



# Bacteria Watershed Based Plan Twenty-five Mile Creek Watershed South Carolina

September 23, 2013



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# 1 Introduction

- *Why is a Watershed Based Management Plan needed?*
- *What is the ultimate goal of the Watershed Based Management Plan?*
- *Who is involved in creating the management plan?*
- *How was the Public involved in the process?*

A watershed is the area of land where all of the water that is under it or drains off of it into a river, stream, or other body of water to the same point. The purpose of a Watershed Based Plan (WBP or Plan) is to document the sources of water pollution and present a course of action to improve water quality within an impaired watershed. The WBP provides an approach to manage and restore the impaired waterbody to its designated use. Community stakeholders play a critical role in plan development, and the final plan reflects the community's goals for their watershed.

Twenty-five Mile Creek Watershed has an area of 124 square miles (322 km<sup>2</sup>) that mostly encompasses Kershaw and Richland Counties, but also extends into Fairfield County (Figure 1). The Twenty-five Mile Creek in the watershed is a freshwater creek that flows into the Wateree River. The Wateree River, a continuation of the Catawba River, stretches about 75 miles before it joins the Congaree River. The Wateree River is popular for being a recreational resource for kayaking, fishing, and tubing. Therefore, improvement in Twenty-five Mile Creek's water quality will improve the quality of life and local economics in Kershaw, Richland, and Fairfield County.

The United States Environmental Protection Agency (EPA) defines impaired waterbodies as any waterbody that does not meet water quality criteria that support its designated use (USEPA, 2012). Impaired waterbodies are then placed on the Section 303(d) list. In 1998, Twenty-five Mile Creek was first identified on the State of South Carolina's 303(d) list for violations of fecal coliform bacteria water quality standard at the water quality monitoring station CW-080. This water quality monitoring station is located at the S-28-5 bridge near Lugoff before the creek's confluence with the Wateree River. CW-080 remained on the 303(d) list until 2004 when an approved Total Maximum Daily Load (TMDL) was written for fecal coliform for Twenty-five Mile Creek (see Section 4.2.1.1 for more definition and details on TMDLs). During the assessment period for the TMDL development (1996-2000), standards were exceeded in 24% of samples taken at CW-080 (N=29). From the 2004 TMDL, a fecal coliform bacteria pollutant load reduction of 71% (1.51 x 10<sup>12</sup> cfu/day) to Twenty-five Mile Creek upstream of station CW-080 will be required to meet clean water quality standards as specified in the TMDL document (SCDHEC, 2004).

High levels of bacteria in streams are harmful to human health and to the health of the creek; therefore, this WBP describes the bacteria impairments and identifies the recommendations needed to restore Twenty-five Mile Creek's water quality. Furthermore, the Plan has considered the unique conditions within the watershed and developed suitable approaches to minimize future impacts to the Twenty-five Mile Creek. Altogether, the importance of developing this WBP to address the bacteria impairment in the Twenty-five Mile Creek Watershed is very clear. Efforts that will be taken to reduce bacteria in

Twenty-five Mile Creek, and ultimately the Wateree River, will be a tremendous benefit to the local economy and the quality of life for citizens who live around and enjoy the stream and river.

### ***1.1 How was the plan developed? And who was involved?***

The plan was developed using a collaborative approach. This approach aimed to actively involve local stakeholders in selecting management strategies that may be implemented over time to solve water quality problems within the Twenty-five Mile Creek Watershed. Active participants in the process included Kershaw County of South Carolina partnered with Richland County of South Carolina that jointly provided the \$13,434 match for the grant to develop this Bacteria WBP and the Macroinvertebrate WBP, also dated September 23, 2013. Other cooperating organizations included the Town of Elgin; Town of Blythewood; Fairfield County; Kershaw's, Richland's and Fairfield's Natural Resources Conservation Service (NRCS); Kershaw's, Richland's and Fairfield's Soil and Water Conservation Districts (SWCD); Kershaw's, Richland's and Fairfield's Public Health Departments; Clemson Extension; Catawba Riverkeeper Foundation; Central Midland Council of Governments (COG); SC Rural Water Association; South Carolina Department of Health & Environmental Control (SCDHEC); AMEC Environment & Infrastructure, Inc.; and watershed residents.

Over the span of a year, a kickoff meeting and a total of six (6) brainstorming sessions were held with the above-mentioned local stakeholders and the Public in order to determine sources of bacteria pollutants within the Twenty-five Mile Creek Watershed (see Section 5 for greater detail and Appendix B for Meeting Summaries). Along with these meetings, the following helped develop and refine management strategies: the TMDL developed in 2004 for Twenty-five Mile Creek, Kershaw County's experience sampling the creek and its tributaries, a windshield survey, and other items mention in Section 4.

This WBP incorporates this work as well as SCDHEC guidelines that are required in watershed based management plans to restore impaired waters. This alignment with SCDHEC guidance is intended to enable project partners to seek future SCDHEC funding to help implement the plan.

### ***1.2 Who should read this plan?***

Any group that influences or is affected by water quality, habitat management, and land use decisions should read this report. Municipalities and local groups in and around the Twenty-five Mile Creek Watershed should use this plan as the foundation for local action. State and federal agencies can use this plan to enhance their understanding of local watershed conditions and as a basis for coordinating, planning, permitting and regulatory decisions.

## **2 Executive Summary**

This project is located in Twenty-five Mile Creek Watershed (HUC 03050104). A bacteria pollutant load reduction of approximately 71% at Water Quality Monitoring Station CW-080 will be required to meet clean water standards as specified in the associated 2004 TMDL document (SCDHEC, 2004). Because

Twenty-five Mile Creek discharges to the Wateree River, bacteria pollutant load reduction in Twenty-five Mile Creek Watershed will have a direct impact on the water quality of the Wateree River, which will be a tremendous benefit to the local economy and the quality of life for citizens who live around and enjoy the stream and river.

A variety of non-point sources (NPS) have the potential to cause the bacteria loading in Twenty-five Mile Creek Watershed. Agricultural NPS pollutant sources of bacteria include grazing livestock depositing manure directly into Twenty-five Mile Creek and its tributaries, as well as manure/litter from cattle, horse and poultry farms entering Twenty-five Mile Creek and its tributaries through runoff. Septic tank usage is common for rural homes and businesses, particularly in the upper portion of the Twenty-five Mile Creek Watershed, with an estimated septic system failure rate of approximately 5 to 10% (Schueler, 1999). As well sanitary sewer overflows (SSOs) are also a pollutant source of bacteria in the Twenty-five Mile Creek Watershed. According to Palmetto Utilities, which provides sewer services to the Richland County portion of the watershed, the placement of fats, oils and grease (FOG) down the drain are a frequent cause of SSOs. In addition, urban runoff, such as domestic pet waste, contributes to bacteria in Twenty-five Mile Creek Watershed. Lastly, wildlife sources, such as improper disposal of game and fish carcasses into Twenty-five Mile Creek and its tributaries is a source of bacteria loading.

To implement the TMDL, the Counties will use funding to install Best Management Practices (BMPs) to reduce bacteria entering Twenty-five Mile Creek and its tributaries from non-point sources. BMPs will include septic system repairs and replacements, used cooking oil recycling program, pet waste stations, storm drain markers, stream bank stabilization, buffers, and agricultural BMPs such as stacking sheds, fencing, and manure composting. An outreach effort will accompany this project, educating farmers, residents and businesses of Twenty-five Mile Creek Watershed about the causes and results of bacterial contamination and how they can prevent it.

### **3 Watershed Characteristics**

- *What are the features of the surrounding landscape?*
- *What effect does hydrology and soil type have on the Watershed?*
- *What natural resources does the Watershed provide?*
- *How is land within the Watershed being used?*

The following sections have also been paraphrased from the SCDHEC “TMDL Development for Fecal Coliform Bacteria for Twenty-five Mile Creek CW-080 (HUC 03050104-060)” dated September 1, 2004 available at [http://www.scdhec.gov/environment/water/tmdl/docs/tmdl\\_25mile\\_fc.pdf](http://www.scdhec.gov/environment/water/tmdl/docs/tmdl_25mile_fc.pdf).

#### **3.1 Location**

Twenty-five Mile Creek Watershed has an area of 124 square miles (322 km<sup>2</sup>) that mostly encompasses Kershaw County, but also extends into Richland and Fairfield counties (see Figure 1). The Twenty-five Mile Creek in the watershed flows into the Wateree River. Twenty-five Mile Creek is designated as Class

Freshwater. There is one SCDHEC water quality monitoring station on Twenty-five Mile Creek. Station CW-080 is located at the S-28-5 bridge near the town of Lugoff. The other monitoring station in Twenty-five Mile Creek Watershed, CW-229, is located on Bear Creek; a tributary of Twenty-five Mile Creek. The watershed is partly in the Piedmont Ecoregion and partly in the Southern Plains Ecoregion. The watershed is mostly rural, but suburbs of Columbia and portions of several towns (Town of Blythewood, Elgin, and Lugoff) are located in the watershed.

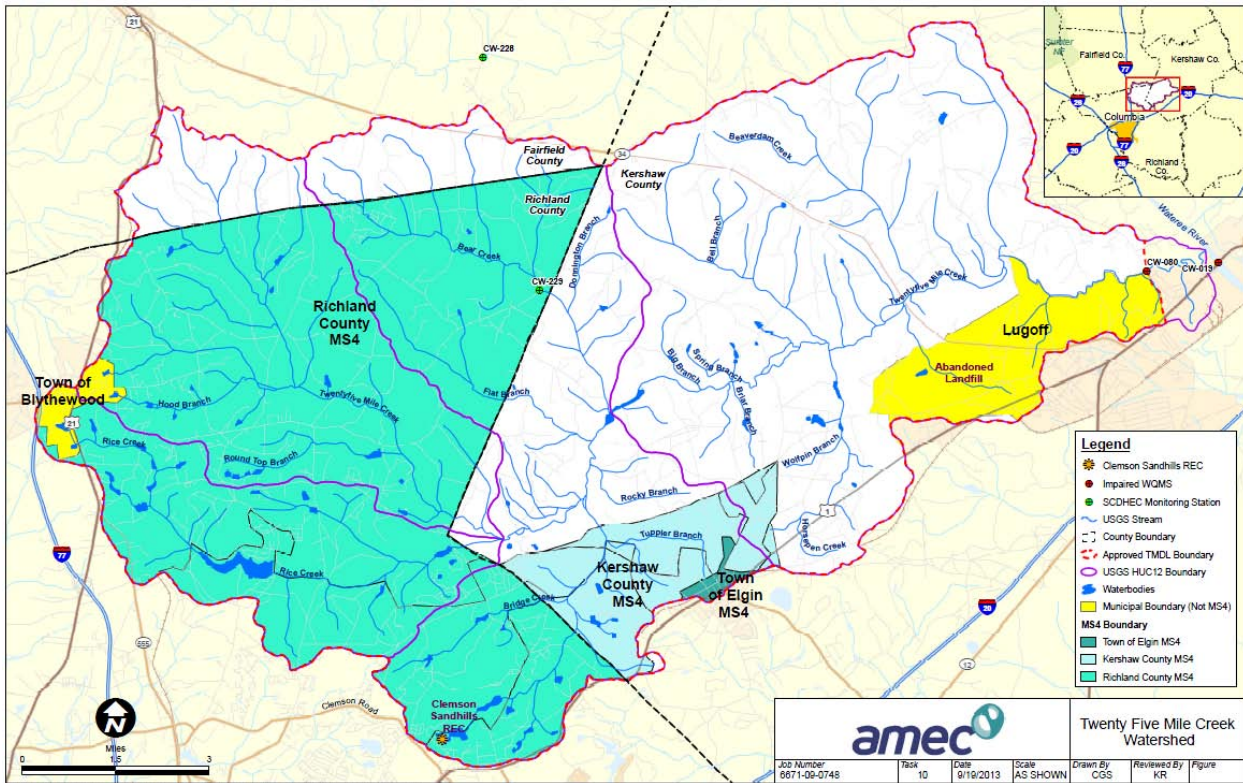


Figure 1. Twenty-five Mile Creek Watershed<sup>1</sup>

### 3.2 Climate

According to South Carolina Department of Natural Resources (SCDNR), Kershaw County has an average mean temperature of 60.7 °F and an annual average precipitation of 43.8 inches per year. Richland County has an average mean temperature of 66.7 °F and annual average precipitation of 46.3 inches per year. Lastly, Fairfield County has an average mean temperature of 62.1 °F and an annual average precipitation of 43.9 inches per year.

