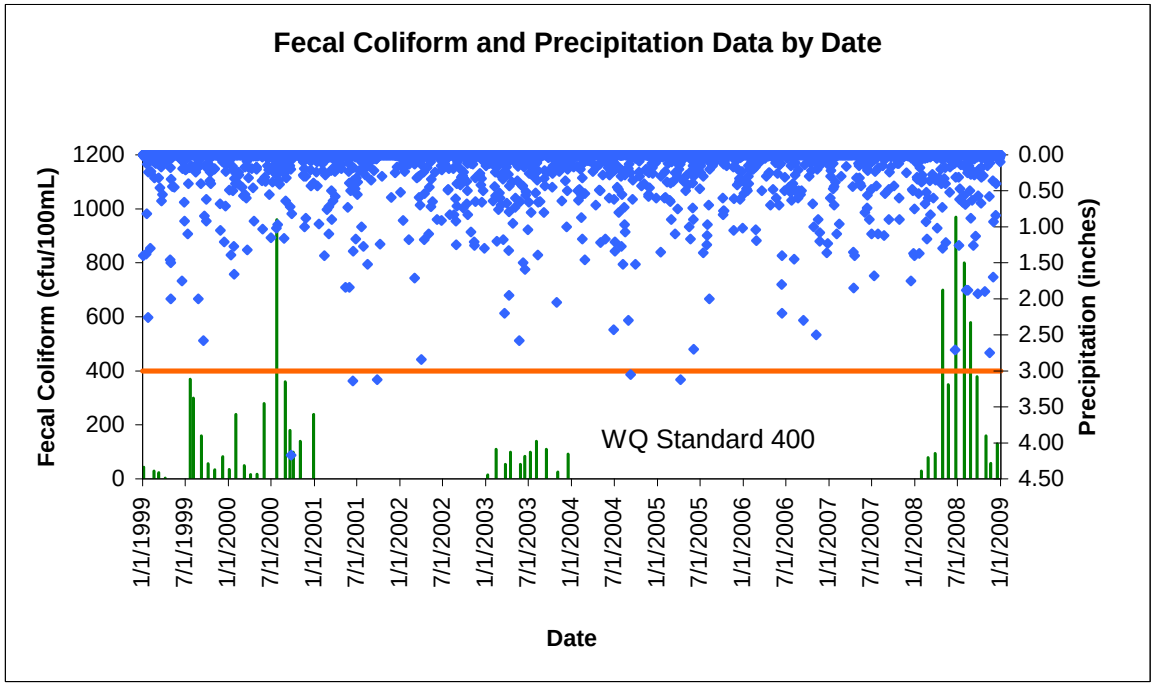
APPENDIX A
ADDITIONAL RAIN CHARTS BY STATION

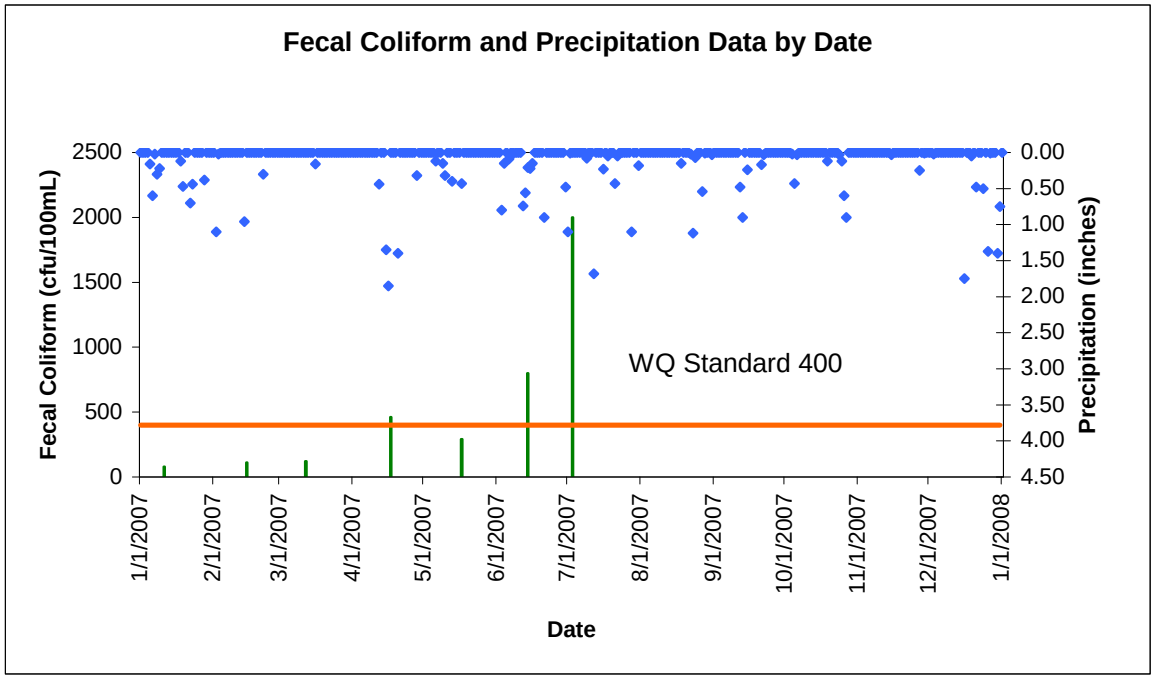
Precipitation and FC Data by Date for Monitoring Station RS-03345



Precipitation and FC Data by Date for Monitoring Station PD-202



Precipitation and FC Data by Date for Monitoring Station RS-07192



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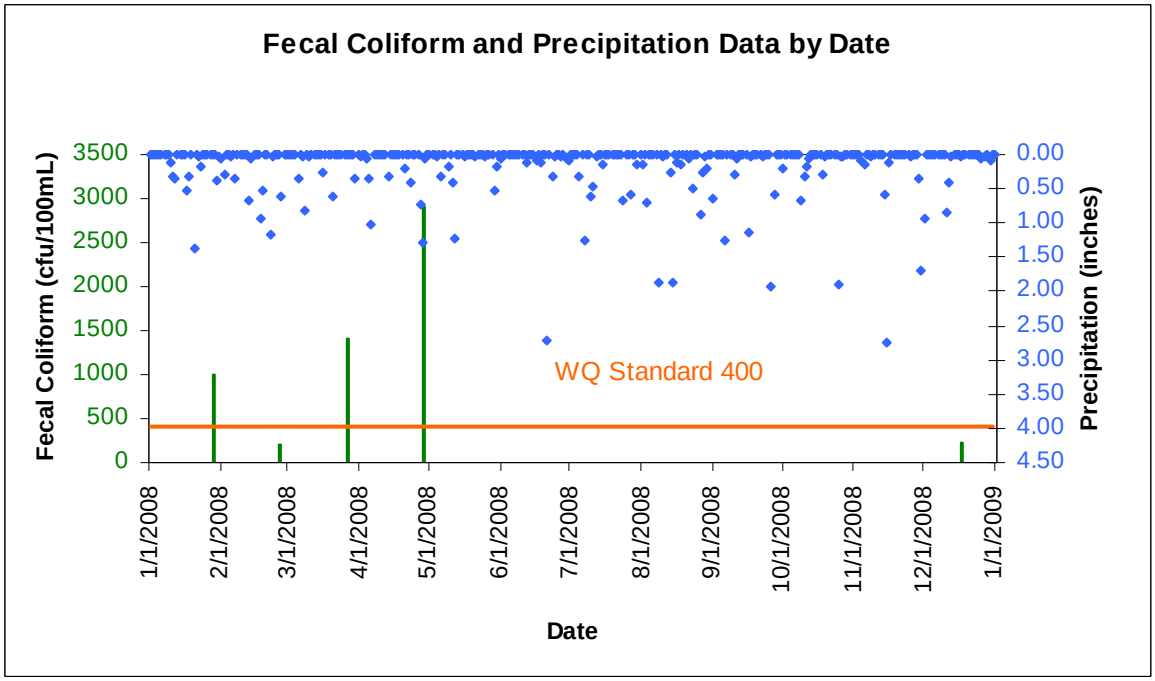

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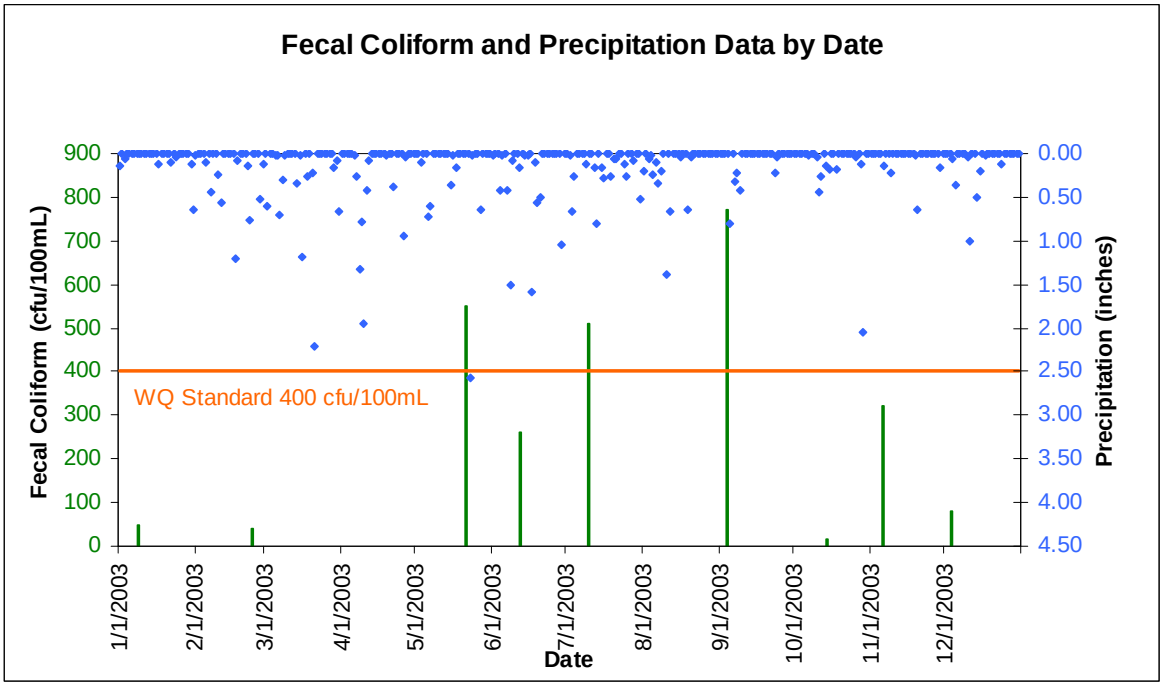

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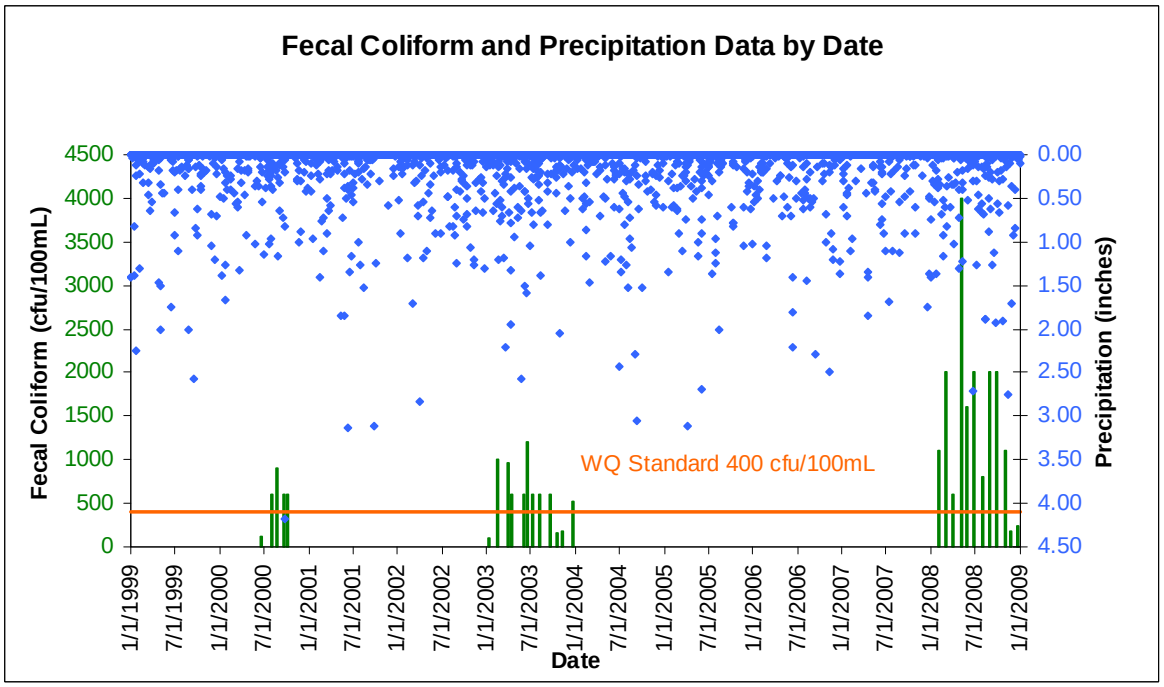