### 3.3 Soils

There is a diversity of soil types within this large watershed, however for the purpose of this Plan, Hydrologic Soil Groups within the watershed were examined in order to analyze areas with higher runoff potential. Hydrologic Soil Groups (HSG) are a designation developed by the National Resource

<sup>1</sup> See Appendix A for larger figure



Conservation Service (NRCS) which describes the infiltration capacity of soil. Soil associations are categorized in decreasing infiltration capacity from A to D and are described in greater detail below:

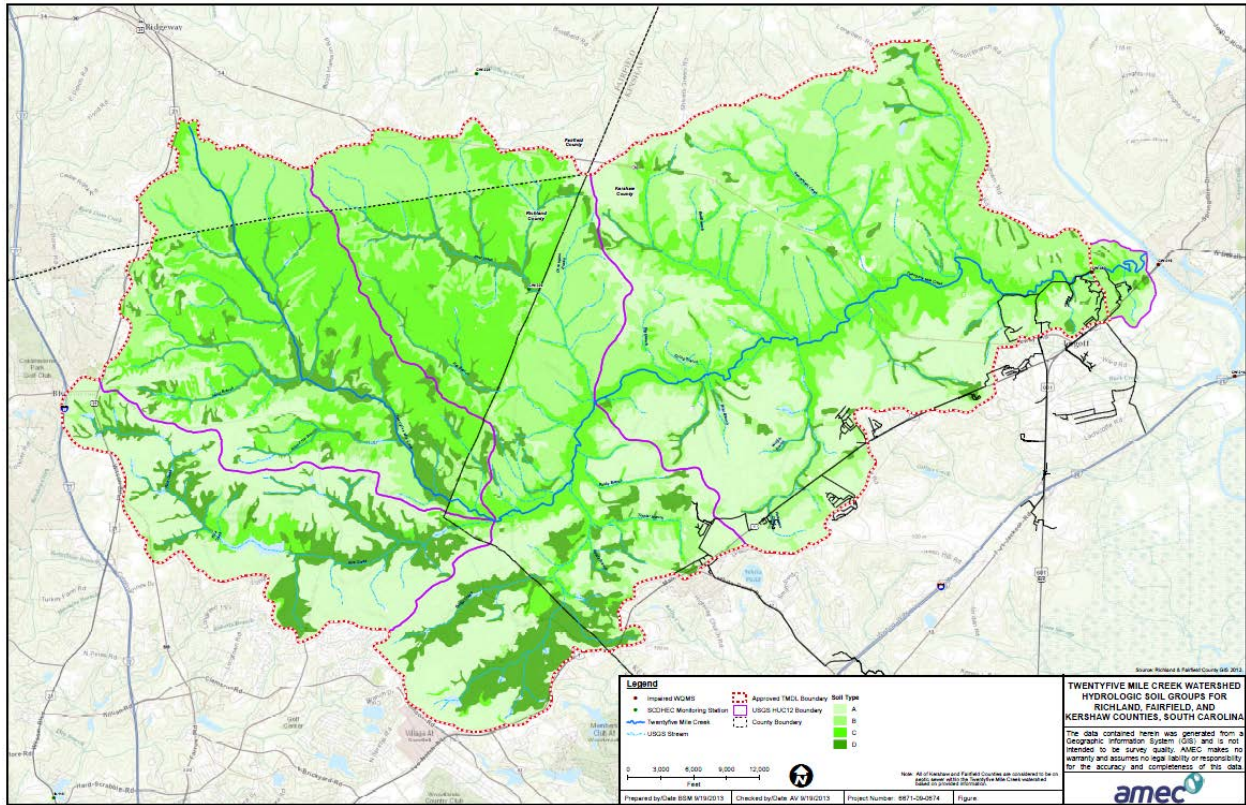
**Group A** is sand, loamy sand or sandy loam types of soils. These soils have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sand or gravel and have a high rate of water transmission (greater than 0.30 inches/hour).

**Group B** is silt loam or loam. These soils have moderate infiltration rates when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (0.15-0.30 inches/hour).

**Group C** soils are sandy clay loams. They have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine texture. These soils have a low rate of water transmission of (0.05-0.15 inches/hour).

**Group D** soils are clay loam, silty clay loam, sandy clay, silty clay or clay. This HSG has the highest runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low rate of water transmission (0-0.05 inches/hour).

Figure 2 below displays the Hydrologic Soils Groups throughout the Twenty-five Mile Creek Watershed. Compared to Richland and Fairfield Counties, Kershaw County mostly has HSG A and B soils. As well, in Kershaw County, adjacent to Twenty-five Mile Creek and its tributaries is HSG C soils. HSG C soils also appear to be predominant in the northern part of Richland County. As a result, understanding the watershed's runoff potential will help narrow down areas that may have a higher potential for bacteria runoff.



**Figure 2. Hydrologic Soil Groups within the Twenty-five Mile Creek Watershed<sup>2</sup>**

Along with understanding the watershed’s runoff potential areas, Hydrologic Soil Groups may shed some light on the soils’ erodibility. Soil erodibility is an estimate of the ability of soils to resist erosion, based on the physical characteristics of each soil. Generally, soils with faster infiltration rates, higher levels of organic matter and improved soil structure have a greater resistance to erosion. Sand, sandy loam and loam textured soils tend to be less erodible than silt, very fine sand, and certain clay textured soils. Though HSG can only characterize infiltration rates and generalize certain soil textures, identifying the Hydrologic Soils Groups can aid the decision process of narrowing down potential sources of pollution via increased sediment loads.

### 3.4 Land Use

Based on 2006 USGS Multi-Resolution Land Characteristic (MRLC) land use data, 64.5 percent of the watershed is forested land. The remaining 35.5 percent is composed of urban areas (19.5%), wetlands (6.7%), pasture (5.5%), cropland (2.0%), and a small mix of water and barren land (1.3 and 0.5%, respectively). Table 1 presents the percentage of total watershed area for each aggregated land use. Figure 3 displays land use activities in the watershed. The figure illustrates the current 2006 USGS National Land Cover Data (NLCD) compared to the 1992 USGS NLCD. The rest of the document will cite 1992 USGS NLCD data which only varies by tenths of a percentage from the data that was used to develop the TMDL (early 1990s). Using the 1992 USGS NLCD data will not alter the conclusions.

<sup>2</sup> See Appendix A for larger figure

The predominant land use in the watershed is forest; which accounted for 69.9% of the land in 1992 and remained the predominant land use in 2006, covering 64.5% of the watershed (see Table 1). Concentrated forested areas are located mostly in the northern portion of the watershed. When the TMDL was developed, the next largest land use was classified as agriculture. Agriculture areas consisted of crop lands and pastures (18.9% of the watershed). In Richland County, many pasture lands are adjacent to Twenty-five Mile Creek and concentrated in the northern portion of the watershed. Kershaw County's agriculture lands are spread throughout the watershed (see Section 5.3 for more details on agriculture land use in the Twenty-five Mile Creek Watershed).

According to 2006's USGS NLCD, the percentage of agriculture in the watershed dropped by 11.4% since the TMDL was written. As a result, urban growth excelled in the watershed and became the second largest land use, based on the 2006 NLCD. The loss of forested and agriculture lands (5.4% and 11.4%, respectively) nearly accounts for the amount of urbanized areas gained (16.4%). Commercial and industrial properties dominate in Richland County's southern portion of the watershed, and urbanized areas along U.S. Highway 1 in Kershaw County, such as the Kershaw County MS4 and the Town of Elgin and Lugoff. From 1992 to 2006, the watershed experienced extensive urban growth and has continued to receive growth pressures since 2006 as a result of the watershed's close proximity to the population center of Columbia.

Figure 3 displays the current (2006) USGS National Land Cover Data compared to the 1992 USGS NLCD land use data, which is closely correlated to the land use data used in the Twenty-five Mile Creek TMDL.

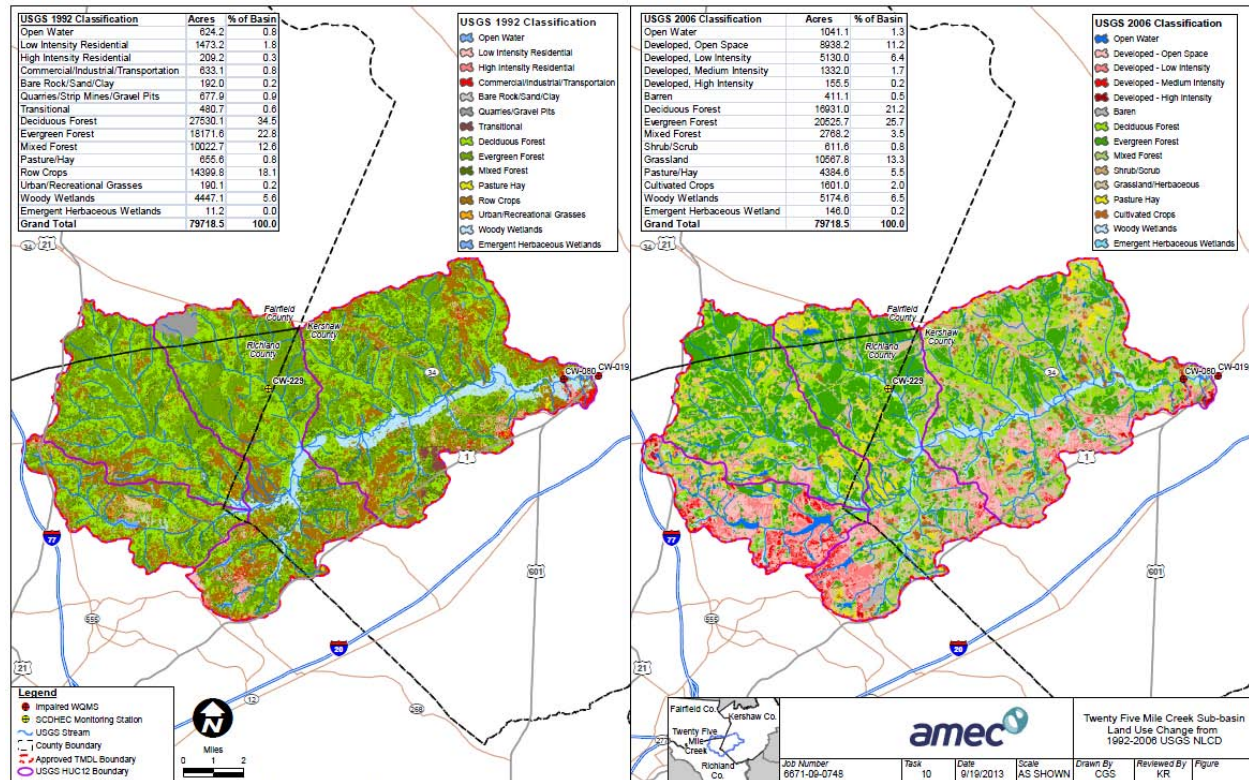


Figure 3. Twenty-five Mile Creek Land Use Change from 1992-2006<sup>3</sup>

Table 1 provides a summary of current land use for the Twenty-five Mile Creek Watershed based on 2006 USGS NLCD compared to the information used to develop the TMDL (first column) and the 1992 USGS NLCD (second column). The information used to develop the TMDL claimed to use NLCD data that was collected in the early 1990's, which closely matches the 1992 data. Nonetheless, the watershed's acreage slightly differs by about 42 acres. Both data sets are provided in the table below.