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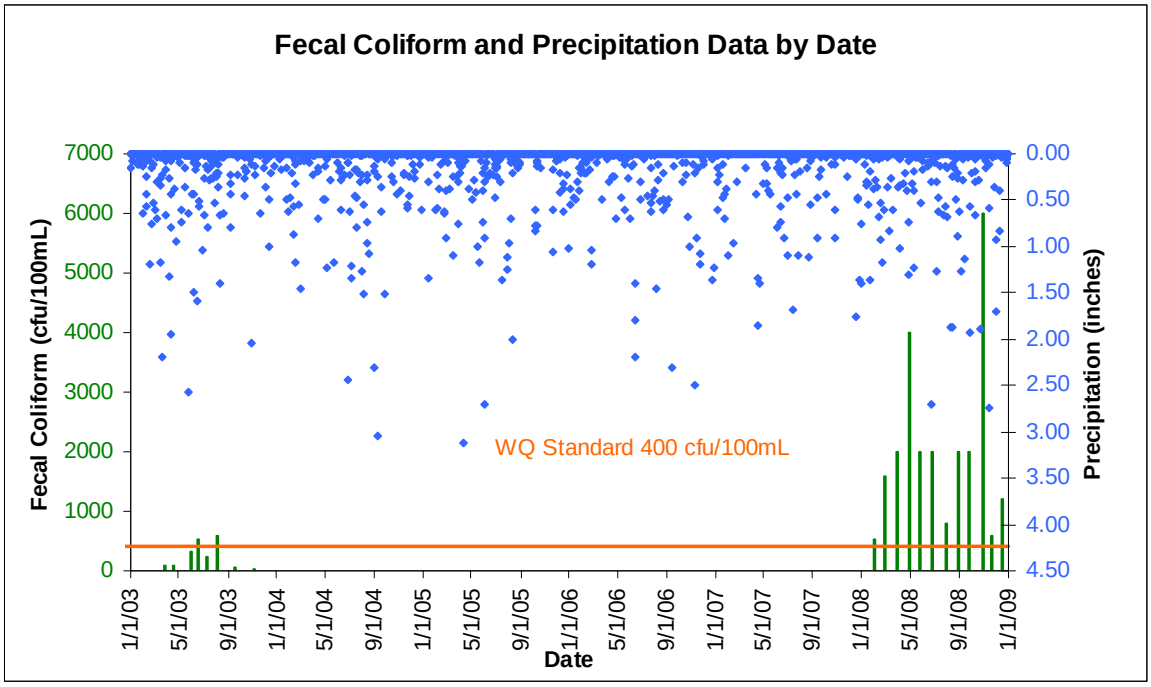
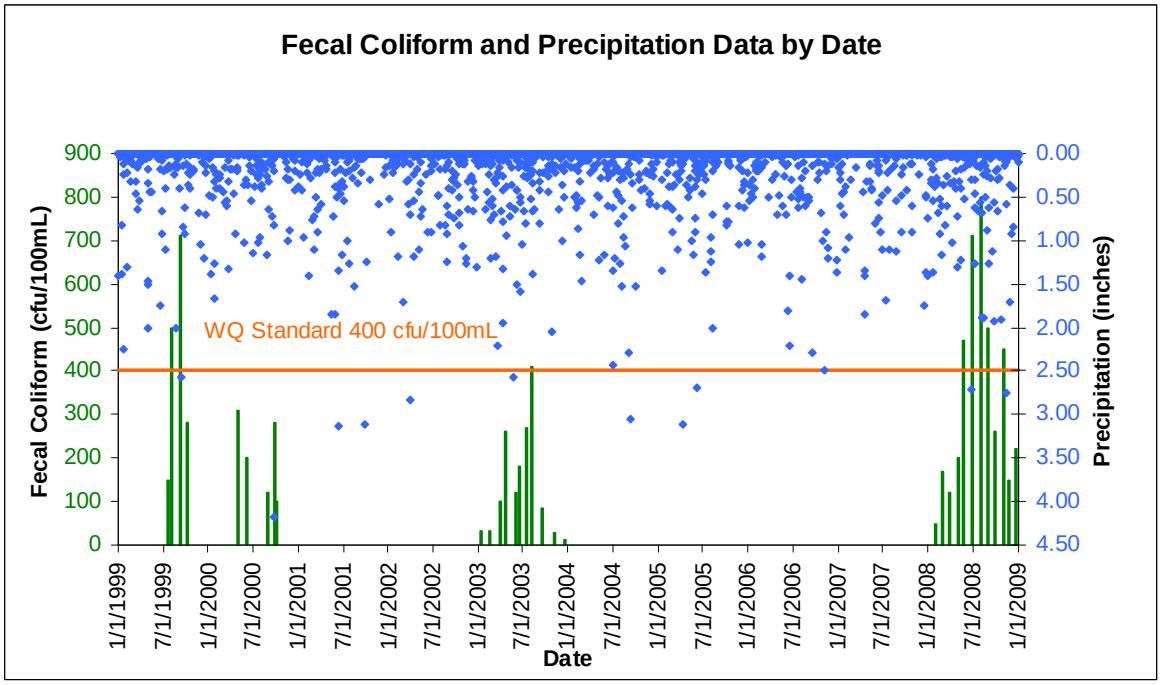
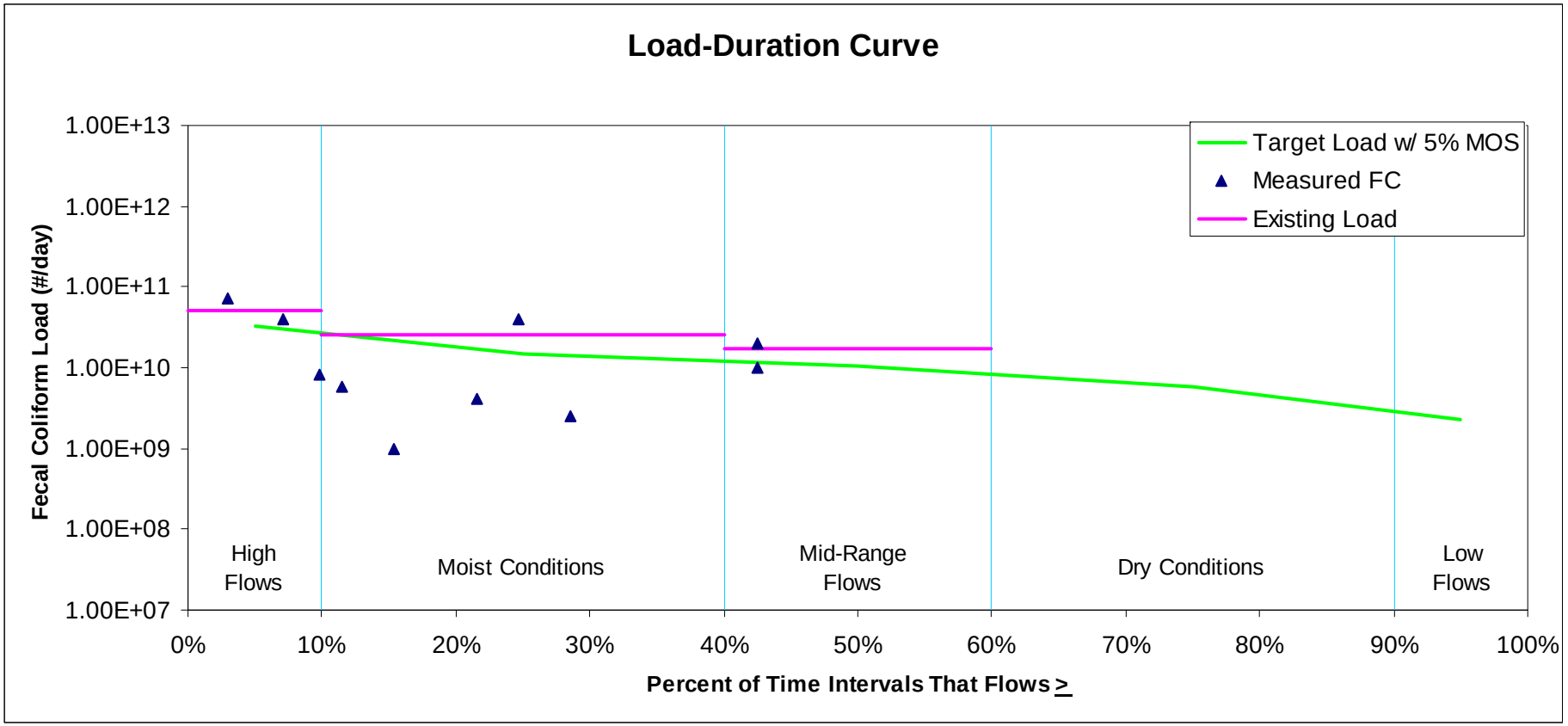


Precipitation and FC Data by Date for Monitoring Station PD-239

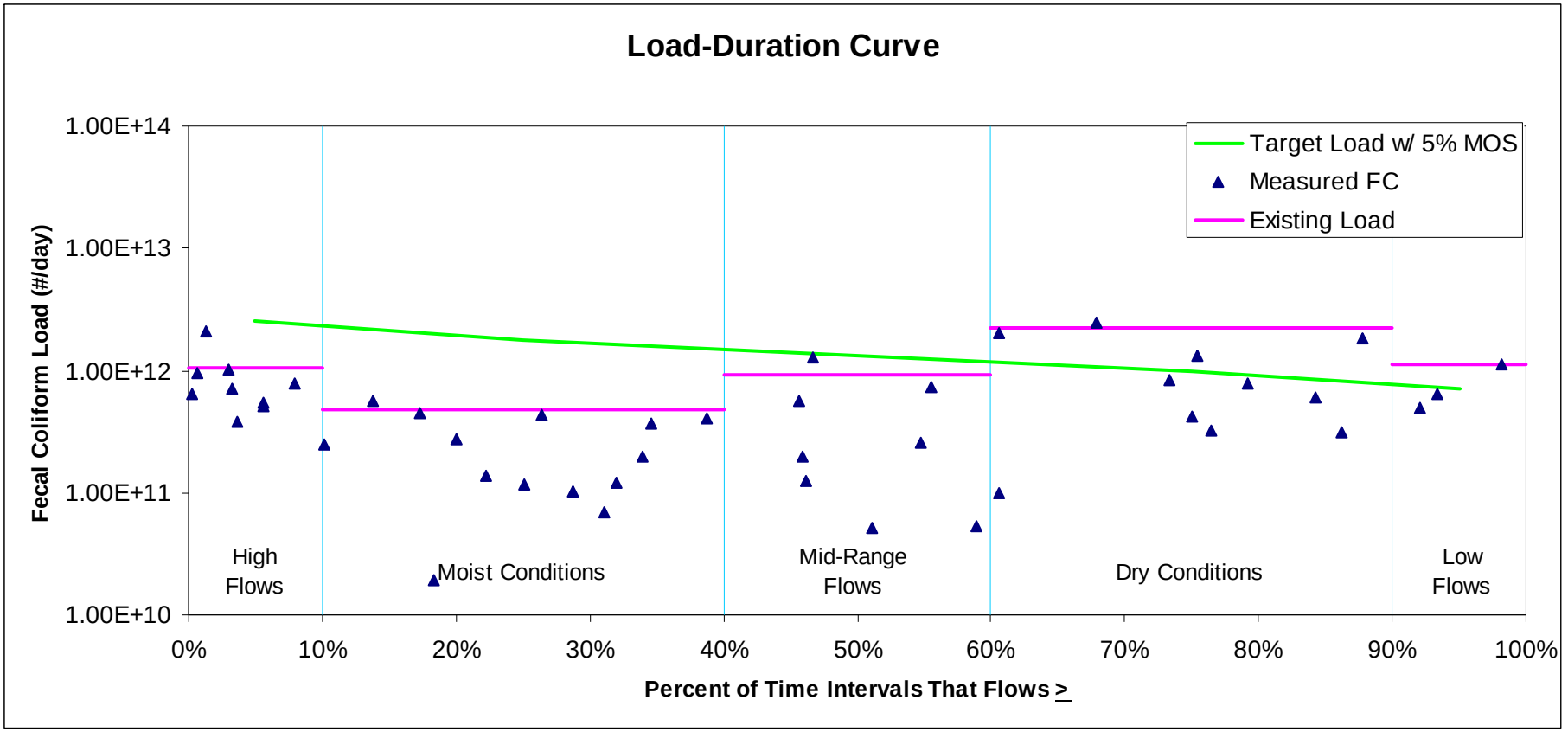


APPENDIX B
ADDITIONAL LOAD-DURATION CURVES BY STATION

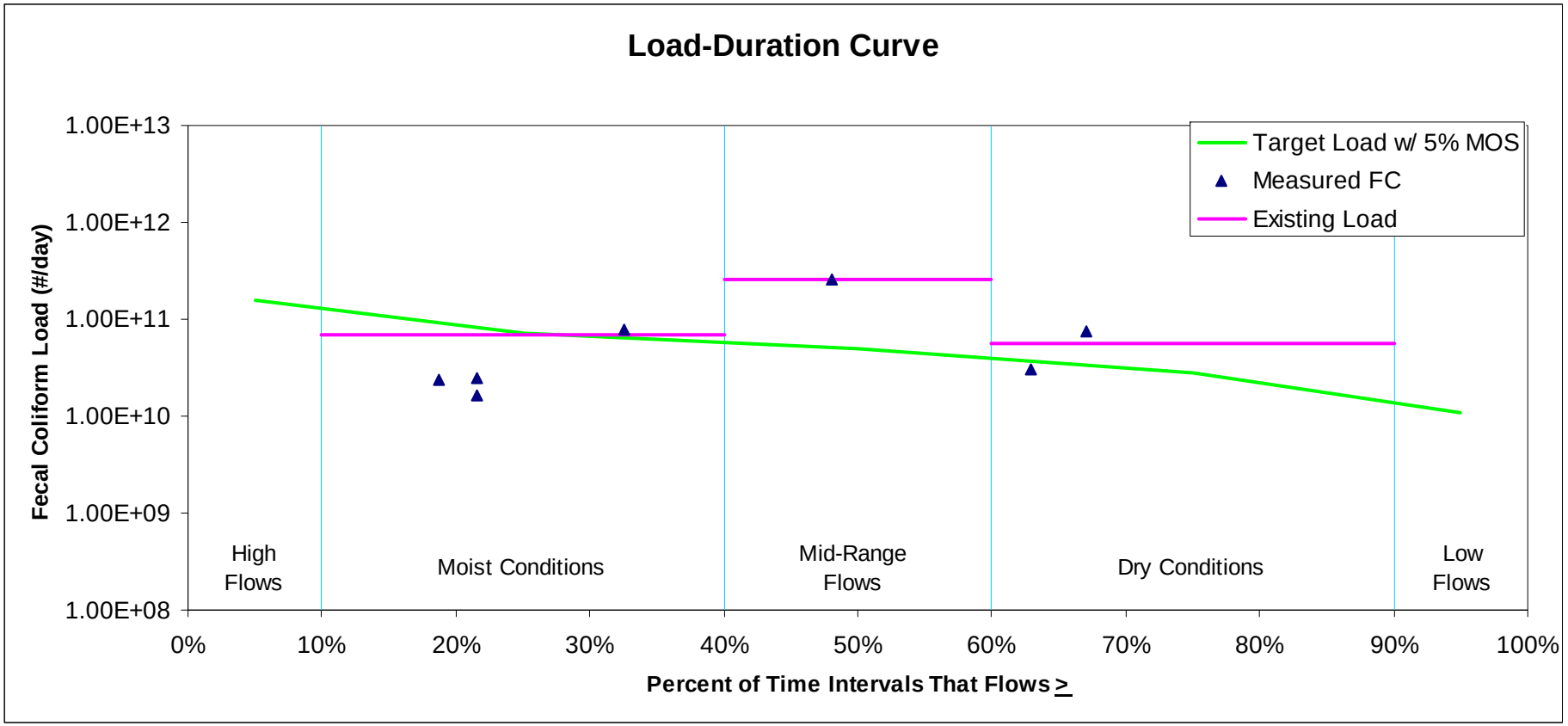
Load Duration Curve for Reach 1 of the Pocotaligo River Watershed, WQM Station RS-03345



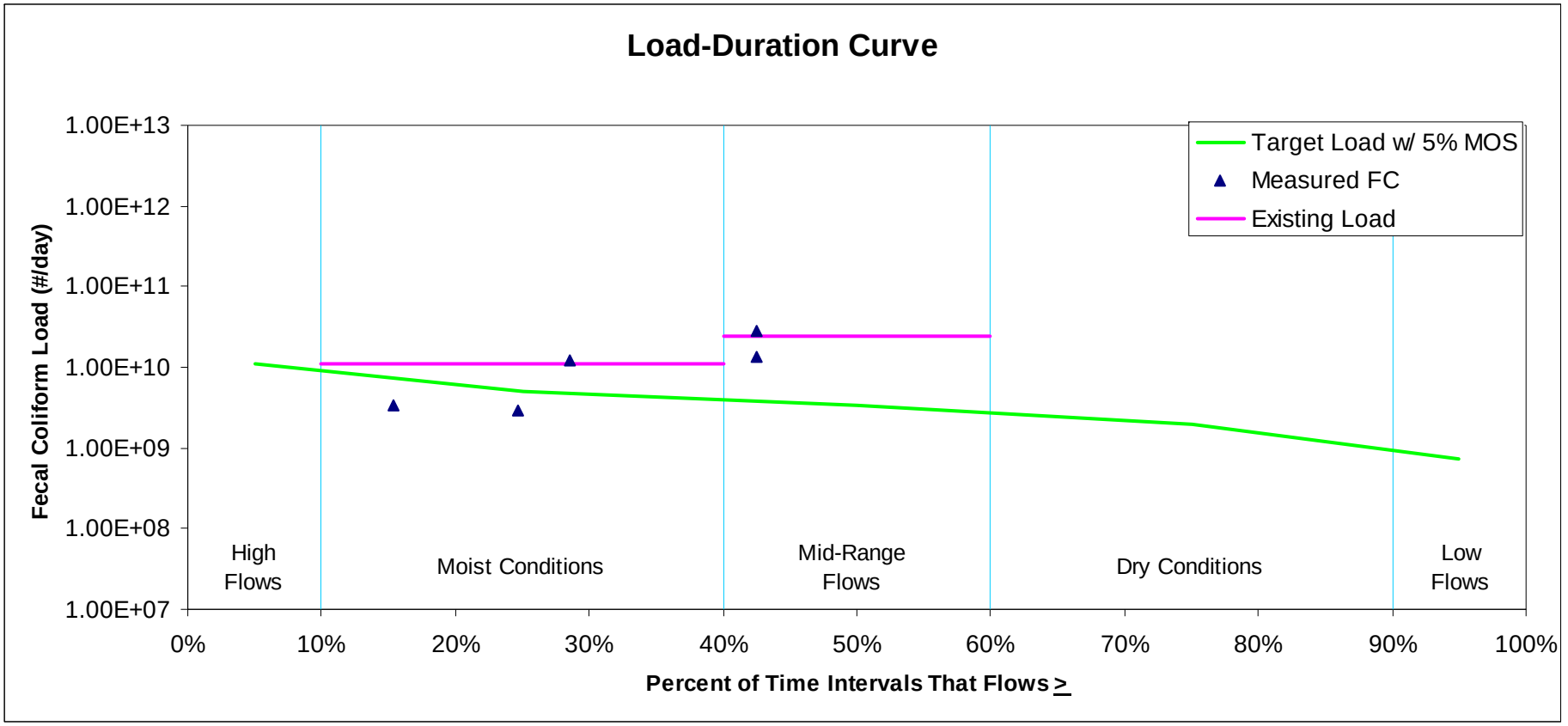
Load Duration Curve for Reach 2 of the Pocotaligo River Watershed, WQM Station PD-202



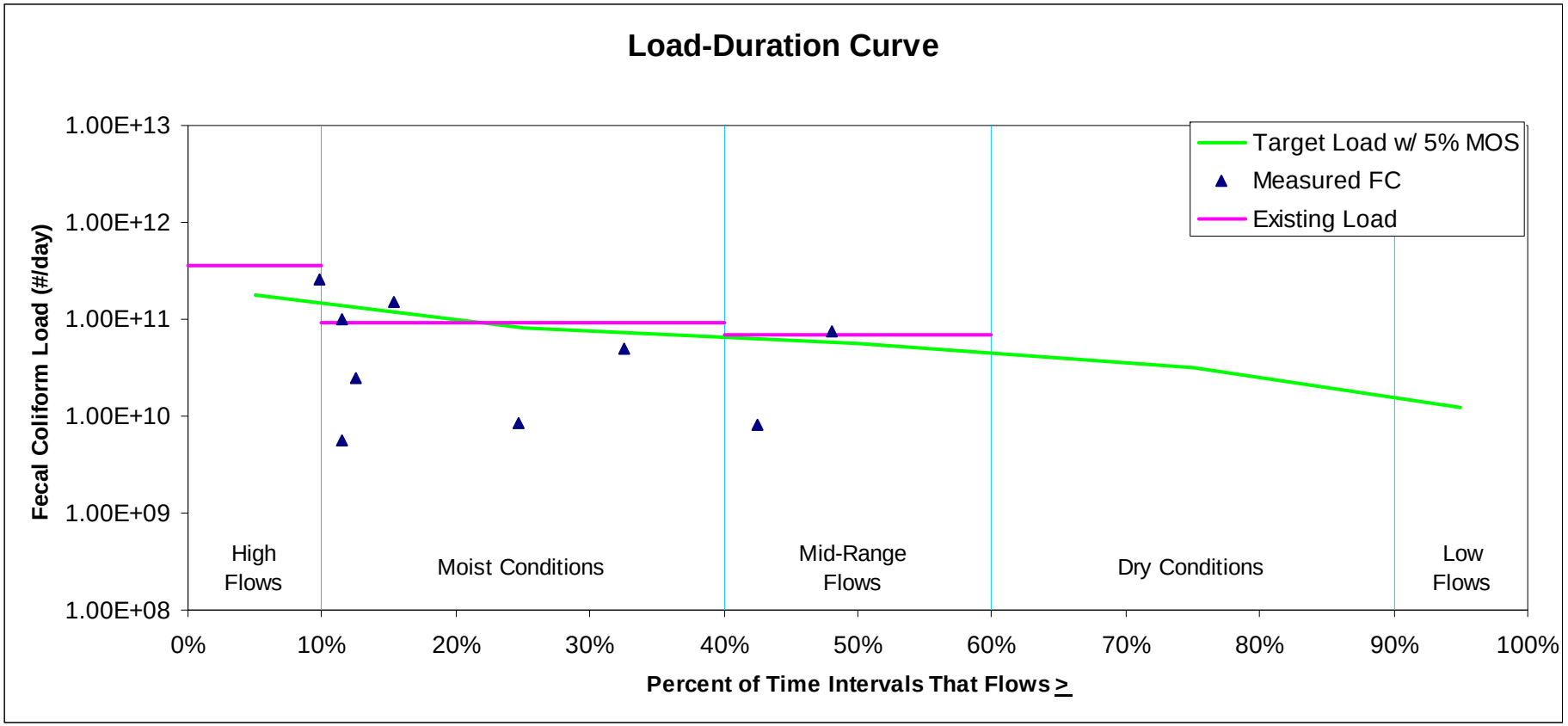
Load Duration Curve for Reach 3 of the Pocotaligo River Watershed, WQM Station RS-07192