Table 1. Land use distributions in the Twenty-five Mile Creek Watershed

Land Use Classification	Data Used to Develop TMDL		USGS 1992 NLCD		USGS 2006 NLCD	
	Areas [acres]	% of Watershed	Areas [acres]	% of Watershed	Areas [acres]	% of Watershed
Built-up	2,414.3	3.0	2,505.6	3.1	15,555.7	19.5
Barren	834.0	1.0	869.9	1.1	411.1	0.5
Transitional	525.5	0.7	480.7	0.6	0	0.0
Forest	55,589.1	69.8	55,724.4	69.9	51,404.3	64.5
Pasture	679.9	0.9	655.6	0.8	4,384.6	5.5
Row Crops	14,587.0	18.3	14,399.8	18.1	1,601.0	2.0
Wetlands	4,423.6	5.6	4,458.3	5.6	5,320.6	6.7
Water	622.9	0.8	624.2	0.8	1,041.1	1.3
<b>Total</b>	<b>79,676.3</b>	<b>100.0</b>	<b>79,718.5</b>	<b>100.0</b>	<b>79,718.4</b>	<b>100.0</b>

<sup>3</sup> See Appendix A for larger Figure

### **3.4.1 Land Use Effects on Twenty-five Mile Creek**

Based on the 2004 TMDL and knowledge of the watershed, contributing sources of bacteria that are effected by land use in the Twenty-five Mile Creek Watershed include runoff from agricultural land (including poultry and cattle farming), crop farming (row, hay and pasture), urbanized areas, and wildlife. These sources of bacteria pollution are of concern and are addressed in greater detail in Section 5.

## **4 Watershed Conditions**

- *What are the designated and desired uses of our surface waters?*
- *What standards are used to judge water quality?*
- *What is the current condition of the watershed?*
- *What are the impacts of pollutants on the watershed?*

### **4.1 Stream Class & Criteria**

The South Carolina Legislature (S.C. Regulation 61-68) has established water quality classification standards for all surface waters in the State of South Carolina. This system provides water quality goals and criteria and guides management efforts so that individual water bodies can be protected and restored to meet these goals. The impaired stream segment, Twenty-five Mile Creek, is designated as Class Freshwater. Waters of this class are described as follows: “Freshwaters suitable for primary and secondary contact recreation and as a source for drinking water supply after conventional treatment in accordance with the requirements of the Department. Suitable for fishing and the survival and propagation of a balanced indigenous aquatic community of fauna and flora. Suitable also for industrial and agricultural uses.” (R.61-68)

Specifically, Twenty-five Mile Creek was first identified on the 1998 303(d) list of impaired waterbodies for violations of the fecal coliform bacteria water quality standard. It remained on the 303(d) list until 2004 when an approved Total Maximum Daily Load (TMDL) was written for fecal coliform for Twenty-five Mile Creek. Twenty-five Mile Creek is also impaired for aquatic life based on benthic macroinvertebrates. The macroinvertebrate impairment is addressed in a separate Watershed Based Plan dated September 23, 2013.

### **4.2 Stream Assessments**

SCDHEC has sampled and analyzed two water quality monitoring stations (WQMS) in Twenty-five Mile Creek Watershed for various parameters periodically over the past 40 years. WQMS CW-080 is located at the lower end of the creek just upstream of its confluence into the Wateree River. WQMS CW-229 is located in Bear Creek, a tributary of Twenty-five Mile Creek, in the northern portion of the watershed. Figure 1 from Section 3.1 shows the approximate locations of CW-229 and CW-080. WQMS CW-080 and WQMS CW-229 have been analyzed periodically between 1964 and 2008 for Alkalinity, Ammonia, Biological Oxygen Demand, Cadmium, Total Organic Carbon, Chromium, Copper, Dissolved Oxygen, Enterococcus, Fecal Coliform, E. Coli, Hardness, Inorganic Nitrogen, Iron, Kjeldahl Nitrogen, Lead,

Manganese, Mercury, Nickel, pH, Phosphate, Turbidity and Zinc. According to the Twenty-five Mile Creek TMDL dated September 1, 2004, Twenty-five Mile Creek is impaired for fecal coliform.

WQMS CW-229 has been analyzed monthly for fecal coliform between 1990 and 2000 and seven (7) times per year in 2002 and 2007. WQMS CW-080 has been analyzed for fecal coliform monthly during the summer months between 1968 and 2000. WQMS CW-080 was analyzed for fecal coliform monthly between 2001 and 2008. SCDHEC discontinued monitoring at WQMS CW-229 after 2007 and CW-080 after 2008.

#### **4.2.1 Fecal Coliform Assessments**

##### **4.2.1.1 SCDHEC's 2004 TMDL for Fecal Coliform**

Section 303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR part 130) require states to develop TMDLs for water bodies that are not meeting designated uses under technology-based pollution controls. The TMDL process establishes the allowable loadings of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and in stream water quality conditions so that states can establish water quality-based controls to reduce pollution and restore and maintain the quality of water resources (USEPA, 1991). When the TMDL was written in September 1, 2004, the portion of Twenty-five Mile Creek draining to WQMS CW-080 had been placed on the South Carolina §303(d) list of impaired waters for violations of the fecal coliform bacteria water quality standard. Fecal coliform bacteria are an indicator of possible contamination by fecal matter and are thus a public health concern due to the potential for exposure to pathogens through contact recreation.

At the time that the TMDL was written, samples analyzed at WQMS CW-080 failed to attain recreational use support by exceeding the state water quality standard of 400 colonies per 100ml sample. Between 1996 and 2000, 24% of the samples (N=29) at CW-080 exceeded the state standard. Monitoring Station CW-080 was added to the 303(d) list in 2012, and has been added to "Sites Covered Under an Approved TMDL and Attainment Status" as of September 16, 2004.

The load-duration curve methodology was used to calculate allowable fecal coliform loads in the watershed. Sample loads were determined using measured fecal coliform concentrations from the impaired water quality monitoring station, comparable flow rates from Black Creek (in Chesterfield County, SC) that corresponded to the date of sampling, and a conversion interval to generate the load-duration curve. A TMDL target line was created by calculating the allowable load from the flow and the appropriate fecal coliform standard concentration in the same manner. Loadings from all sources were taken into consideration, such as, failing septic systems, cattle-in-streams, and loadings from runoff. Sample loads above the target line are in violation of the standard. As a result, a trend line was fit to these samples above the target line. Therefore, the existing load ( $5.18 \times 10^{12}$  cfu/day) was calculated from the trend line and compared to the target load to establish the required reduction for Twenty-five Mile Creek.

The TMDL for the Twenty-five Mile Creek (HUC 030050104-060) was effective September 1, 2004. To achieve the TMDL target, SCDHEC has estimated that a 71% load reduction will be necessary (target loading value of  $1.51 \times 10^{12}$  cfu/day) in the Twenty-five Mile Creek based on the monitoring and pollutant loading data available to SCDHEC at the time. The reduction is directed primarily at runoff from urban and agricultural lands, possible failing septic systems, sanitary sewer overflows, and livestock with uncontrolled access to streams. See Section 5 for further discussion of these pollution sources.

**Table 2. Twenty-five Mile Creek bacteria loadings**

Existing Load (cfu/day)	$5.18 \times 10^{12}$
Target Load (cfu/day)	$1.51 \times 10^{12}$
Percent Reduction	71%

#### **4.2.1.2 SCDHEC's Fecal Coliform Data through 2008**

As mentioned in Section 4.2, SCDHEC's monitoring data is available through STORET starting with data collected in 1968 and including legacy data (i.e. sampling conducted from 1968 to 1998) and modern data (i.e. sampling conducted in 1999 to 2008) which has been collected since the TMDL became effective in 2004. Both legacy and modern data sets were used to develop the TMDL for fecal coliform from years 1996 to 2000. The monthly samples appear to be grab samples that were not correlated to storm events.

Fecal coliform data collected previous to 2001 at monitoring station CW-080 was mostly collected once a month from May to October. From 2001 to 2008, SCDHEC conducted a monthly sampling schedule throughout the year at CW-080.

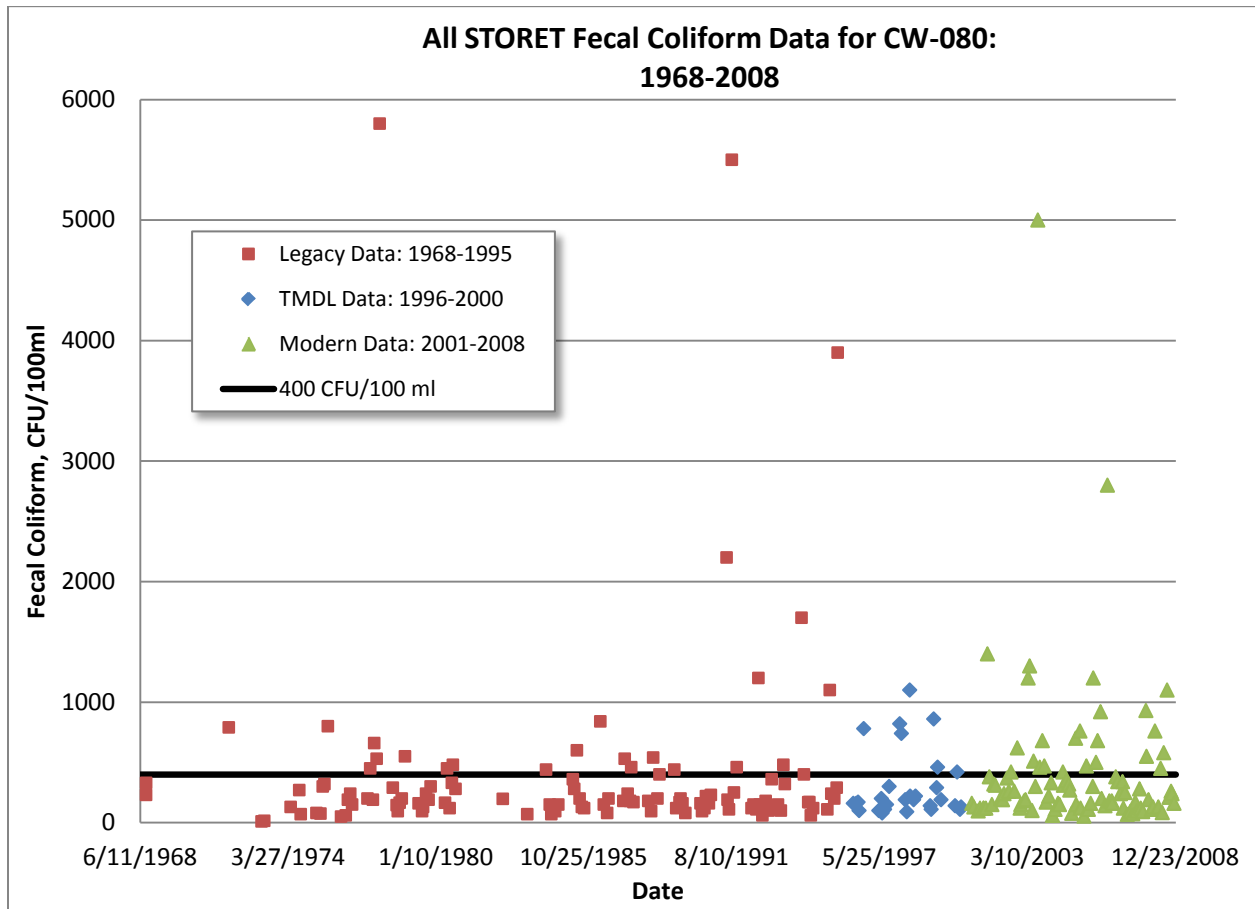
From 1990 through 2000 SCDHEC sampled CW-229 once a month for the entire year. In 2002, DHEC adopted a schedule of sampling CW-229 for a one-year period on a monthly basis, every five years with the latest sampling data taken in 2007.

According to SCDHEC's State of South Carolina Monitoring Strategy for Calendar Year 2012, both CW-080 and CW-229 are inactive monitoring sites.

The following figures (Figures 4-7) summarize fecal coliform sampling results for the legacy and modern data for monitoring locations CW-080 and CW-229. Tables 3-5 statistically analyze the fecal coliform data for CW-080 and CW-229.