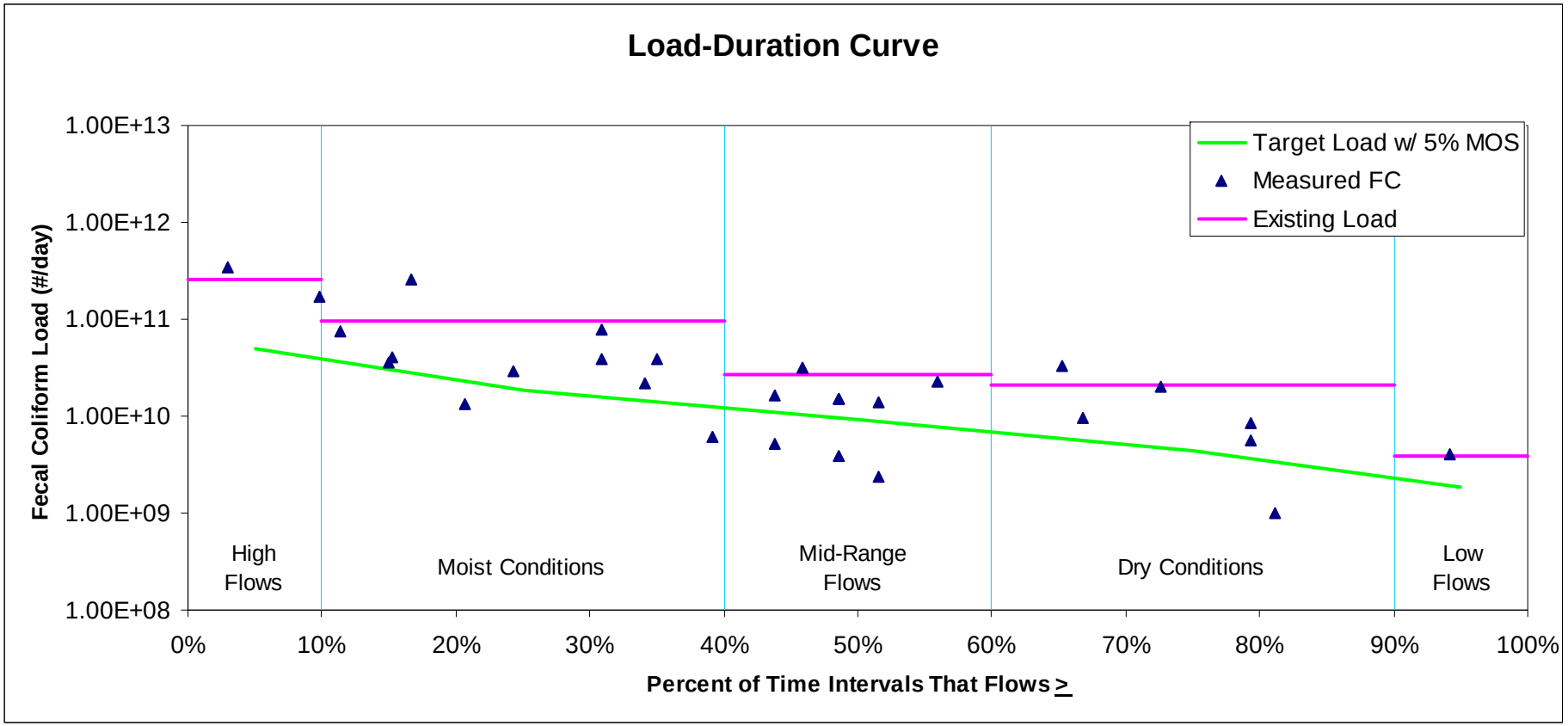
Load Duration Curve for Juneburn Branch Tributary Watershed, WQM Station RS-08232



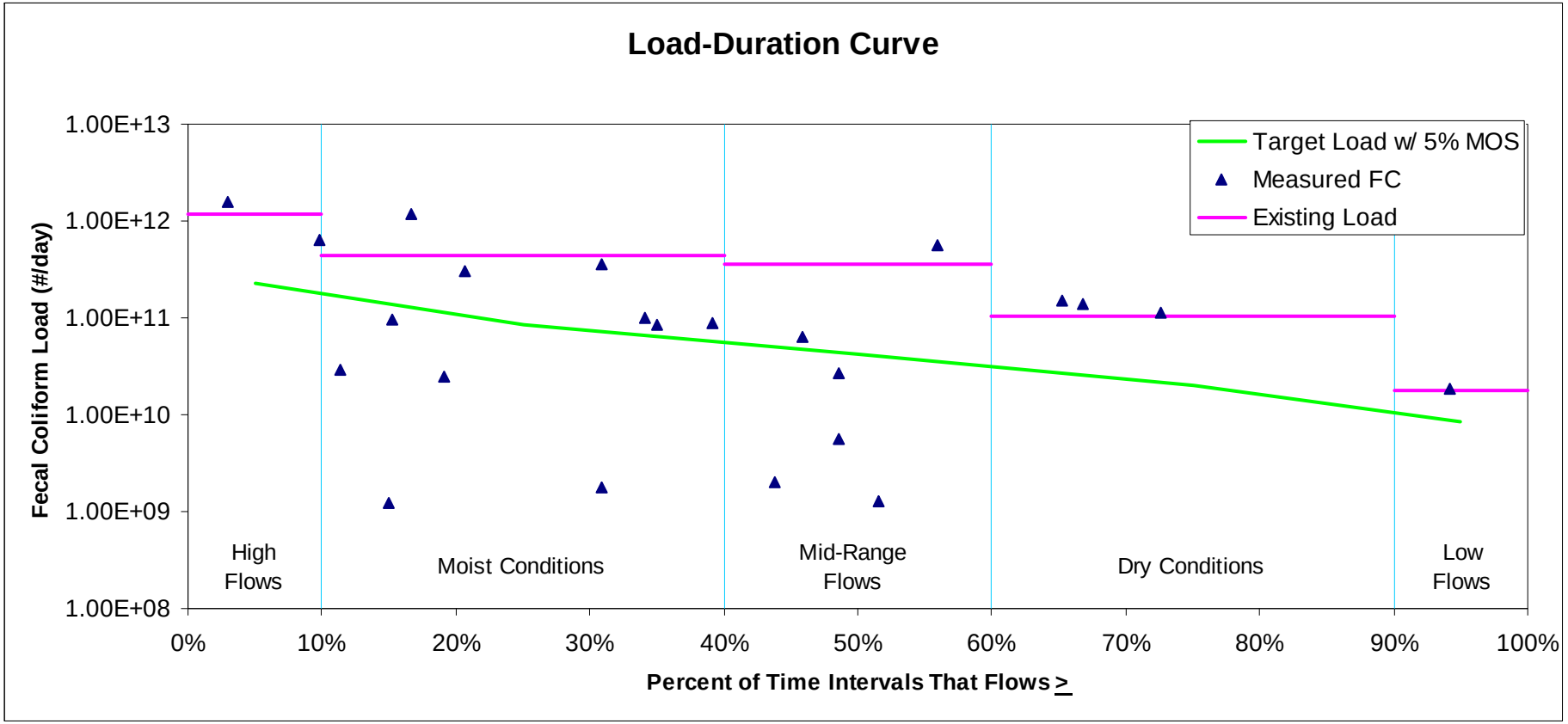
Load Duration Curve for the Deep Creek Watershed, WQM Station RS-03347



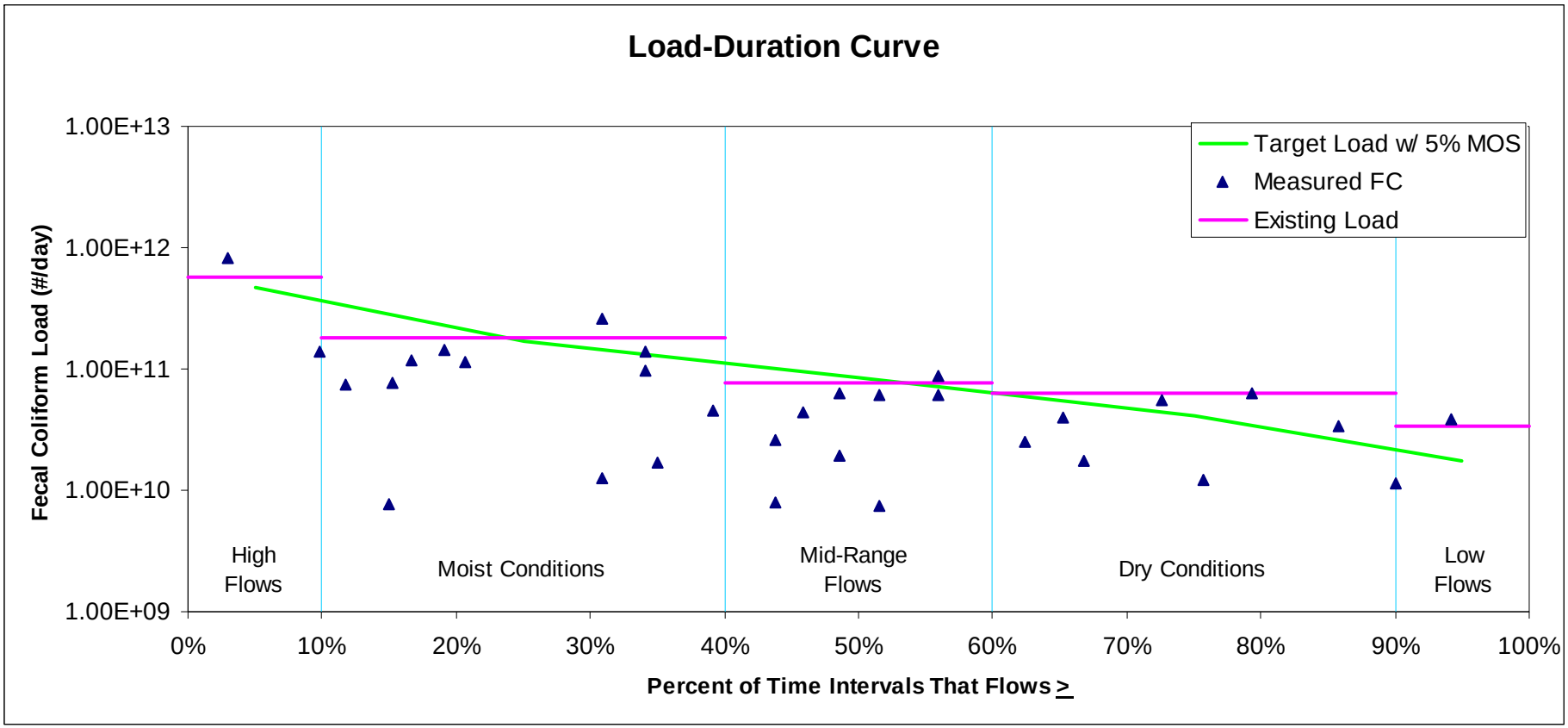
Load Duration Curve for Reach 1 of the Turkey Creek Watershed, WQM Station PD-098



Load Duration Curve for Reach 2 of the Turkey Creek Watershed, WQM Station PD-040



Load Duration Curve for the Nasty Branch Watershed, WQM Station PD-239



Appendix C

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 the 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 sotrmwater 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 D
DATA TABLES

Fecal Coliform WQS Exceedence Summary for Impaired Station RS-03345 by Date

Date	FC (cfu/day)
1/9/2003	**660**
2/13/2003	340
3/25/2003	130
4/16/2003	100

Date	FC (cfu/day)
5/28/2003	96
6/16/2003	**540**
8/4/2003	**600**
9/15/2003	**980**

Date	FC (cfu/day)
11/3/2003	68
12/16/2003	20

____ **WQS Exceeded**

90th Percentile FC Concentrations (#/100 mL)

Hydro Category Range	High Flow 0-10	Moist Cond. 10-40	Mid Range 40-60	Dry Flow 60-90	Low Flow 90-100	Samples
RS-03345	588	628	628	NS	NS	10

NS = No samples

Mid Point Hydrologic Category Flow (cfs)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
RS-03345	3.57	1.63	1.12	0.63	0.24

Existing Load (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
RS-03345	5.13E+10	2.51E+10	1.72E+10	NM	NM

NM = Not measured

Target Load (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
RS-03345	3.32E+10	1.52E+10	1.04E+10	5.87E+09	2.27E+09

Load Reduction Necessary (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
RS-03345	N/A	9.89E+09	6.80E+09	NM	N/A

NM = Not measured

% Load Reduction Necessary

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
RS-03345	N/A	39	39	NM	N/A

NM = Not measured

Fecal Coliform WQS Exceedence Summary for Impaired Station PD-202 by Date

Date	FC (cfu/day)
1/5/1999	44
2/18/1999	30
3/10/1999	24
4/6/1999	4
7/21/1999	370
8/4/1999	300
9/7/1999	160
10/6/1999	57
11/3/1999	34
12/7/1999	83
1/4/2000	36
2/1/2000	240
3/8/2000	50
4/4/2000	17
5/1/2000	18
6/1/2000	280

Date	FC (cfu/day)
7/25/2000	**960**
8/29/2000	360
9/19/2000	180
10/2/2000	100
11/1/2000	140
12/28/2000	240
1/9/2003	16
2/13/2003	110
3/25/2003	54
4/16/2003	100
5/28/2003	54
6/16/2003	84
7/9/2003	100
8/4/2003	140
9/15/2003	110
11/3/2003	26

Date	FC (cfu/day)
12/16/2003	92
1/29/2008	30
2/26/2008	80
3/27/2008	95
4/29/2008	**700**
5/22/2008	350
6/24/2008	**970**
7/29/2008	**800**
8/26/2008	**580**
9/22/2008	380
10/30/2008	160
11/20/2008	58
12/17/2008	130

____ WQS Exceeded

90th Percentile FC Concentrations (#/100 mL)

Hydro Category Range	High Flow 0-10	Moist Cond. 10-40	Mid Range 40-60	Dry Flow 60-90	Low Flow 90-100	Samples
PD-202	160	107	279	960	716	45

Mid Point Hydrologic Category Flow (cfs)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-202	266.17	181.54	134.42	94.66	64.86

Existing Load (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-202	1.04E+12	4.75E+11	9.18E+11	2.22E+12	1.14E+12

Target Load (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-202	2.31E+12	1.54E+12	1.10E+12	7.41E+11	4.71E+11

Load Reduction Necessary (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-202	N/A	NRN	NRN	1.48E+12	N/A

NRN = no reduction needed. Existing load below target load.

% Load Reduction Necessary

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-202	N/A	NRN	NRN	67	N/A

NRN = no reduction needed. Existing load below target load.

Fecal Coliform WQS Exceedence Summary for Impaired Station RS-07192 by Date

Date	FC (cfu/day)
1/11/2007	80
2/15/2007	110
3/12/2007	120

Date	FC (cfu/day)
4/17/2007	**460**
5/17/2007	290
6/14/2007	**800**

Date	FC (cfu/day)
7/3/2007	**2000**

____ **WQS Exceeded**

90th Percentile FC Concentrations (#/100 mL)

Hydro Category Range	High Flow 0-10	Moist Cond. 10-40	Mid Range 40-60	Dry Flow 60-90	Low Flow 90-100	Samples
RS-07192	NS	358	2000	749	NS	7

NS = No samples

Mid Point Hydrologic Category Flow (cfs)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
RS-07192	17.01	7.77	5.34	3.01	1.17

Existing Load (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
RS-07192	NM	6.81E+10	2.62E+11	5.52E+10	NM

NM = Not measured

Target Load (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
RS-07192	1.58E+11	7.23E+10	4.97E+10	2.80E+10	1.08E+10

Load Reduction Necessary (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
RS-07192	N/A	NRN	2.12E+11	2.72E+10	N/A

NRN = no reduction needed. Existing load below target load.

% Load Reduction Necessary

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
RS-07192	N/A	NRN	81	49	N/A

NRN = no reduction needed. Existing load below target load.

Fecal Coliform WQS Exceedence Summary for Impaired Station PD-115 by Date

Date	FC (cfu/day)
5/13/1999	120
7/27/1999	47
8/4/1999	52
9/22/1999	350
10/6/1999	50
6/27/2000	200
7/13/2000	48
8/22/2000	64
9/6/2000	**690**
10/12/2000	110
1/9/2003	36
2/24/2003	8

Date	FC (cfu/day)
3/13/2003	6
4/10/2003	130
5/21/2003	90
6/12/2003	110
7/10/2003	42
8/6/2003	36
9/4/2003	120
10/14/2003	90
11/6/2003	100
12/4/2003	140
1/29/2008	58
2/26/2008	55

Date	FC (cfu/day)
3/27/2008	18
4/29/2008	110
5/22/2008	75
6/24/2008	**610**
7/29/2008	**1300**
8/26/2008	74
9/22/2008	94
10/30/2008	190
11/20/2008	**720**
12/17/2008	110

___ WQS Exceeded

90th Percentile FC Concentrations (#/100 mL)

Hydro Category Range	High Flow 0-10	Moist Cond. 10-40	Mid Range 40-60	Dry Flow 60-90	Low Flow 90-100	Samples
PD-115	118	410	384	260	1059	34

Mid Point Hydrologic Category Flow (cfs)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-115	436.93	296.01	216.97	150.23	100.97

Existing Load (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-115	1.26E+12	2.97E+12	2.04E+12	9.56E+11	2.62E+12

Target Load (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-115	4.14E+12	2.84E+12	2.10E+12	1.49E+12	1.04E+12

Load Reduction Necessary (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-115	N/A	1.30E+11	NRN	NRN	N/A

NRN = no reduction needed. Existing load below target load.

% Load Reduction Necessary

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-115	N/A	4	NRN	NRN	N/A

NRN = no reduction needed. Existing load below target load.

Fecal Coliform WQS Exceedence Summary for Impaired Station RS-08232 by Date

Date	FC (cfu/day)
1/29/2008	**1000**
2/26/2008	210

Date	FC (cfu/day)
3/27/2008	**1400**
4/29/2008	**2900**

Date	FC (cfu/day)
12/17/2008	220

____ WQS Exceeded

90th Percentile FC Concentrations (#/100 mL)

Hydro Category Range	High Flow 0-10	Moist Cond. 10-40	Mid Range 40-60	Dry Flow 60-90	Low Flow 90-100	Samples
RS-08232	NS	844	2750	NS	NS	5

NS = No samples

Mid Point Hydrologic Category Flow (cfs)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
RS-08232	1.17	0.53	0.37	0.21	0.08

Existing Load (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
RS-08232	NM	1.10E+10	2.47E+10	NM	NM

NM = Not measured

Target Load (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
RS-08232	1.08E+10	4.96E+09	3.41E+09	1.92E+09	7.44E+08

Load Reduction Necessary (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
RS-08232	N/A	6.05E+09	2.13E+10	NM	N/A

NM = Not measured

% Load Reduction Necessary

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
RS-08232	N/A	55	86	NM	N/A

NM = Not measured

Fecal Coliform WQS Exceedence Summary for Impaired Station RS-03347

Date	FC (cfu/day)
1/9/2003	50
2/24/2003	40
5/21/2003	**550**

Date	FC (cfu/day)
6/12/2003	260
7/10/2003	**510**
9/4/2003	**770**

Date	FC (cfu/day)
10/14/2003	18
11/6/2003	320
12/4/2003	82

____ WQS Exceeded

90th Percentile FC Concentrations (#/100 mL)

Hydro Category Range	High Flow 0-10	Moist Cond. 10-40	Mid Range 40-60	Dry Flow 60-90	Low Flow 90-100	Samples
RS-03347	770	435	464	NS	NS	9

NS = No samples

Mid Point Hydrologic Category Flow (cfs)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
RS-03347	19.32	8.83	6.07	3.42	1.32

Existing Load (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
RS-03347	3.64E+11	9.40E+10	6.89E+10	NM	NM

NM = Not measured

Target Load (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
RS-03347	1.80E+11	8.21E+10	5.64E+10	3.18E+10	1.23E+10

Load Reduction Necessary (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
RS-03347	N/A	1.19E+10	1.25E+10	NM	N/A

NM = Not measured

% Load Reduction Necessary

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
RS-08232	N/A	13	18	NM	N/A

NM = Not measured

Fecal Coliform WQS Exceedence Summary for Impaired Station PD-098 by Date

Date	FC (cfu/day)
6/13/2000	120
7/26/2000	**600**
8/22/200	**900**
9/20/2000	**600**
10/2/2000	**600**
1/9/2003	102
2/13/2003	**1000**
3/24/2003	**960**
4/14/2003	**600**
5/28/2003	**600**

Date	FC (cfu/day)
6/16/2003	**1200**
7/9/2003	**600**
8/4/2003	**600**
9/15/2003	**600**
10/13/2003	160
11/3/2003	190
12/16/2003	**530**
1/29/2008	**1100**
2/26/2008	**2000**
3/27/2008	**610**

Date	FC (cfu/day)
4/29/2008	**4000**
5/22/2008	**1600**
6/24/2008	**2000**
7/29/2008	**800**
8/27/3008	**2000**
9/22/2008	**2000**
10/30/2008	**1100**
11/20/2008	190
12/17/2008	240

____ **WQS Exceeded**

90th Percentile FC Concentrations (#/100 mL)

Hydro Category Range	High Flow 0-10	Moist Cond. 10-40	Mid Range 40-60	Dry Flow 60-90	Low Flow 90-100	Samples
PD-098	2000	2000	1120	1800	800	29

Mid Point Hydrologic Category Flow (cfs)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-098	5.27	1.96	0.98	0.47	0.20

Existing Load (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-098	2.58E+11	9.57E+10	2.68E+10	2.08E+10	3.89E+09

Target Load (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-098	4.90E+10	1.82E+10	9.09E+09	4.40E+09	1.85E+09

Load Reduction Necessary (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-098	N/A	7.75E+10	1.77E+10	1.64E+10	N/A

% Load Reduction Necessary

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-098	N/A	81	66	79	N/A

Fecal Coliform WQS Exceedence Summary for Impaired Station PD-040 by Date

Date	FC (cfu/day)
1/9/2003	12
2/13/2003	10
3/24/2003	80
4/16/2003	94
5/28/2008	310
6/16/2008	**520**
7/9/2003	240
8/4/2003	**600**

Date	FC (cfu/day)
9/15/2003	50
11/3/2003	16
12/16/2003	4
1/29/2008	**530**
2/26/3008	**1600**
3/27/2008	**2000**
4/29/2008	**4000**
5/22/2008	**2000**

Date	FC (cfu/day)
6/24/2008	**2000**
7/29/2008	**800**
8/27/2008	**2000**
9/22/2008	**2000**
10/30/2008	**6000**
11/20/2008	**600**
12/17/2008	**1200**

___ WQS Exceeded

90th Percentile FC Concentrations (#/100 mL)

Hydro Category Range	High Flow 0-10	Moist Cond. 10-40	Mid Range 40-60	Dry Flow 60-90	Low Flow 90-100	Samples
PD-040	1960	2000	3260	2000	800	23

Mid Point Hydrologic Category Flow (cfs)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-040	24.10	8.95	4.47	2.16	0.91

Existing Load (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-040	1.16E+12	4.38E+11	3.57E+11	1.06E+11	1.78E+10

Target Load (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-040	2.24E+11	8.32E+10	4.16E+10	2.01E+10	8.45E+09

Load Reduction Necessary (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-040	N/A	3.55E+11	3.15E+11	8.58E+10	N/A

% Load Reduction Necessary

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-040	N/A	81	88	81	N/A

Fecal Coliform WQS Exceedence Summary for Impaired Station PD-239 by Date

Date	FC (cfu/day)
7/21/1999	150
8/4/1999	**500**
9/7/1999	**710**
10/6/1999	280
5/1/2000	310
6/1/2000	200
8/29/2000	120
9/20/2000	280
10/2/2000	100
1/9/2003	34
2/13/2003	34

Date	FC (cfu/day)
3/25/2003	100
4/16/2003	260
5/28/2003	120
6/16/2003	180
7/9/2003	270
8/4/2003	**410**
9/15/2003	84
11/3/2003	30
12/16/2003	12
1/29/2008	50
2/26/2008	170

Date	FC (cfu/day)
3/27/2008	120
4/29/2008	200
5/22/2008	**470**
6/24/2008	**710**
7/29/2008	**800**
8/27/2008	**500**
9/22/2008	260
10/30/2008	**450**
11/20/2008	150
12/17/2008	220

____ WQS Exceeded

90th Percentile FC Concentrations (#/100 mL)

Hydro Category Range	High Flow 0-10	Moist Cond. 10-40	Mid Range 40-60	Dry Flow 60-90	Low Flow 90-100	Samples
PD-239	467	397	338	584	740	32

Mid Point Hydrologic Category Flow (cfs)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-239	49.74	18.46	9.23	4.47	1.88

Existing Load (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-239	5.68E+11	1.79E+11	7.63E+10	6.38E+10	3.40E+10

Target Load (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-239	4.62E+11	1.72E+11	8.58E+10	4.15E+10	1.74E+10

Load Reduction Necessary (#/day)

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-239	N/A	7.68E+09	NRN	2.23E+10	N/A

NRN = no reduction needed. Existing load below target load.

% Load Reduction Necessary

Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
PD-239	N/A	4	NRN	35	N/A

NRN = no reduction needed. Existing load below target load.