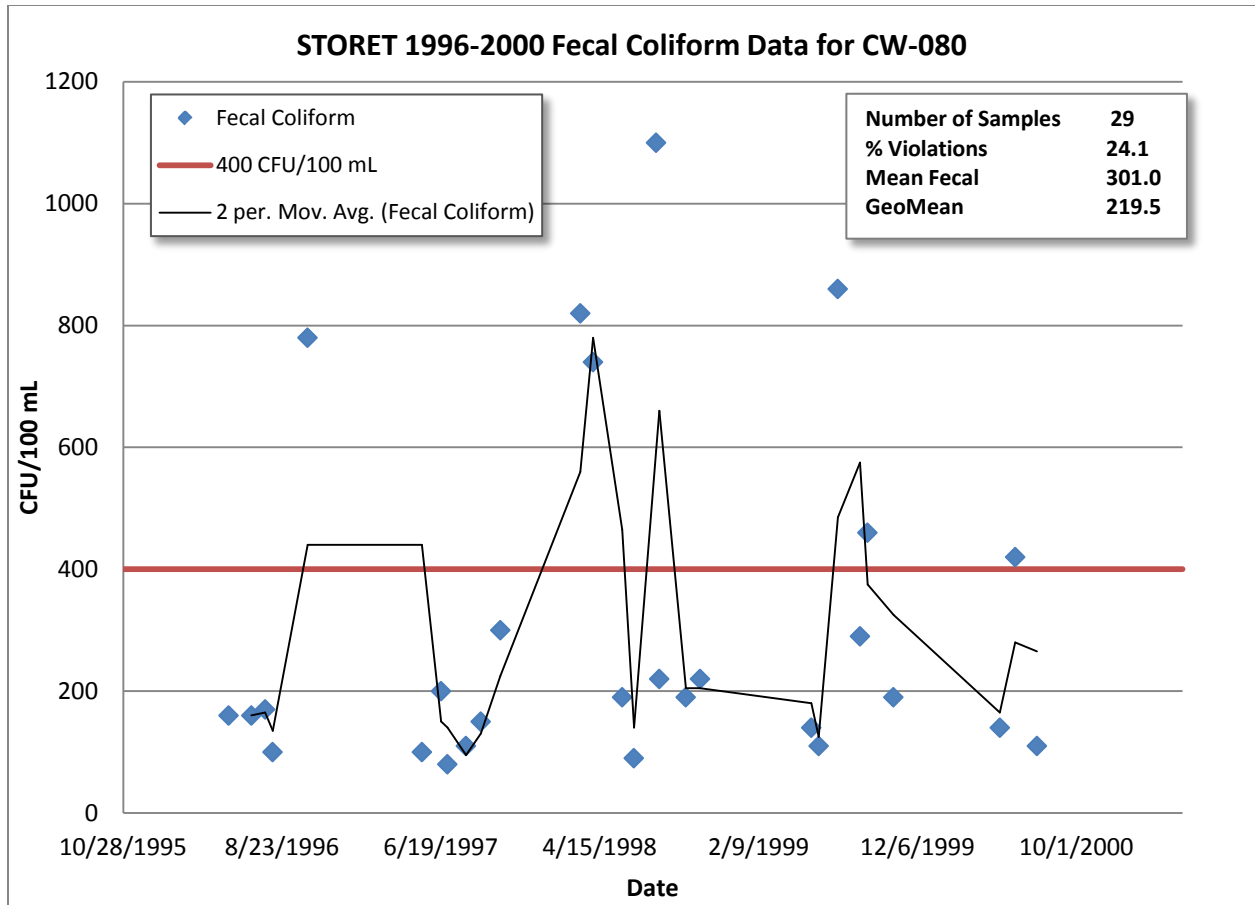
**Table 3. Summary of all STORET fecal coliform data for CW-080 (1968-2008)**

<b>Parameter</b>	<b>Legacy Data: 1968-1995</b>	<b>TMDL Data: 1996-2000</b>	<b>Modern Data: 2001-2008</b>
Number of Samples	118	29	94
% Violations	22.0	24.1	26.6
Mean Fecal	398.7	301.0	403.4
GeoMean Fecal	212.1	219.5	254.3



**Figure 4. Monitoring Station CW-080 STORET fecal coliform data from 1968-2008**





**Figure 5. Monitoring Station CW-080 fecal coliform data from 1996-2000<sup>4</sup>**

From the data displayed in Figure 4 and the statistical analysis in Table 3, it was found that the percentage of fecal coliform violations at monitoring station CW-080 has followed an increasing trend over the sample years. This was also the case for the geometric mean (a better comparison than the arithmetic mean to represent the data). The increasing trend may be the result of extensive urban growth from 1992 to 2006.

The geometric mean (a measure of central tendency) throughout the years remained in the 200-250 CFU/100ml concentration range. Hence, on average, concentrations sampled at monitoring station CW-080 were below the 400 CFU/100ml limitation. However, there were enough elevated concentrations to cause CW-080 to violate the 400 CFU/100ml more than 10% of the time, resulting in Twenty-five Mile Creek to remain impaired since the TMDL was written.

Fecal coliform data collected previous to 2001 at monitoring station CW-080 was primarily collected once a month from May to October. It must also be noted that, according to the TMDL, the sampling performed at this station did not appear to correlate with rainfall. Therefore, it is not possible to identify any trends in fecal coliform concentrations throughout a year regarding wet season and dry season and

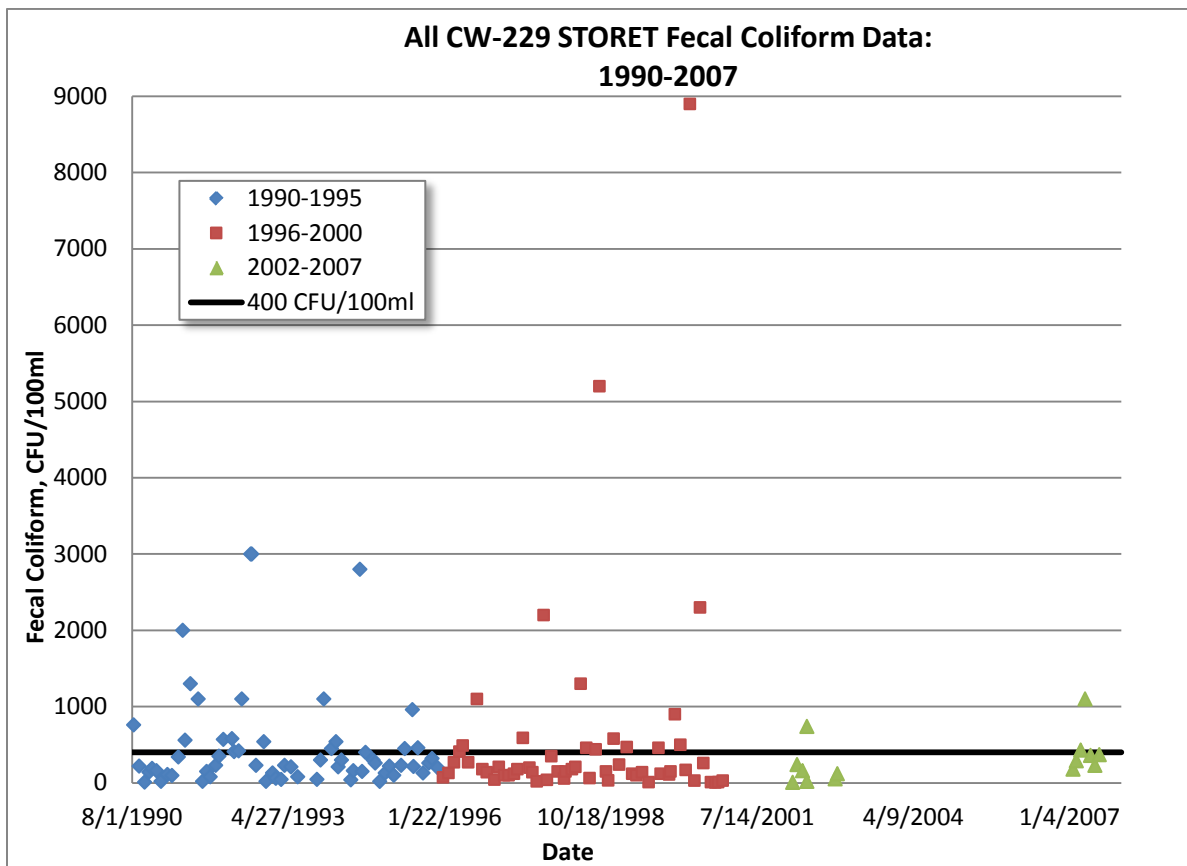
<sup>4</sup> This data was used to develop the TMDL.

summer/winter loadings. However, CW-080's data from 2001 to 2008 was statistically evaluated for the warmer months of May to October and the remaining cooler months. In doing so, it was found that compared to the cooler months, the warmer months had more violations and a higher geometric mean. Though this trend cannot be determined for years 1968 to 2000, this information could potentially be confirmed with the proposed sampling locations suggested in Section 8.1. If confirmed, this information could be useful for future preventative measures.

Table 4 and Figures 6-7 below summarize the fecal coliform data that was sampled for monitoring station CW-229.

**Table 4. Summary of STORET fecal coliform data for CW-229 (1990-2007)**

Parameter	Legacy Data: 1990-1995	TMDL Assessment: 1996-2000	Modern Data: 2001-2007
Number of Samples	62	56	14
% Violations	33.9	28.6	21.4
Mean Fecal	471.2	560.1	307.1
GeoMean Fecal	233.5	173.9	171.6

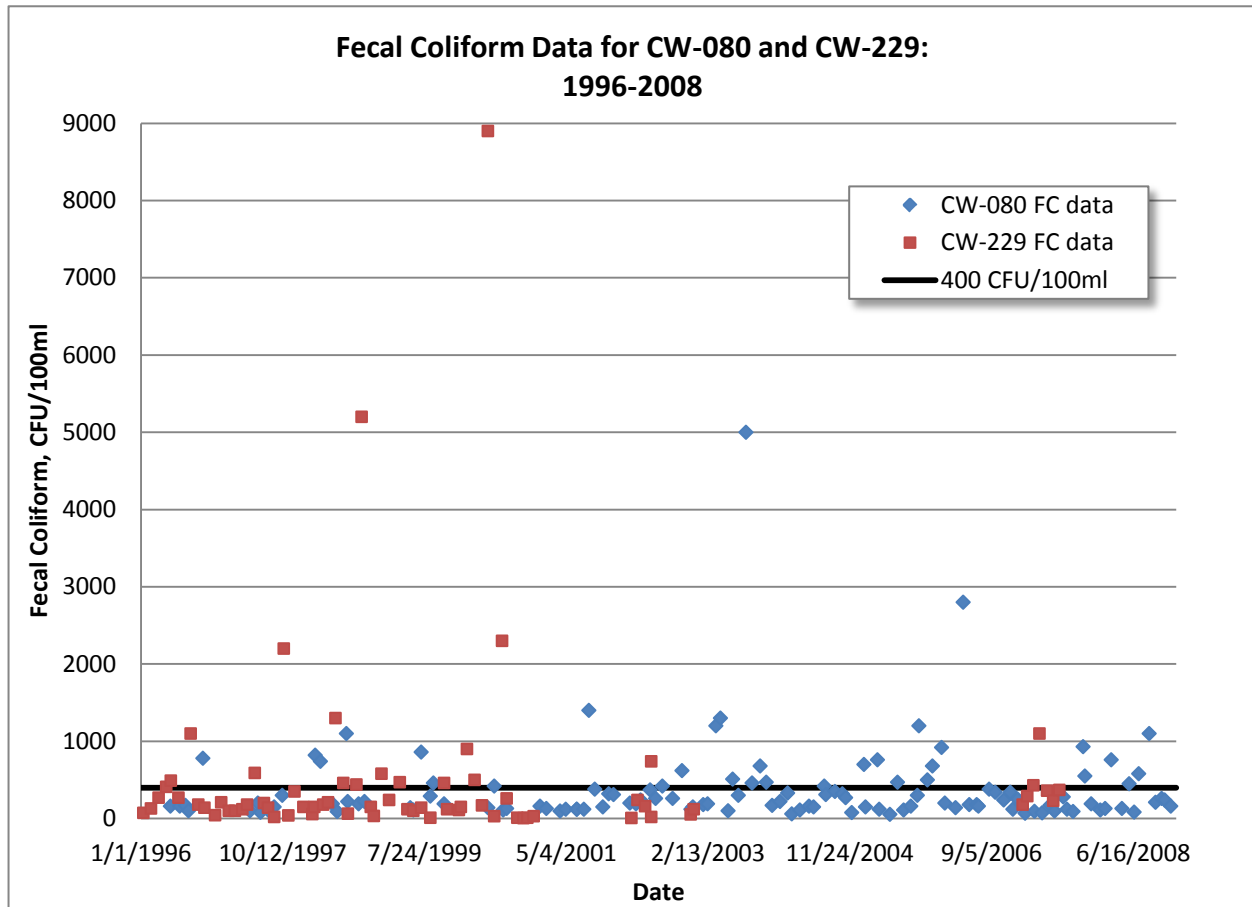


**Figure 6. Monitoring Station CW-229 STORET fecal coliform data from 1990-2007<sup>5</sup>**

<sup>5</sup> 1996-2000 were the years the TMDL was assessed for CW-080.