Appendix E

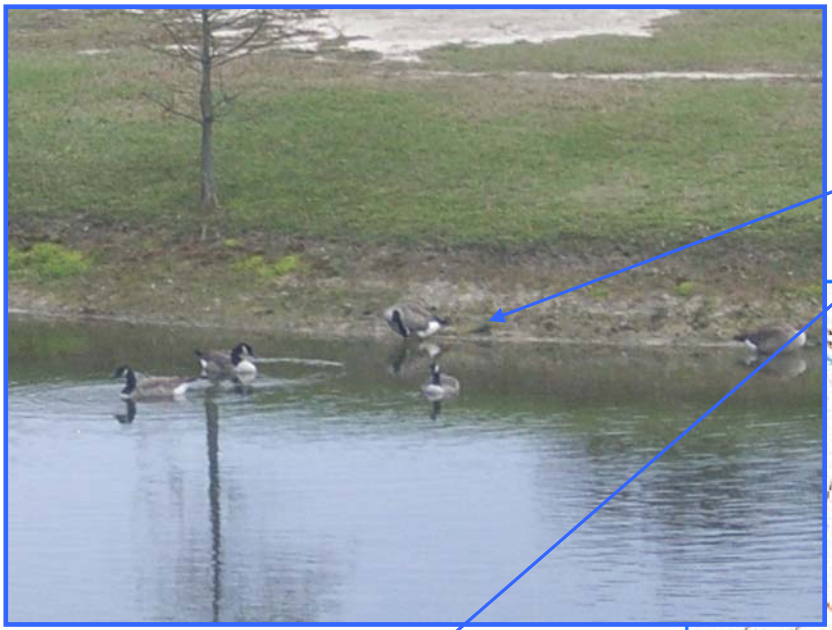
SOURCE ASSESSMENT PICTURES

Figure E-1

Blue heron near an intermittent pond (location: 33.99606 N, -80.41336 W) on W. Brewington Road in Sumter County. Found in Reach 2 of the Pocotaligo River Watershed (Date of photography: October 30, 2012).

Figure E-2

Ducks in an impoundment (location: 33.93256 N, -80.47944 W) at the intersection of Cane Savannah Road and Eagle Road in Sumter County. Found in Reach 2 of the Pocotaligo River Watershed (Date of photography: October 30, 2012).



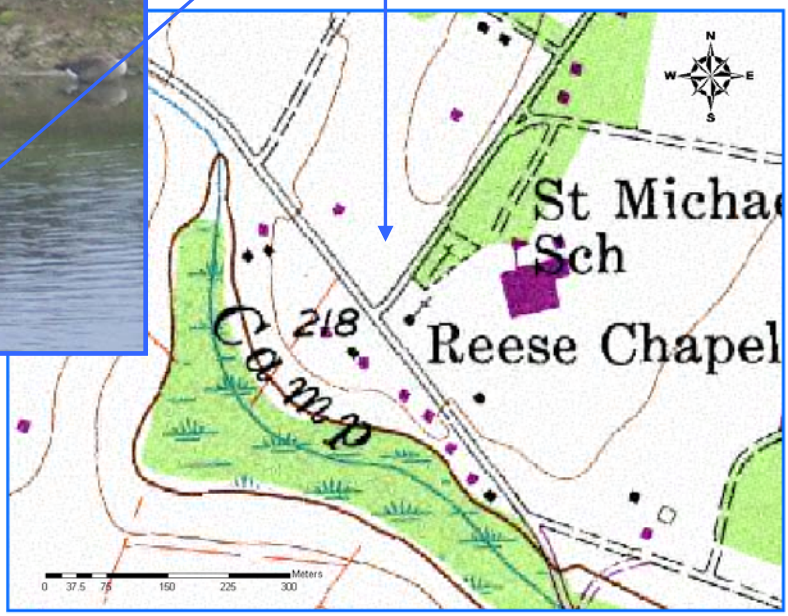


Figure E-3

Horse and manure pile in a pen (location: 33.82617 N, -80.45031 W) on Pond Loop Road in Sumter County. Found in Reach 1 of the Pocotaligo River Watershed (Date of photography: October 31, 2012).

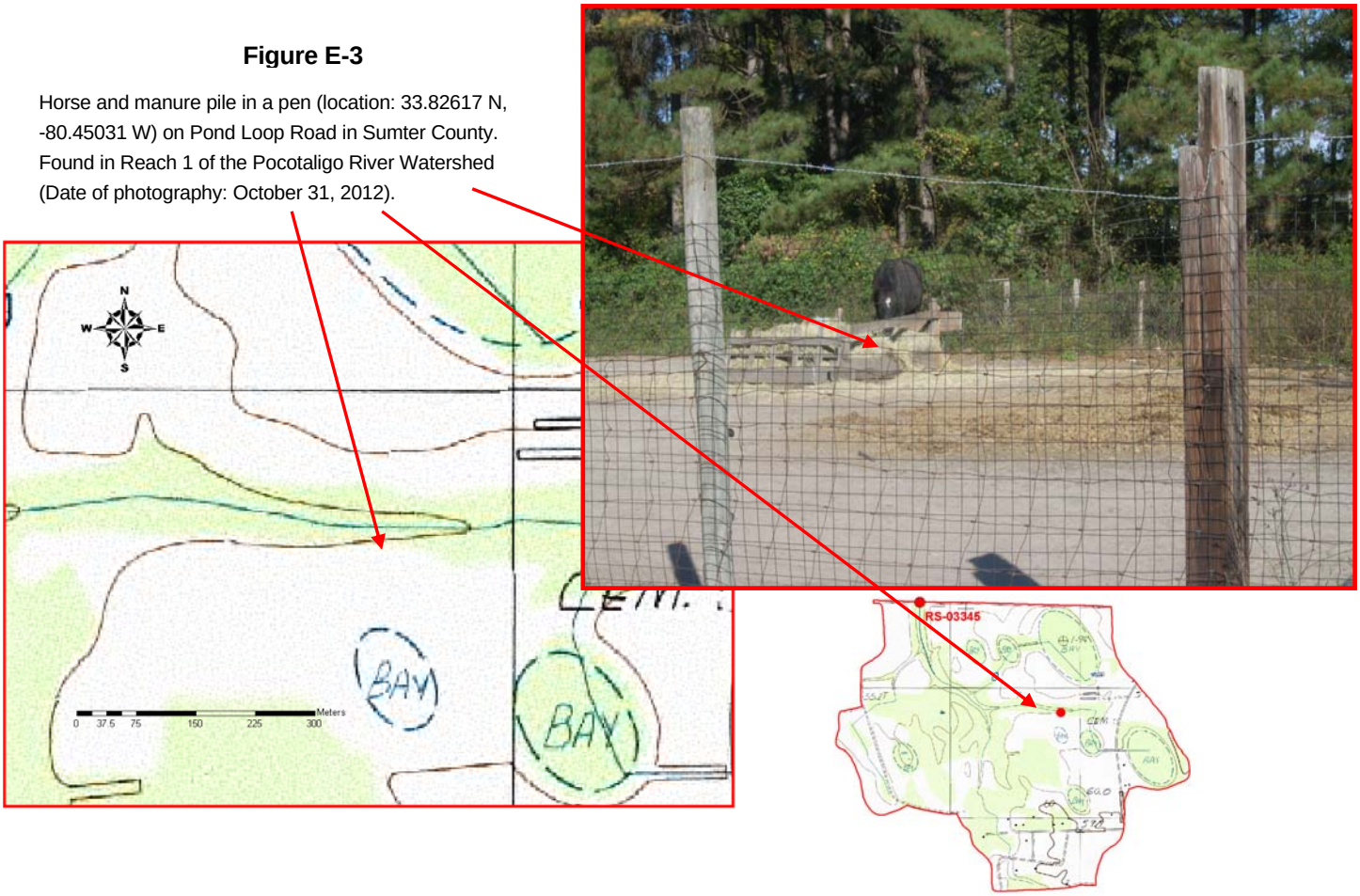


Figure E-4

Horse and cattle in a pasture with a stream-fed pond (location: 33.61297 N, -80.14979 W) on Bloomville Road in Clarendon County. Found in the Deep Creek Watershed (Date of photography: October 31, 2012).

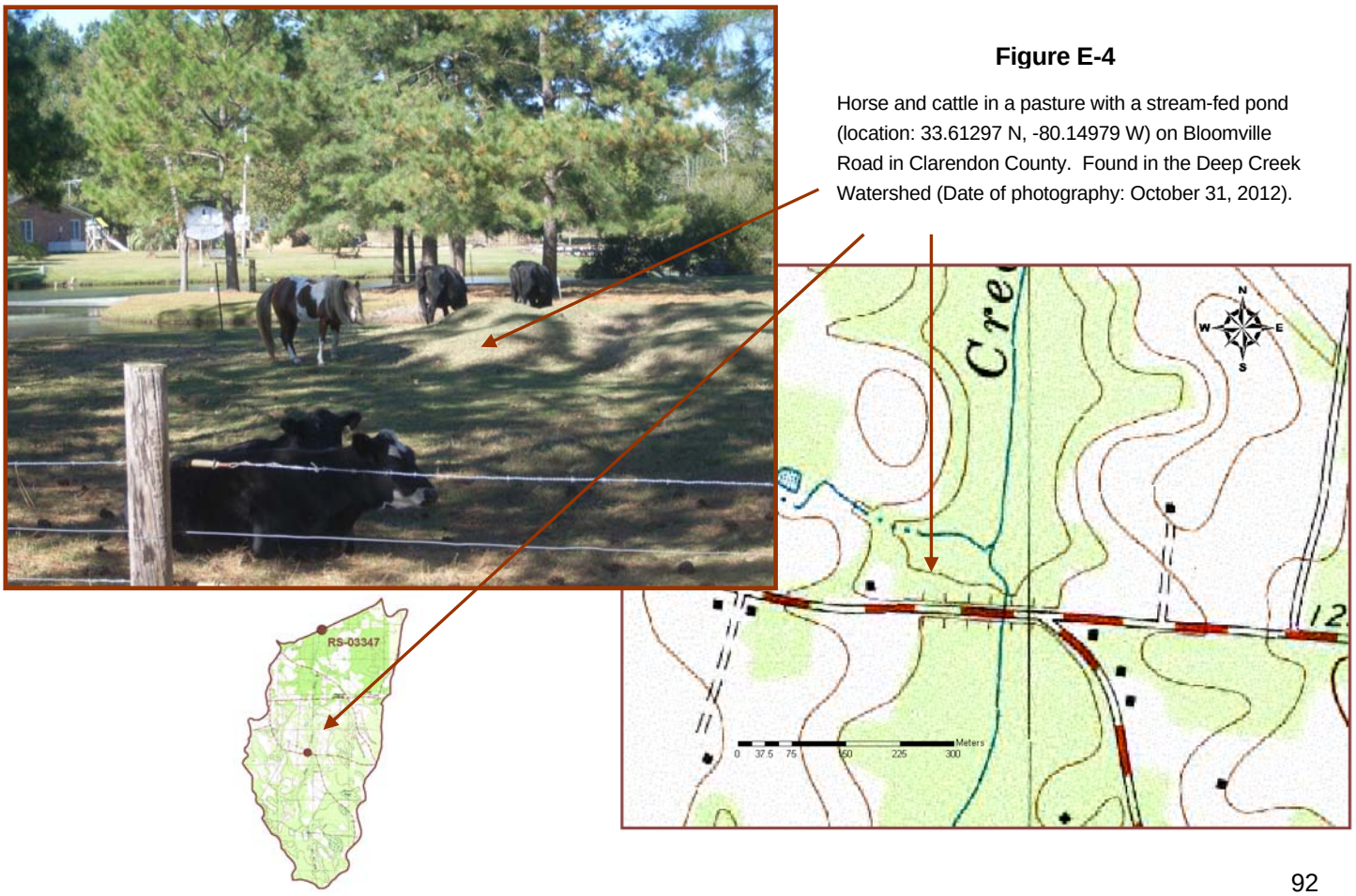


Figure E-5

Horses in a pasture (location: 33.78208 N, -80.21989 W) on Brogdon Road in Clarendon County. Found in Reach 3 of the Pocotaligo River Watershed (Date of photography: October 31, 2012).

Figure E-6

Sign for a horse stable (location: 33.91011 N, -80.43507 W) on SC Route 763 in Sumter County. Found in Reach 2 of the Pocotaligo River Watershed (Date of photography: October 30, 2012).

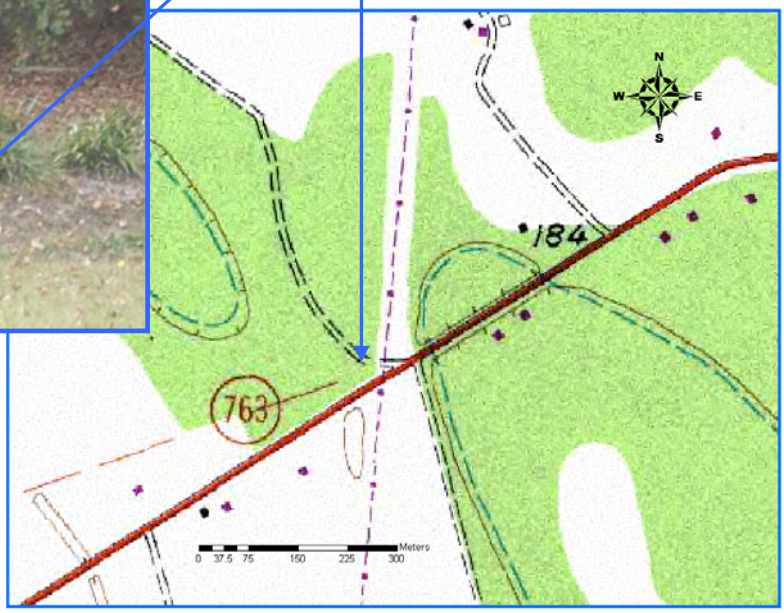


Figure E-7

Sign for a horse stable (location: 33.91222 N, -80.43103 W) on SC Route 763 in Sumter County. Found in Reach 2 of the Pocotaligo River Watershed (Date of photography: October 30, 2012).

Figure E-8

Goats in a pasture (location: 33.81763 N, -80.45408 W) on Muriel Street in Sumter County. Found in Reach 1 of the Pocotaligo River Watershed (Date of photography: October 31, 2012).

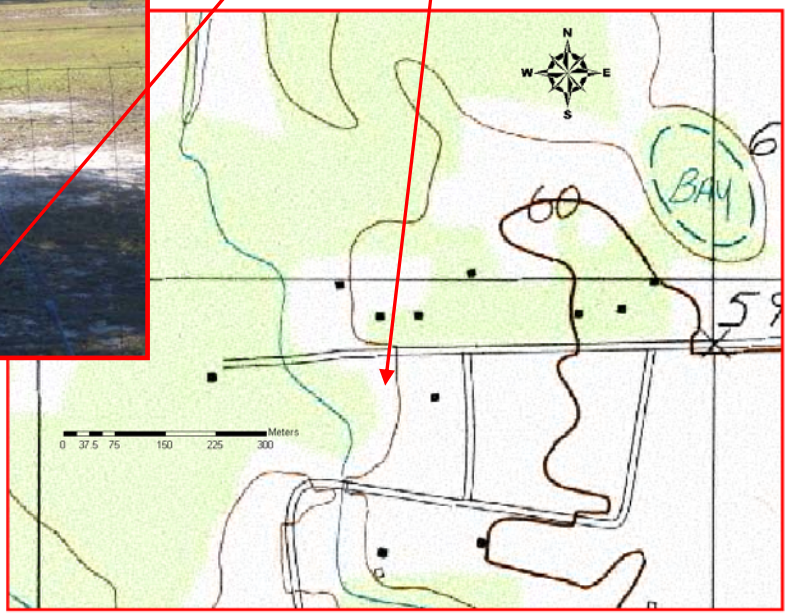


Figure E-9

Goats in a pasture (location: 33.73909 N, -80.19788 W) on Trinity Church Road in Clarendon County. Found in Reach 4 of the Pocotaligo River Watershed (Date of photography: October 31, 2012).

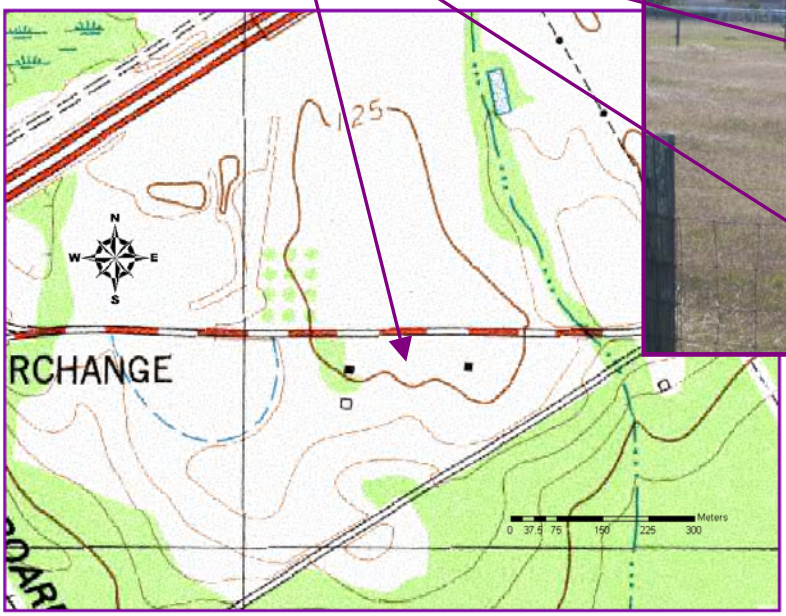


Figure E-10

Donkeys in a pasture with a pond (location: 33.71767 N, -80.23619 W) on County Route S-14-687 in Clarendon County. Found in Reach 4 of the Pocotaligo River Watershed (Date of photography: October 31, 2012).

Figure E-11

Donkeys in a pasture (location: 33.81728 N, -80.45403 W) on Muriel Street in Sumter County. Found in Reach 1 of the Pocotaligo River Watershed (Date of photography: October 31, 2012).

Figure E-12

Cattle in a pasture (location: 33.74556 N, -80.17778 W) on U.S. 301 in Clarendon County. Found in the Juneburn Branch Tributary Watershed (Date of photography: October 31, 2012).

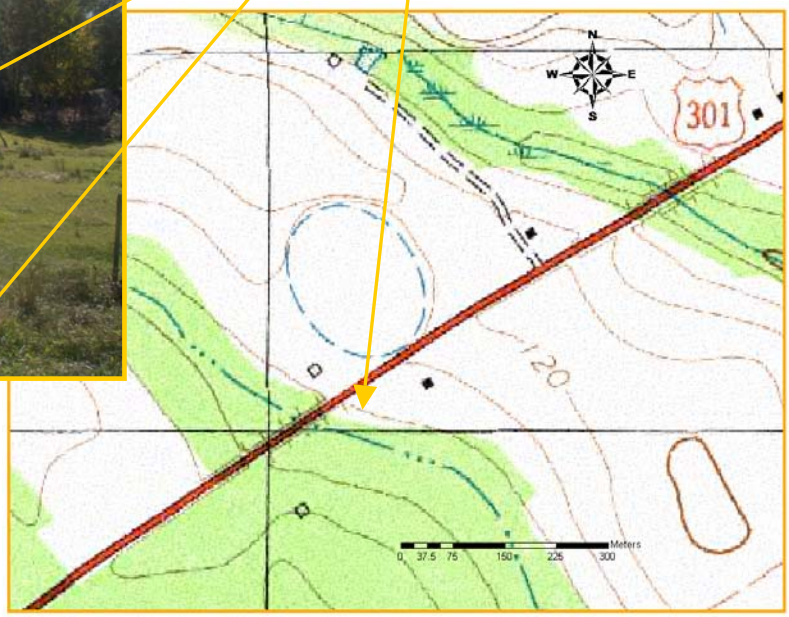


Figure E-13

Cattle in a pasture (location: 33.80953 N, -80.31975 W) at Old Manning Road and Ard Lane in Sumter County. Found in Reach 2 of the Pocotaligo River Watershed (Date of photography: October 30, 2012).

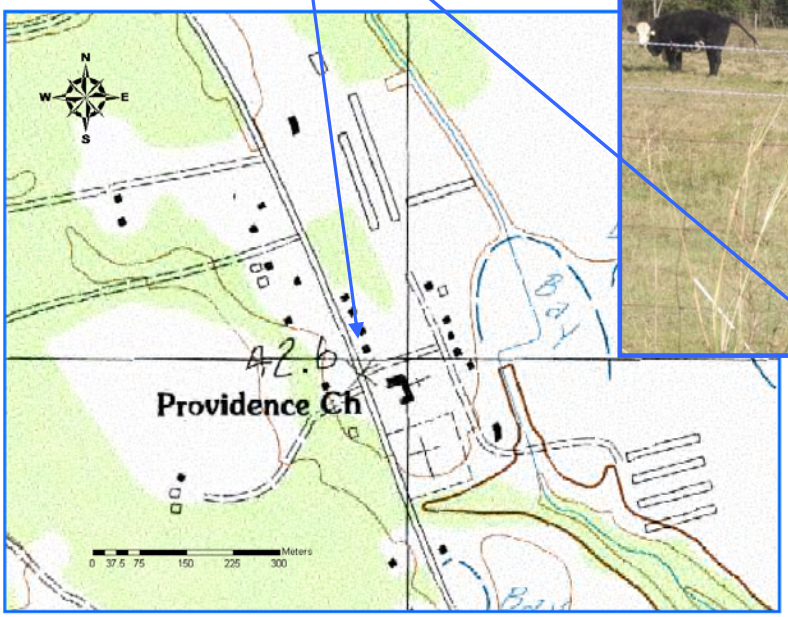


Figure E-14

Cattle in a pasture (location: 33.79598 N, -80.30999 W) on Old Manning Road in Sumter County. Found in Reach 2 of the Pocotaligo River Watershed (Date of photography: October 30, 2012).

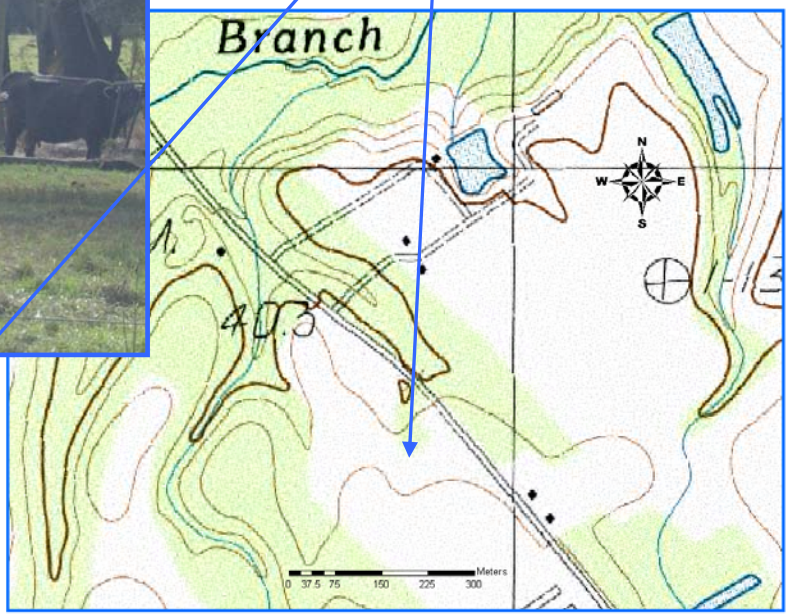


Figure E-15

Cattle in a pasture (location: 33.67313 N, -80.36122 W) on Furse Road in Clarendon County. Found in Reach 4 of the Pocotaligo River Watershed (Date of photography: October 31, 2012).

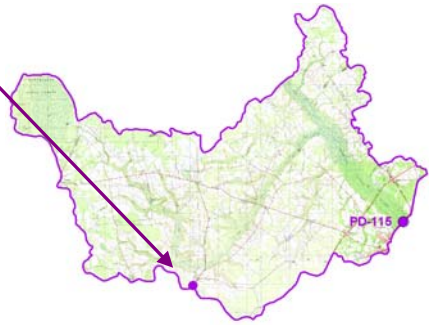
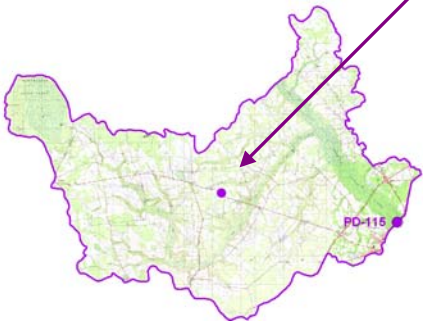


Figure E-16

Cattle lying in the shade in a pasture (location: 33.73199 N, -80.33452 W) near Paxville Highway and Fennel Street in Clarendon County. Found in Reach 4 of the Pocotaligo River Watershed (Date of photography: October 31, 2012).