**Table 5. Summary of modern STORET fecal coliform data for CW-080 & CW-229 (1996-2008)**

Parameter	TMDL Assessment		Modern Data	
	CW-080: 1996-2000	CW-229: 1996-2000	CW-080: 2001-2008	CW-229: 2001-2007
Number of Samples	29	56	94	14
% Violations	24.1	28.6	26.6	21.4
Mean Fecal	301.0	560.1	403.4	307.1
GeoMean Fecal	219.5	173.9	254.3	171.6



**Figure 7. Fecal coliform results for monitoring station CW-080 and CW-229<sup>6</sup>**

CW-229 is located in the TMDL watershed and was on the 303(d) list for fecal coliform (1998-2004). However, the station data was not included in the assessment for the development of the Twenty-five Mile Creek TMDL. Regardless, the station’s data was examined for this monitoring plan and was compared to CW-080’s TMDL data (1996-2000). During years 1996 to 2000, 29% of samples collected at CW-229 violated the 400 CFU/100ml limit. This may have contributed to the impairment of Twenty-five

<sup>6</sup> Samples displayed on the figure include the dates data was used to develop the TMDL (1996-2000) and the most recent modern data collected for each station (2001-2008).

Mile Creek during this time period. Data sampled after this time period for CW-229 was collected only for 2002 and 2007. Therefore, due to sparse data, the influence that the CW-229 subwatershed has recently had on Twenty-five Mile Creek or whether it is an area of concern cannot be determined. However, field bacteria analysis was conducted in 2013 at this location to get a better understanding of potential bacteria pollution in this area and is described in Section 4.2.1.3 below (specifically, Table 6 labeled as 'CW-229').

#### **4.2.1.3 2013 Field Bacteria Analysis**

In 2013, Kershaw County Stormwater Management Program (KCSWM Program) collected fecal coliform water quality samples within the Twenty-five Mile Creek Watershed between February 2013 and June 2013, the results of which are made available as a part of this WBP. Please note these stream samples were not QAPP approved; the sampling was conducted for the KCSWM Program as a screening tool to help prioritize problems areas within the watershed. Also note that these were ambient samples and not specifically collected during storm events.

The first three sampling events (during February and March 2013) were conducted in colder and much wetter time periods than the fourth sampling event (June 2013). Frequent rain events had likely not allowed significant bacteria to accumulate on land between rain events. However, the fourth event occurred in June (hotter weather) after a long dry stretch (approximately 12 days, allowing bacteria to accumulate on land) and portions of the watershed did receive rain during the evening before sampling (contributing to bacteria runoff into the stream). The fecal coliform concentrations at seven (7) locations exceeding 400 CFU/100ml on June 4, 2013 (compared to the previous three sampling events) are attributed to these factors and may also be attributed to the lower stream flow and resulting high pollutant concentrations.

These unofficial bacteria monitoring results do provide insight into areas from which the bacteria loads may be coming. None of the samples collected from streams flowing from the Blythewood, Elgin or Lugoff urban areas exceeded the water quality standard for fecal coliform. On the other hand, several of the sampled tributaries flowing from the northern, rural areas of the watershed had high bacteria levels (Bear Creek at CW-229 was 1120 MPN /100ml and 981 MPN/100ml), Bell Branch at Station 14 was 436 MPN/100ml and 1120 MPN /100ml, Beaverdam Creek at Station 32 was 817 MPN /100ml, Tributary of Beaverdam Creek at Station 33 was 1987 MPN /100ml, Beaverdam Creek at Station 8 was 817 MPN /100ml and Horsehead Branch at Station 7 was 1120 MPN/100ml. These are very limited and unofficial sampling events. The streams flowing from Elgin and Lugoff were not sampled on June 4, 2013, the day following the rain event which resulted in higher bacteria concentrations in other locations in the watershed. But, initial observations of these limited, unofficial results indicate that the more rural portions of the watershed may be a larger source of bacteria load than the urban portions.

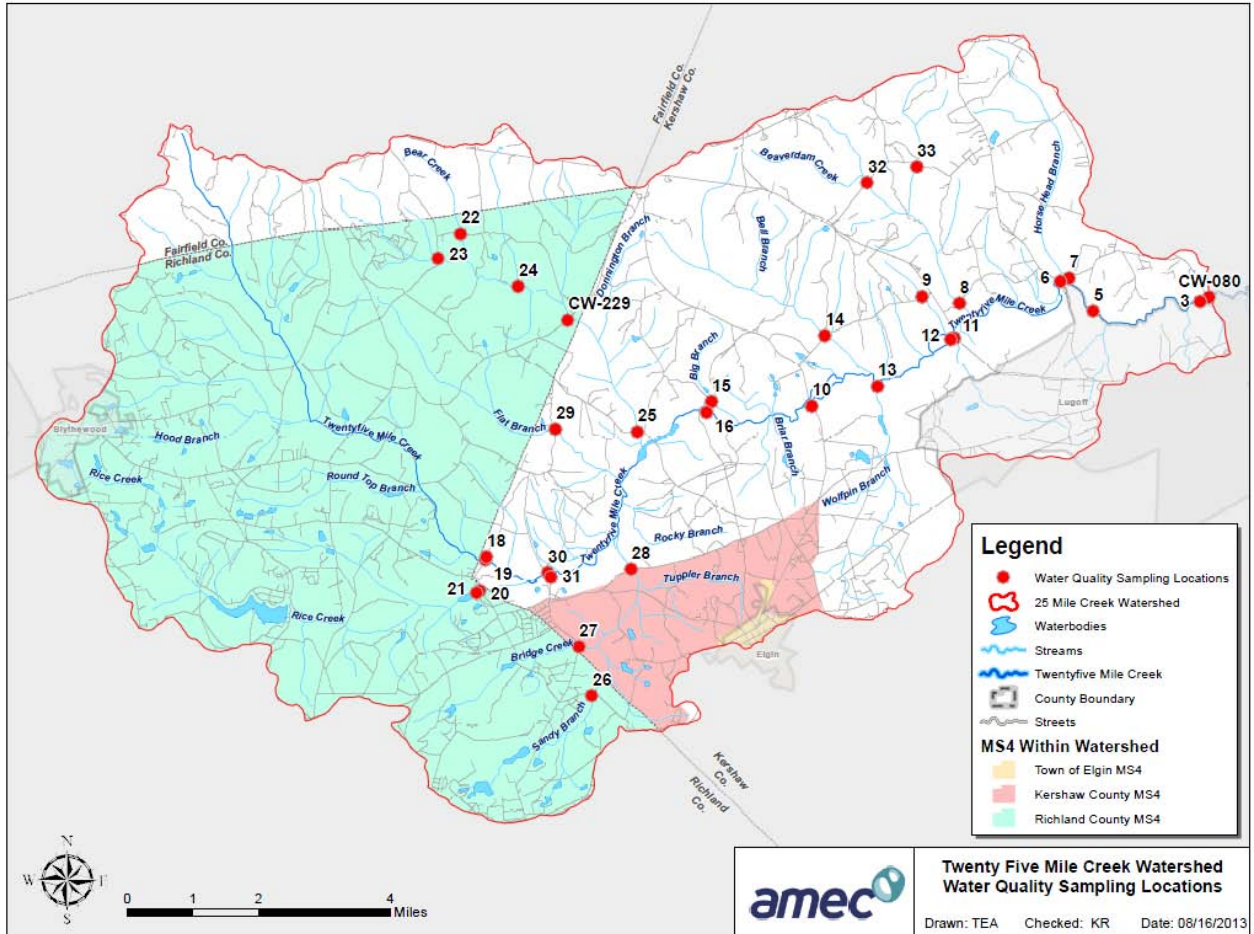


Figure 8. Twenty-five Mile Creek Watershed water quality sampling locations<sup>7</sup>

<sup>7</sup> See Appendix A for larger figure

**Table 6. Twenty-five Mile Creek Watershed water quality sampling results for fecal coliform.  
Test Method: Colilert-18, Units: MPN/100ml**

Location	Description	Sample 1	Result 1	Sample 2	Result 2	Sample 3	Result 3
CW-080 <sup>1</sup>	25mi Creek at Longtown Rd.	2/21/13	50	3/7/13	56	6/4/13	<b>1047</b>
CW-229 <sup>1</sup>	Bear Creek at Smyrna Church Rd.	3/7/13	<b>1120</b>	3/28/13	210	6/4/13	<b>981</b>
3	25mi Creek at sewer crossings	2/21/13	79				
5	25mi Creek	2/21/13	57				
6	25mi Creek at Grey Fox Rd.	2/21/13	94				
7	Horse Head Branch	2/21/13	356	6/4/13	<b>1120</b>		
8	Beaverdam Creek at Smyrna Rd.	2/21/13	199	6/4/13	<b>817</b>		
9	Cook Run Creek at Gettys Rd.	2/21/13	166				
10	25mi Creek at Smyrna Rd. North	2/21/13	86				
11	Flat Branch	3/7/13	5				
12	25mi Creek near Ridgeway Rd.	3/7/13	16				
13	Horsepen Creek	3/7/13	≤1				
14	Bell Branch at Gettys Rd.	3/7/13	<b>436</b>	6/4/13	<b>1120</b>		
15	Big Branch Creek at Gettys Rd.	3/7/13	76				
16	25mi Creek at Veterans Rd.	3/7/13	78				
18	25mi Creek at 25mi Creek Rd. North	3/7/13	196				
19	25mi Creek at 25mi Creek Rd. South	3/7/13	28				
20	Rice Ck Downstream of Kelly Mill Rd.	3/7/13	1				
21	Rice Ck Upstream of Kelly Mill Rd.	3/7/13	1				
22	Bear Ck Tributary at Hidden Valley Rd.	3/28/13	205				
23	Bear Creek at Bear Creek Rd.	3/28/13	18				
24	Bear Creek	3/28/13	196				
25	B ear Ck Tributary	3/28/13	276				
26	Sandy Branch at Kelly Mill Rd.	3/28/13	17	6/4/13	22		
27	Bridge Creek at Cherokee Blvd.	3/28/13	7	6/4/13	103		
28	Sandy Branch at Wildwood Lane	3/28/13	10	6/4/13	180		
29	Flat Branch at Tookie Doo Lane	3/28/13	210				
30	25mi Creek at Cherokee Rd. North	6/4/13	74				
31	25mi Creek at Cherokee Rd. South	6/4/13	45				
32	Beaverdam Ck at Three Branch Rd.	6/4/13	<b>817</b>				
33	Beaverdam Ck Tributary	6/4/13	<b>1987</b>				

**Notes:**

Fecal Coliform **results bolded** are above the water quality standard of 400 CFU/ml

<sup>1</sup> SCDHEC Water Quality Monitoring Station

#### **4.2.2 Fairfield Kennecott Gold Mine Assessments**

The Kennecott Ridgeway Gold Mine, located 25 miles northeast of Columbia, South Carolina, is owned by Kennecott Minerals Company. The mine operated from 1988 to 1999 and consisted of two open pits, processing facilities and a tailings impoundment. The Ridgeway site is currently being reclaimed and environmental monitoring of ground water and surface water (under NDPES permit #SC0041378) will

continue for 30 years by SCDHEC. Greater details of the Kennecott Ridgeway Gold Mine are discussed in Section 5.6.1.

### **4.2.3 Abandoned Lugoff Landfill Assessments**

Groundwater at the abandoned Lugoff Landfill, located on the bank of Twenty-five Mile Creek near WQMS CW-080, is being monitored by SCDHEC (Figure 12).

### **4.2.4 Other Assessments**

AMEC and Kershaw County have performed a windshield survey through a majority of the watershed and visited numerous points in Twenty-five Mile Creek and its tributaries. Observations during these field visits have been included in Section 5. Examples of the observations include wildlife carcasses in streams or on banks; livestock and other animals; golf courses, and hunt clubs.

In May 2010, AMEC Environment and Infrastructure, Inc. (formerly MACTEC) conducted a stream evaluation of an unnamed tributary to Twenty-five Mile Creek in the Stratton Hall neighborhood of Lugoff, South Carolina (in this Plan, it will be referred to as the Stratton Hall Stream). AMEC concluded that the approximately 0.25 mile long stretch of stream between Wellington Drive and Cambridge Lane is actively degrading and if left alone, it will likely continue to degrade. A possible consequence include bank failure that could undermine power poles and fences, expose portions of a sanitary sewer line, cause loss of property, and degrade aquatic ecology. Due to bank entrenchment issues, in 2013 Fairfield Electric relocated their power lines to the street-side with underground lines. However, as of AMEC's last visit in September 2013, the poles remain in the banks of the stream. As well, from AMEC's recent site visit, the stream appears to continue to degrade. For further details on the condition of the Stratton Hall Stream, the full 2010 report can be found in Appendix D.

## **5 Identifying and Prioritizing Pollutants, Sources and Causes**

- *What is the process for identifying and prioritizing pollutants in the Watershed?*
- *What are the impairments in the watershed?*
- *What are the sources/causes of the major pollutants in the Watershed?*
- *What are the potential solutions to improve the water quality?*

Section 5 summarizes the pollutants and environmental factors that are preventing Twenty-five Mile Creek and its tributaries from achieving recreational use water quality standards. This section describes the possible sources and causes of the impacts from bacteria loadings. These were identified by reviewing the available assessment data, as previously discussed in Section 4 and conducting supplemental field investigations as further described in Section 4. Technical advisors, stakeholders and community members also provided input on the sources and causes of bacteria pollutants throughout the project. By identifying the cause of pollutant sources, implementation efforts can focus on remedying conditions leading to stream impairment. This will ensure that implementation efforts will be completed efficiently and effectively.

Although point source pollution has not been ruled out, nonpoint source pollution has been identified as a likely cause of impairment during evaluation of Twenty-five Mile Creek Watershed. The four primary sources of nonpoint source pollution in the watershed are stormwater discharges from impervious surfaces from urbanized areas, failing septic systems, sewer sources, agricultural and wildlife contributions. These sources are discussed in greater detail below.

### **5.1 Urbanized Sources**

The higher percentage of impervious surface and concentration of dogs and cats that live in developed areas increase the bacteria loading from built-up or developed land. The increase in pollutant loadings (bacteria, sediment, and nutrients) from these areas is mostly due to the increase in connected impervious surfaces. This alteration in the natural landscape increases runoff volume and creates an efficient mechanism to convey available pollutants. Since the TMDL was developed, extensive development has occurred within the watershed, particularly the headwaters, increasing the developed areas from approximately 2,420 acres (3%) in 1992 to 15,560 (19.5%) in 2006. As well, the watershed has continued to receive growth pressures since 2006 as a result of the watershed's close proximity to the population center of Columbia. Therefore, urban runoff may be a significant source of pollutants to Twenty-five Mile Creek, and further research is needed to determine the significance of this source.

To better understand the impact that urbanization and increased impervious surfaces may have had on the watershed, a brainstorming session for urban sources was held with stakeholders on December 4, 2012. Stakeholders that attended included Elgin Town Council, Kershaw County Stormwater, Fairfield County, Richland County's Carolina Clear, Town of Blythewood, Central Midlands Council of Governments (COG), and South Carolina Rural Water Association (SCRWA). The goal of the meeting was to gain knowledge of the urbanized areas of the watershed to determine if there were any stormwater, erosion, or domestic pet complaints. As well, brainstorming meetings with local residents of the watershed were held in both Kershaw County and Richland County on April 17<sup>th</sup> and 18<sup>th</sup>, 2013 that further helped narrow down potential urban sources of bacteria pollution that need to be addressed.

Compiling information from assessments mentioned in Section 4 and the brainstorming sessions, the following findings on potential urban sources of bacteria pollution are listed below.

#### Findings

##### 1) Pet Waste

- Dog Park in the Lake Carolina Subdivision: It was mentioned in both the Urban Sources Meeting and the Public Meeting that there is a Dog Park in Lake Carolina that may be a source of bacteria pollution. Lake Carolina is a large subdivision (approximately 1,650 acres) located in the Northeast Columbia area of Richland County, SC. The subdivision is on Twenty-five Mile Creek and its tributaries near the Kershaw County border. A field study was conducted by AMEC Environment and Infrastructure, Inc. on August 8, 2013



to investigate Lake Carolina's Dog Park. The one-acre Dog Park (approximately 0.5 mile from Lake Carolina) is located on Lake Carolina Drive, and it was found that adequate pet waste stations are located within this area.



On this site visit, it was also found that there is a pet waste station at Lake Carolina's Sunset Park, which is located on the dam of Lake Carolina (200 acre lake).



Furthermore, it was observed that throughout this large subdivision, there did not appear to be additional pet waste stations. However, it was deduced that Lake Carolina's potential bacteria loadings from pet waste are addressed via pet waste stations in areas where large concentrations of dogs are likely to be found.

- Apartment Complexes: Within the Twenty-five Mile Creek Watershed, there are approximately ten apartment complexes and six of them accept pets. It is anticipated that most of the apartment tenants with pets exercise the pets around the apartment

complex. Therefore, a fairly small area can receive a substantial loading of pet waste and contribute to bacteria loading. The six apartment complexes that accept pets in the watershed include:

1. Reserve at Lake Carolina: 420 Hard Scrabble Road, Columbia, Richland Co.  
-Approximately 165 feet from Lake Carolina (located on Twenty-five Creek)
  2. Rice Terrace Apartments: 100 Rice Terrace Drive, Columbia, Richland Co.  
-Approximately 1.25 miles from Twenty-five Mile Creek
  3. Frenwood Apartments: 841 Frenwood Lane, Lugoff, Kershaw Co.  
- Approximately 500 feet from Twenty-five Mile Creek
  4. Hallmark at Truesdell Apartments: 186 Roy Truesdell Road, Lugoff, Kershaw Co.  
-Approximately 0.4 miles from Twenty-five Mile Creek
  5. Bridle Ridge Apartments: 40 Boulware Road, Lugoff, Kershaw Co.  
-Approximately 0.6 miles from Twenty-five Mile Creek
  6. Bridle Station Apartments: 44 Boulware Road, Lugoff, Kershaw Co.  
-Approximately 0.65 miles from Twenty-five Mile Creek
- Other Areas of Concern for Pet Waste: The areas listed below are potential sources of bacteria pollution due to a larger concentration of pets in a small area.
    - Vets:
      - Kershaw County - Elgin Veterinary Hospital and Wateree Animal Hospital
      - Richland County - Companion Animal Hospital of Blythewood
    - Washing/Grooming Facilities: Elgin Pet Shop and Doggie Do's both located in Elgin of Kershaw County.
    - Pet Supply Facilities: Just 4 Paws in Blythewood of Richland County
    - Ball fields in the watershed
- 2) Long Creek Plantation Equestrian Centre: Long Creek Plantation is a 2400-acre designed subdivision located near Blythewood in Richland County, South Carolina. One of the facility amenities available for this subdivision is the Long Creek Equestrian Centre (LCEC) located on Long Town Road East on 33 ½ acres within the Long Creek Plantation in Blythewood, South Carolina. The main barn houses about 30 horses and the hay barn, where the shavings, hay and

equipment are kept, has three additional stalls. LCEC has 12 pastures, a covered arena, a jumping arena, a dressage arena, and numerous trails. All of the fields are grassed along with coastal round bales. The five outer pastures have natural running water and the upper fields have water troughs. LCEC is approximately 300 feet from the stretch of Twenty-five Mile Creek that runs downstream of Lake Columbia and upstream of Lake Carolina.

- 3) **Water Fowl:** Canada Geese were discussed in brainstorming meetings and mentioned in the 2004 TMDL because they tend to migrate towards stagnant bodies of water (i.e. neighborhood ponds) and directly deposit their waste. However, it is expected that they are not a major contributor to bacteria loadings in the watershed and would be a difficult source to address.
- 4) **Sanitary Sewer Overflows:** Further described in Section 5.2 below.

## **5.2 Sewer Sources**

In urbanized areas, sanitary sewer leakage and overflows can be another source of bacteria and nutrient contamination. Sanitary sewer overflows (SSOs) can be caused by anything capable of obstructing the flow of wastewater in sewer, including a build-up of solids and fats, oils, and greases (FOG). Although there are different causes for sanitary sewer overflows, FOG poured into sanitary sewer collection systems, either intentionally or unintentionally, have a significant effect on the size and frequency of sanitary sewer overflows. Fats, oils and grease in a warm liquid form may appear to be harmless since they flow easily down the drain. However, as the liquid cools, the FOG solidifies and separates from other liquids in the sewer pipes. The layer of FOG sticks to the sewer pipes and, over time, the flow of wastewater becomes restricted and can cause a backup or overflow (HCSA, 2012).



Gathering information from the Brainstorming Meetings (Urban Sources Meeting, Public Meetings and the final Stakeholder Meeting), SCDHEC, municipalities and sewer companies within the watershed, the following findings are discussed below.

## Findings

- AMEC contacted the local municipalities and sewer companies to compile the watershed's Sewer Management Areas Figure (Figure 9 below). Concentrated sewer areas are located in the urbanized areas of Richland County, the Town of Blythewood, the Town of Elgin and the Town of Lugoff.
- To determine the number of sanitary sewer overflows (SSOs) caused by FOG in the Twenty-five Mile Creek Watershed, a FOI was requested from SCDHEC. SSO information received from DHEC included SSOs in the past couple years for all of Kershaw County, Richland County and Fairfield County (not divided up by watershed). The information also was difficult to segregate SSOs caused by FOG. Therefore, these records were not as useful for this Plan; however information provided by Palmetto Utilities and Kershaw County was of use and is mentioned in greater detail below.
- Kershaw County SSOs: According to Dana Reeder, Kershaw County has not had many SSOs in the past couple years, especially not many issues within portions of Kershaw County of the Twenty-five Mile Creek Watershed. As well, Kershaw County's WWTP has conducted significant upgrades to its system in the past 5 to 6 years, initiated a FOG program, and has begun monitoring their pump stations.
- Palmetto Utilities Sewer Services in Twenty-five Mile Creek Watershed:
  - Palmetto Utilities distribute educational door hangers in residential areas that have a spill caused by either an accumulation of grease (FOG) or rags. They also give customers a door hanger if they have a backup on their private service line in order to educate residents on ways to prevent backups.
  - Grease Trap Inspection/ Pump Out Program: Palmetto Utilities has undertaken this program for their commercial customers in order to try and prevent grease from entering their system. All commercial customers that prepare food (restaurants, school cafeterias, etc.) are required to have a grease trap. They have an inspector who inspects the grease trap, and places the restaurants on a pump out schedule depending on how fast it accumulates grease. The inspector is also on-site during each pump out to ensure that all the grease is taken out by the pump trucks, and not pushed into the system.
    - Note: This is a great preventative measure conducted by Palmetto Utilities; however, pump trucks are not followed once they are off site. Aiken/Augusta area (approximately 2 hours away) is the closest place in the vicinity of the watershed that accepts grease. This inconvenience and cost may result in companies illegally dumping grease and contributing to bacteria pollution within the watershed.