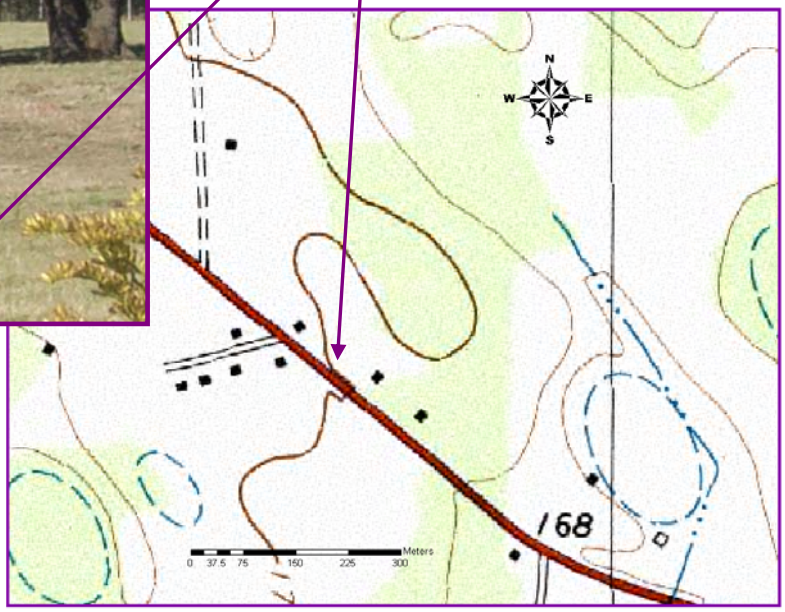


Figure E-17

Unrestrained dog (location: 33.82794 N, -80.44994 W) on Livingwood Drive in Sumter County. Found in Reach 1 of the Pocotaligo River Watershed (Date of photography: October 31, 2012).

Figure E-18

Unrestrained dog (location: 33.82587 N, -80.45443 W) on Pond Loop Road in Sumter County. Found in Reach 1 of the Pocotaligo River Watershed (Date of photography: October 31, 2012).

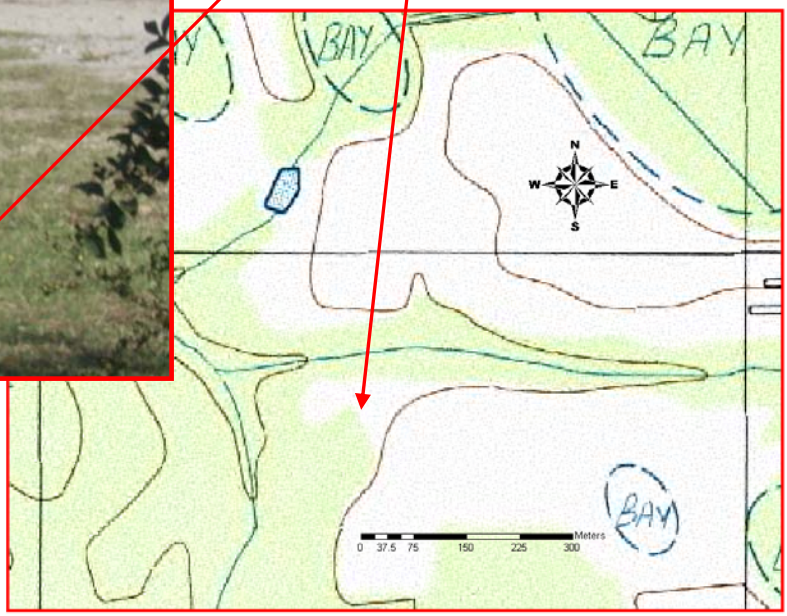
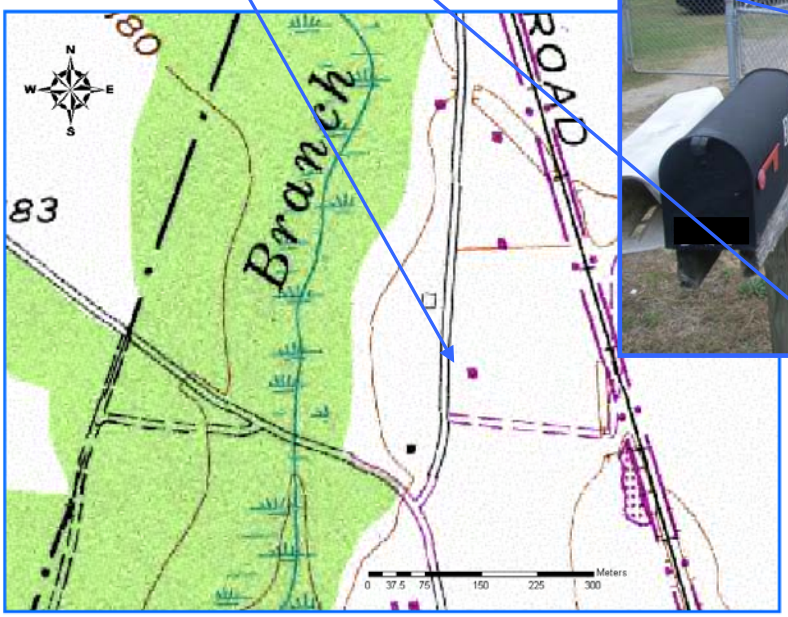


Figure E-19

Unrestrained dogs (location: 33.91195 N, -80.45163 W) on Saint Paul Church Road in Sumter County. Found in Reach 2 of the Pocotaligo River Watershed (Date of photography: October 30, 2012).



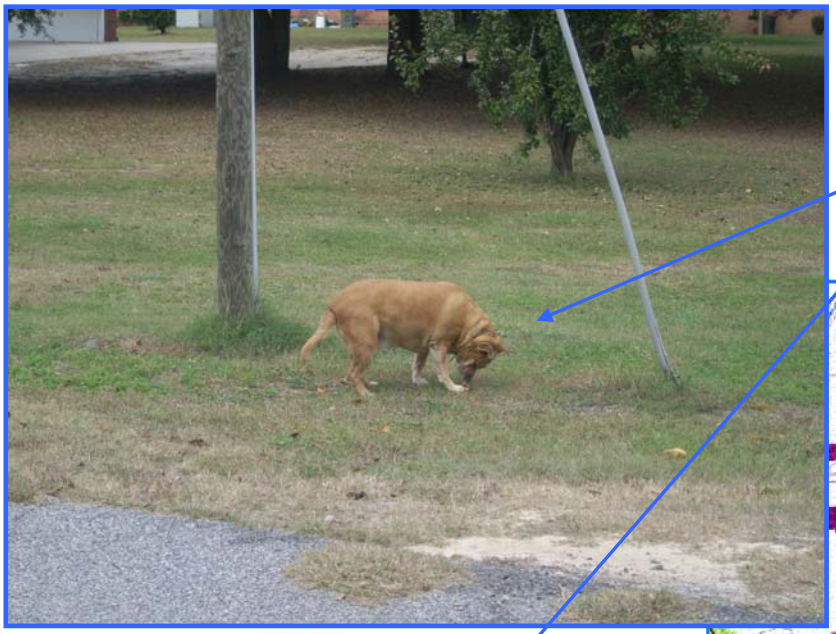


Figure E-20

Unrestrained dog (location: 33.89837 N, -80.34994 W) on Estate Circle in the City of Sumter. Found in Reach 2 of the Pocotaligo River Watershed (Date of photography: October 30, 2012).

Responsiveness Summary
Pocotaligo River and Tributaries *E. coli* TMDLs Document

Comments were received from the following:

Shaw Air Force Base

Comment 1:

"Currently, Shaw AFB's Waste Water Treatment Plant is covered under the NPDES Stormwater Industrial Permit and it requires the base to monitor 3 of their 5 outfalls for fecal coliform for benchmark monitoring. Fecal coliform results from this benchmark monitoring have shown that the outfalls have not exceeded 15 CFUs. Again, the existing fecal load of concern in Reach 2 is 2.22 E + 12 CFU/day. Once Shaw AFB has proven to comply with industrial benchmark monitoring requirements at these outfalls, Shaw AFB will have completed its industrial permit monitoring requirements for the permit term. However, according to the new TMDL requirements in the proposed MS4 permit, Shaw AFB would have to indefinitely monitor 5-10 outfalls on base for fecal coliform. Additional monitoring locations with the requirement of three (3) samples per quarter per outfall indefinitely will be a heavy cost burden for Shaw AFB.

Response 1:

There are areas of Shaw AFB subject to the NPDES Storm Water Industrial General Permit SCR000000. Under the terms and conditions of this permit, benchmark sampling is required and, in the case of being located in an approved TMDL area, the AFB would become subject to monitoring requirements in the affected TMDL area. SCR000000 Sector T monitoring requirements require quarterly sampling be conducted, for a minimum of one-year, and until it is demonstrated through the results of four consecutive sampling events that the water quality standard is being attained for the POC. Once the above condition is met, then additional monitoring may be discontinued. This permit requirement is also consistent with that of monitoring in TMDL areas. If four consecutive samples collected 72 hours apart demonstrate standard attainment within one-year, then monitoring may be discontinued for the POC. Additional monitoring in the TMDL area would not be required if the benchmark and TMDL sampling requirement have been met and the results have demonstrated standard attainment.

In addition, Shaw Air Force Base (AFB) is currently covered under SMS4 NPDES General Stormwater Permit SCR038502. A revised version of this permit has recently completed a public notice period and is currently being updated, based on responses to comments received from the public. Under terms and conditions of the draft permit, there are monitoring requirements within approved TMDL areas. SMS4s may monitor representative outfalls or instream locations in accordance with their permit.

The permittee will be required to monitor to demonstrate towards meeting the TMDL wasteload allocation (WLA) % reduction applicable to non-continuous dischargers. In the case of FC bacteria or *E. coli* TMDLs, the percent reduction target is equivalent to the water quality standard. As indicated in Section 3.1.3.1. of the draft permit, sampling must be conducted during a minimum of three >0.5 inch events from five to ten major outfalls. If, through monitoring, it is demonstrated that the standard is being met at a given outfall, then the permittee may discontinue monitoring for the pollutant of concern (POC) at that location for the duration of the permit cycle.

The draft TMDL document indicates that permittees are responsible for reducing the POC in accordance with their NPDES permit. NPDES permittees are not responsible for demonstrating a WLA reduction for both FC bacteria and *E. coli,* only the prescribed WLA reductions for either pathogen indicator. Nor is the permittee responsible for reducing sources covered under to the load allocation (LA) component of the TMDL.

Sampling or monitoring conducted under the Industrial Stormwater Permit could be incorporated as part of the overall TMDL monitoring strategy under the revised SMS4. As previously mentioned, sampling may be discontinued if it is demonstrated the standard is attained for the POC.

Amendments by the SCDHEC

TMDL Document Placed on Public Notice on June 22, 2013:

Amendment 1:

Table 23 (i.e., Percent Reduction Necessary to Achieve Target Load by Hydrologic Category) on page 39 of the Pocotaligo River and Tributaries TMDL document placed on public notice by the SCDHEC on June 22, 2013, described, "May 2013 Total Maximum Daily Loads," and described, "September 2005 Total Maximum Daily Loads Revised May 2013."

And, Table 25 (i.e., Percent Reduction Necessary to Achieve Target Load) on page 41 of the TMDL document placed on public notice on June 22, 2013, described, "May 2013 Total Maximum Daily Loads," and described, "September 2005 Total Maximum Daily Loads Revised May 2013."

Amendment 2:

Table 23 (i.e., Percent Reduction Necessary to Achieve Target Load by Hydrologic Category) on page 39 of the Pocotaligo River and Tributaries TMDL document, and Table 25 (i.e., Percent Reduction Necessary to Achieve Target Load) on page 41 of the TMDL document both have been corrected to describe, "June 2013 Total Maximum Daily Loads," and to describe, "September 2005 Total Maximum Daily Loads Revised June 2013."

Amendment 3:

Page 36, the last sentence in the second to last paragraph has been changed: **"**At the time of TMDL development, there were no *E. coli* data available to consider for determining percent reductions necessary to meet the calculated TMDLs. Therefore, all percent reductions recommended in this document are based on existing FC bacteria data. For the purposes of establishing these TMDLs, FC bacteria **percent** reductions should also be representative of reductions necessary to meet the *E. coli* WQS."