- Educational Meetings: Palmetto Utilities from time to time have community meetings either at local schools, or homeowners associations to give a presentation that illustrates what FOG and rags do in the sewer system.
- Areas Susceptible to SSOs from FOG: According to Palmetto Utilities service areas in Richland County of the Twenty-five Mile Creek Watershed, they have SSO problems (from FOG and rags) in the Centennial Section of the Lake Carolina subdivision, Colony Park subdivision off of Rhame Road and The Summit subdivision between Rhame Road and Hard Scrabble. In these areas where they have SSO problems from FOG, Palmetto Utilities try to use jet lines to prevent additional backups.
- Communities Recycling Used Cooking Oil: Kershaw County, Richland County, and Fairfield County have partnered with Midlands Biofuels to accept used cooking oil at their Convenience Centers and other various locations within these Counties. For Kershaw County, convenience centers within the Twenty-five Mile Creek Watershed include the Elgin Convenience Center (2328 Hwy. 1 South, Elgin) and the Lugoff Convenience Center (60 Reclamation Rd., Lugoff). Both Centers have used cooking oil collection containers provided by Midlands Biofuels. Richland County recently partnered with Midlands Biofuels to have their used cooking oil containers placed at Richland's C&D Landfill (1070 Caughman Road North) and the Lower Richland Drop-Off Facility (10531 Garners Ferry Road). Both of these locations are not within the Twenty-five Mile Creek Watershed. As well, there are no Fairfield County Recycling Centers in the Twenty-five Mile Creek Watershed; the closest center is the Ridgeway Center (1966 US Hwy. 21 South, Ridgeway).
- Rendering Facilities: Rendering facility in Lugoff, formerly Biocrude, closed down and it is uncertain if/when it will re-open. A rendering facility is planned to open on Shop Road in Columbia, South Carolina; however, it will most likely take two years or more. Cayce WWTP in Lexington County (near Columbia, South Carolina) accepts grease, but will only accept grease from Lexington County. As mentioned above, Aiken/Augusta area (approximately 2 hours away) is the closest place in the vicinity of the watershed that accepts grease. Again, this inconvenience and cost may result in companies illegally dumping grease and contributing to bacteria pollution within the watershed.

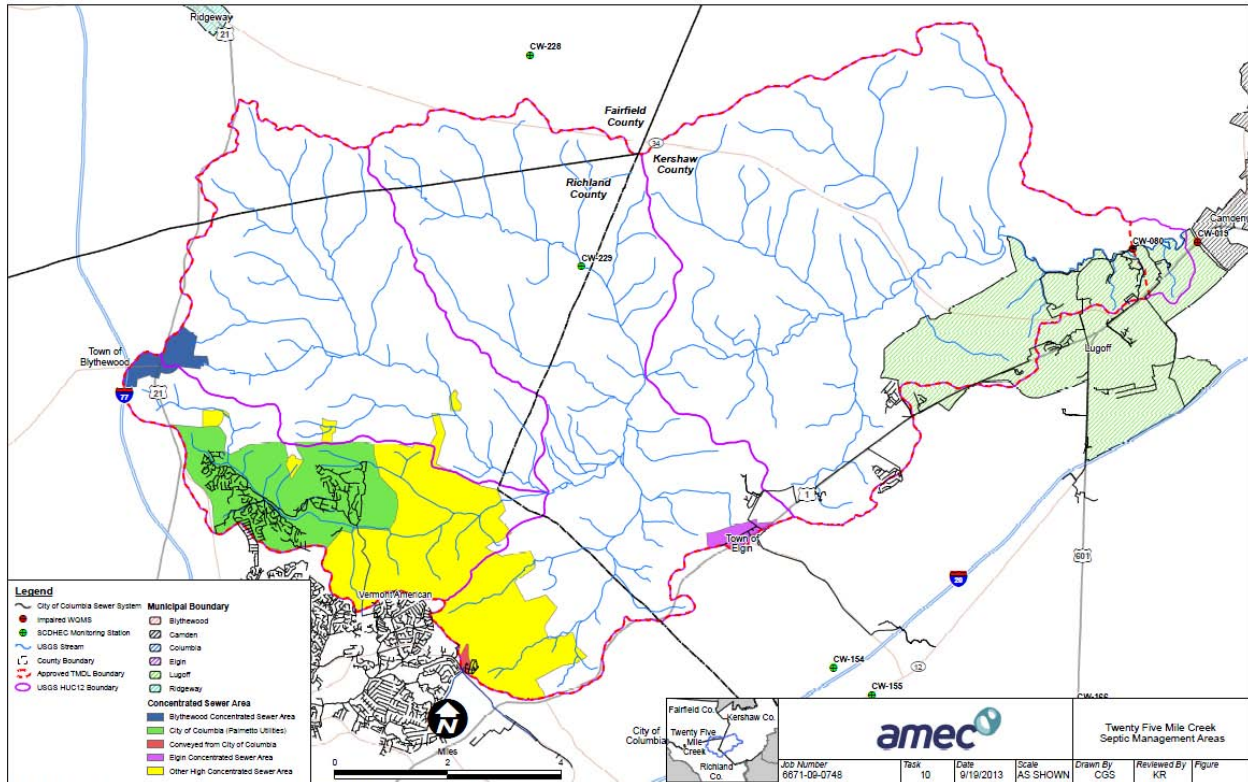


Figure 9. Concentrated sewer areas in the Twenty-five Mile Creek Watershed<sup>8</sup>

### 5.3 Agricultural Sources

#### 5.3.1 Livestock

Livestock such as cattle, goats, and horses grazing on pasture land can be a significant source of bacteria loading and a source of nutrients and sediments causing macroinvertebrate impairment.

The two main methods of bacteria loading to the Twenty-five Mile Creek Watershed from cattle/horses are stormwater runoff from pastures containing manure and cattle depositing manure directly in the stream. According to the TMDL, loading of bacteria to the Twenty-five Mile Creek by cattle's direct discharge in the stream is possibly a significant source. As well, cattle concentrated in smaller areas (i.e. shaded area, water sources, feeding areas, etc.) often results in larger, more concentrated manure deposits and poorly stabilized soils resulting in erosion which provides additional mechanism to transport bacteria.

Based on 2006 USGS NLCD data, pasture lands cover 5.5 percent of the Twenty-five Mile Creek Watershed (about 4,385 acres) and may be a significant source of pollution. To help determine if cattle/horse farming activities contribute to the impairment of Twenty-five Mile Creek, a brainstorming session for Agricultural Sources was held on January, 14 2013 to utilize cooperators and stakeholders' knowledge of farms in the watershed. Attendees included Kershaw County Stormwater; Fairfield

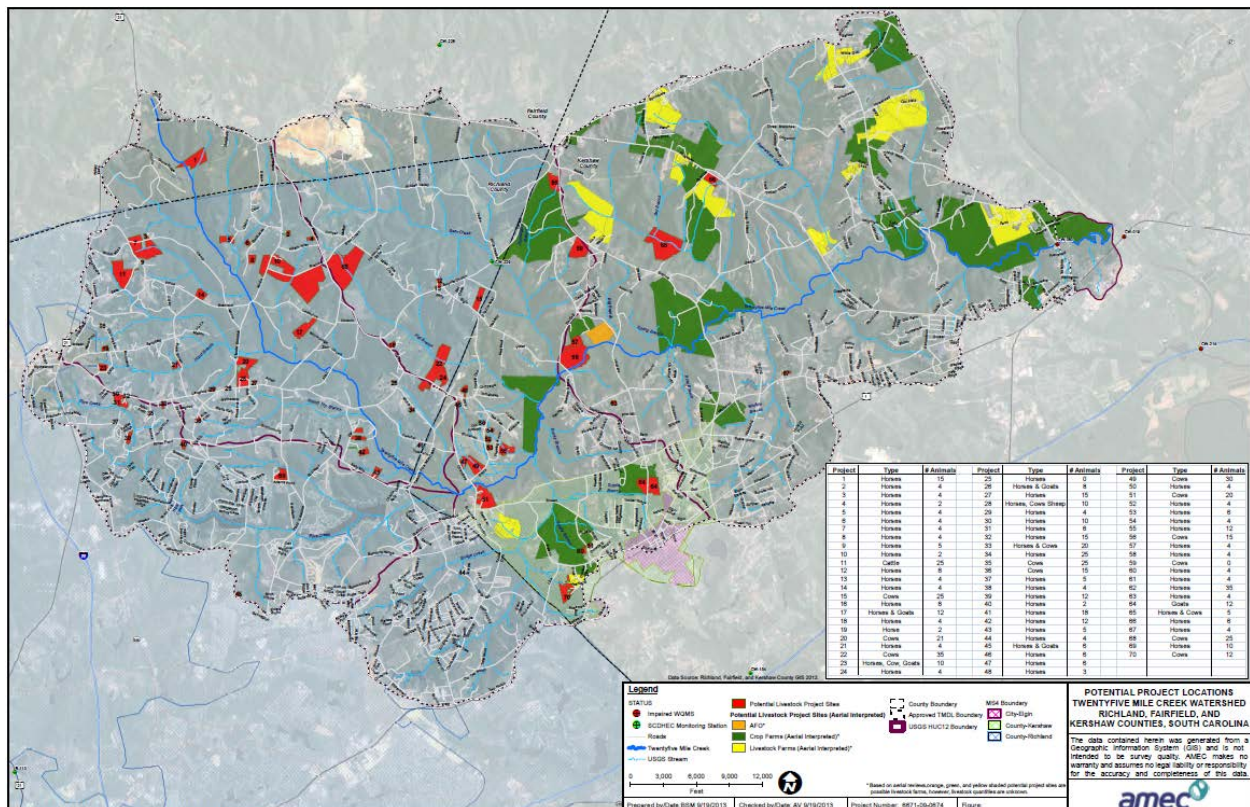
<sup>8</sup> See Appendix A for larger figure

County; Town of Blythewood; Kershaw, Richland and Fairfield NRCs; Richland SWCD; Fairfield SWCD; and SCRWA.

Utilizing information from assessments mentioned in Section 4, GIS and aerial reviews, and the brainstorming sessions, the findings on agricultural livestock sources of bacteria pollution are listed below.

**Findings**

The number of farms with livestock was determined for the Twenty-five Mile Creek Watershed. Figure 10 displays the overall number of livestock farms (labeled “Potential Livestock Project Sites” and “Potential Livestock Project Sites (Aerial Interpreted)” on the Figure) and the estimated number of animals per livestock farm. Farms tend to be in the northern half of the watershed, with many hobby farms located in this watershed. Based on information gathered from stakeholders, the estimated numbers of livestock on the farms displayed in Figure 10 are shown in Table 7 below. Due to gaps in stakeholders’ knowledge of all of the farms in the watershed, ten percent was added to the stakeholders’ estimated numbers of livestock, resulting in the values shown in Table 7. From this information, estimated bacteria loadings from livestock farms were calculated and results are shown in Table 12 in Section 7.



**Figure 10. Livestock, Poultry and Crop Farms located in the Twenty-five Mile Creek Watershed<sup>9</sup>**

<sup>9</sup> See Appendix A for larger figure

**Table 7. Estimated Total Number of Livestock in the Twenty-five Mile Creek Watershed**

<b>Livestock</b>	<b>Estimated Total</b>
Cows	267
Horses	290
Goats	18
Sheep	4

### **5.3.2 Poultry**

According to the fecal coliform TMDL at the time it was written in 2004, there were two permitted animal feeding operations in the Twenty-five Mile Creek Watershed. However, it has since been found that one is no longer running in this watershed. Most of the litter from these facilities is carried out of the watershed. However, the manure that is not taken out of the watershed is typically applied to pastures. The facilities' pasture fields within the watershed are permitted for land application of manure. Thus, these fields are exposed to stormwater runoff and potentially contribute to bacteria loadings, as well as a source of nutrients contributing to macroinvertebrate impairments, that reach downstream waterbodies.

All modern poultry facilities are required to have a Waste Management Plan by both NRCS and SCDHEC to address the cleaning of chicken litter. There are two types of litter cleaning processes in poultry houses:

- once a year the entire house is cleaned, and
- partial cleanout between cycles where 30-50% of the litter is removed while the remaining litter is wind rowed and then spread back on the floor to a depth of approximately 3 inches deep and then covered with pine shaving.

If the litter is removed from the house and moved into an open space, it is required to be covered within 72 hours. Many facilities employ stacking sheds to keep the litter covered, while others store the litter on the ground (but covered) until needed for personal field application, or until sold to manure brokers. When farmers sell excess litter to manure brokers, it is distributed to other Counties in SC as well as to surrounding states.

The standards that are in place today for poultry farming have improved since the TMDL development. Poultry farmers are more conscientious about the environment, and mandatory permitting regulations have become more stringent over the years. No-till technology is currently employed, which allows the remnant foliage to be left on the field, thereby reducing the likelihood of land-applied manure being transported to waterways by stormwater runoff. Likewise, the use of stacking sheds for the coverage of manure is a more recent practice, which reduces the potential for runoff from the site.



Using stakeholder's knowledge of farms in the watershed from the Agriculture Brainstorming Session (mentioned Section 5.3.1), along with aeriels and GIS, poultry farming activities should be considered a potential source of bacteria loading to Twenty-five Mile Creek.

Findings:

- One animal feeding operation (AFO) from aerial review: AFO off of Veterans Road in Kershaw County. TMDL estimated approximately 56,000 chickens on this facility. Figure 10 displays the location of the AFO in Kershaw County of the Twenty-five Mile Creek Watershed. Stakeholders believe that this poultry farm sells excess litter to manure brokers. There are a few licensed litter brokers in the area that obtain litter from poultry houses and spread it on various farms in the state including farms in Fairfield, Kershaw and Richland Counties. Therefore, it is likely that this manure is distributed around the watershed.

### **5.3.3 Cropland**

Bacteria loading from croplands is mostly attributed to runoff from manure used for fertilizer and poorly stabilized soils easily runoff and transport bacteria to streams. Cropland within the Twenty-five Mile Creek Watershed has been greatly reduced according to the NLCD 1992 landuse data used to develop the TMDL. In the TMDL, row crop land use accounted for approximately 18.1% of the overall watershed with a total of 14,400 acres. As of the most recent land use data, there are estimated to be less than 2,000 acres of cultivated croplands, approximately 2.0% of the overall watershed.

Using stakeholder's knowledge of farms in the watershed from the Agriculture Brainstorming Session (mentioned in Section 5.3.1), along with aeriels and GIS, there is a possibility that cropland farming activities contribute to the impairment of Twenty-five Mile Creek.

Findings

- DHEC stated that there no ND (No Discharge) Permits in the watershed for land application of manure, however stakeholders stated that many crop farms spread turkey litter in the watershed, especially near Lugoff in Kershaw County.
- Although the number of crop farms was not determined for this watershed, Figure 10 above displays potential crop farm project sites based on aerial reviews of the watershed.
- The conservative practice of applying turkey litter via disking it in is most likely not occurring; therefore, crop farms within the watershed are potentially contributing to bacteria polluted runoff.

### **5.4 Septic Sources**

Failing septic systems represent a nonpoint source that can contribute bacteria and nutrients to receiving waterbodies through surface or subsurface malfunctions. Septic systems that do not function

properly may leak sewage which can reach nearby streams. Septic systems can fail due to improper design or construction, and systems may no longer function because of neglected maintenance. According to the TMDL written in 2004, it was estimated that there are 4700 septic systems in the Twenty-five Mile Creek Watershed. There is no accurate estimate of failure rate in this watershed, but several studies have reported failure rates ranging from 5 to 39%, and a rule of thumb of 10% failure is generally used (Schueler, 1999). Many residential property owners may be unaware of problems with their septic tanks or may be unable to afford repair of their septic tanks. Therefore, failing septic systems may be a significant source of fecal coliform in the watershed. To help determine if failing septic tanks contribute to the impairment of Twenty-five Mile Creek, a brainstorming session for Septic Sources was held on February 7, 2013 with Kershaw County Stormwater, Richland County's Carolina Clear, and SCDHEC from Region 3 and Kershaw County.

Compiling information from assessments mentioned in Section 4, parcel data, soils data, sewer data (Figure 9), and the brainstorming sessions, the following conclusions on failing septic systems as a source of bacteria pollution are listed below.

### Findings

- Kershaw County was awarded a grant to build a septic receiving station at their WWTP to accept waste from septic systems, and it is projected to be completed by the end of 2013. This provides septic companies a good local option for proper disposal of septic waste.
- As discussed in Section 5.2, Kershaw County, Richland County and Fairfield County have partnered with Midlands Biofuels to accept used cooking oil at their Convenience Centers. However, Midlands Biofuels used cooking oil containers are currently not located in the Twenty-five Mile Creek Watershed for Richland and Fairfield Counties. The practice of recycling used cooking oil for septic systems owners prevents backups in their systems as well.
- Gathered Twenty-five Mile Creek Watershed Septic Parcel Data:
  - AMEC obtained building parcel data from Kershaw County. Kershaw County estimates about 800 sewer customers in the Twenty-five Mile Creek Watershed area. Therefore, the number of building parcels for the area minus 800 gave a rough estimate of septic owners in Kershaw County portion of the watershed (Figure 11 below and Table 8 below<sup>10</sup>)
  - Richland County provided septic parcel data for the watershed and is displayed in Figure 11 and Table 8.

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<sup>10</sup> Figure 11 and Table 8 disclaimer: Septic data obtained for the Twenty-five Mile Creek Watershed is a rough estimate of septic parcels within this area. However, this number is believed to be more accurate than the estimated 4,700 septic systems stated in the 2004 TMDL.

- o AMEC obtained building parcel data from Fairfield County. All parcels within the Twenty-five Mile Creek Watershed portion of Fairfield County are on septic. Therefore, an estimate of septic owners in the Fairfield County portion of the watershed is shown in Figure 11 and Table 8 .
- o AMEC overlaid the watershed’s septic data with the area’s Hydrologic Soil Groups (Figure 11). Soils information (i.e. infiltration properties) along with age of buildings information will help narrow down areas that may be susceptible to failing septic systems. The analysis of Figure 11 to identify targeted areas is discussed in Section 7.

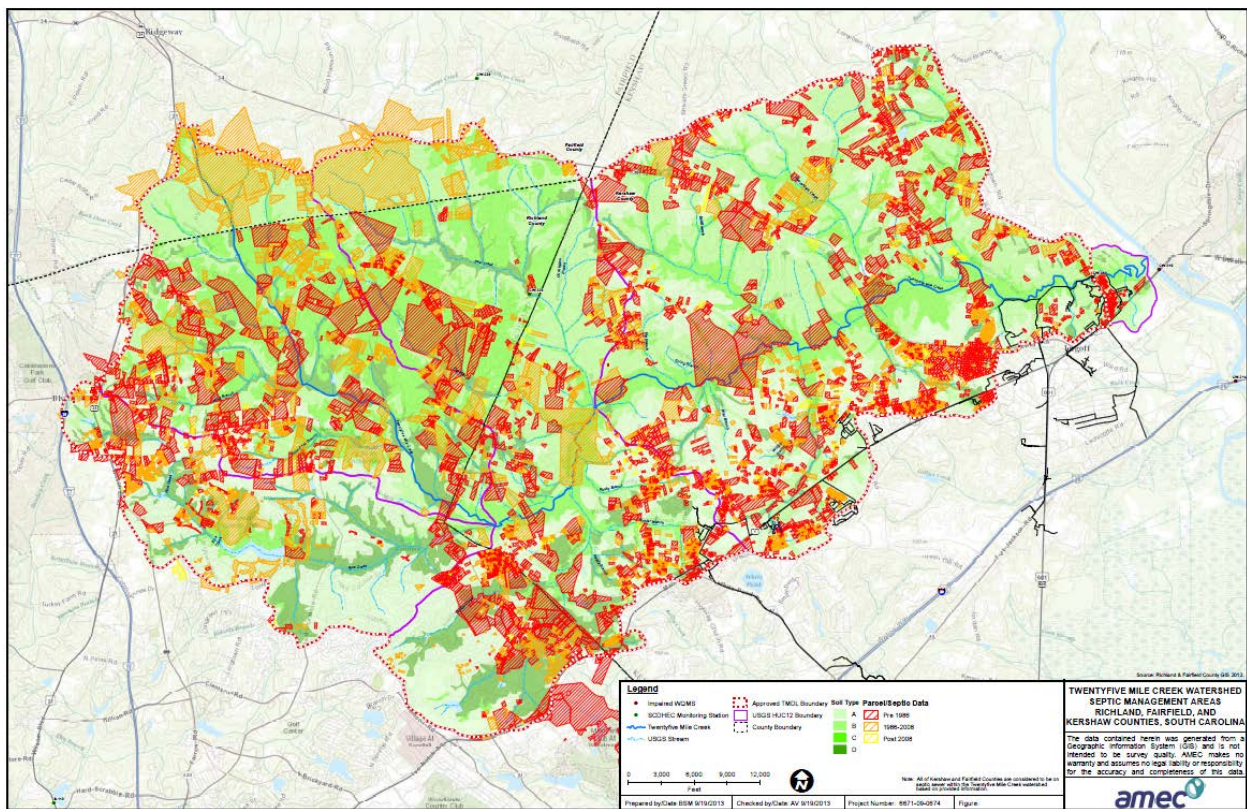


Figure 11. Twenty-five Mile Creek Watershed Septic Management Areas<sup>11</sup>

<sup>11</sup> See Appendix A for larger figure

**Table 8. Total Estimated Septic Systems within the Twenty-five Mile Creek Watershed**

County	Number of Septic Systems
Kershaw	171
Richland	3873
Fairfield	2018
<b>Total</b>	<b>6062</b>

### **5.5 Wildlife Sources**

Wildlife (mammals and birds) are contributors of bacteria and nutrients to surface waters via wastes that are either carried into nearby streams by runoff following a rainfall or deposited directly in streams. When the TMDL was written, deer were designated as a significant wildlife contributor of fecal coliform. In 2000, the SC Department of Natural Resources (SCDNR) estimated a density of approximately 45 deer/mi<sup>2</sup> in the Twenty-five Mile Creek Watershed.

In order to target wildlife sources of pollution, information was gathered by meeting with SCDNR and Richland’s Carolina Clear on April 17, 2013 to develop potential bacteria sources that are mentioned below. Sources of wildlife pollution in the Twenty-five Mile Creek Watershed were drawn from this Wildlife Brainstorming meeting as well as assessments mentioned in Section 4.2. Forest lands, which usually have only wildlife as sources of bacteria, usually have low loading rates for bacteria. However, potential bacteria sources associated with wildlife listed below were found in the Twenty-five Mile Creek Watershed.

#### Findings:

- Improper Disposal of Carcasses:
  - Stream Dumping: From the Windshield Survey, it was observed that many deer carcasses are dumped at stream crossings, especially near WQMS CW-229 on Bear Creek of Richland County.
  - Road-side Dumping: If carcasses are dumped on a state road, SCDOT will remove the animal carcasses from the road and properly dispose of them in the municipal landfill on Screaming Eagle Road and Kershaw County Landfill.
  - Options for Proper Disposal of Carcasses:
    - County Landfills - Kershaw County Landfill (no cost for residents) and Richland County’s Screaming Eagle Landfill (with cost of \$60/carcass) accept animal carcasses for disposal. Animal carcasses taken to these landfills are properly buried and do not contaminate surface water or ground water.

- Animal Control - will incinerate animals for \$30/carcass
- Processors - Some processors may accept the whole deer (such as Campbell's Custom Deer Processing and the new Columbia Deer Processing), but most facilities require for the deer to be skinned and gutted before it can be processed (such as Bass Processors in Blythewood, SC). These animal processor facilities either have rendering facilities come pick up their remains (i.e. Valley Proteins, Inc.) or arrange for dumpster pick-up (i.e. Advanced Disposals) to transport the remains to a landfill where they are properly buried.

Even with these options for proper disposal, deer carcasses were observed by AMEC Environment & Infrastructure, Inc. and Kershaw County to remain a problem in the watershed. The improper disposal of carcasses is most likely a result of inconvenience, cost burdens and lack of knowledge.

- Wild Hog Problem: From the Wildlife Brainstorming Session, SCDNR stated that one of their biggest problems in the area is wild hogs. Wild hogs are reproducing at an exponential rate, have no natural enemies in South Carolina, and carry two bad diseases (swine brucellosis and pseudorabies). Their habit of "wallowing in the mud" and their preference to bottomlands (such as rivers, creeks and other drainages) can have a direct effect on water quality. To help mitigate this problem, SCDNR and legislation strongly encourage hunters to kill as many wild hogs as they can to control their population.
- Hunt Clubs in the Twenty-five Mile Creek Watershed:
  - Crooked Creek Hunt Club in the Richland County portion of the Watershed.
  - Blythewood Hunt Club
  - Hidden Valley Hunt Club
  - 15 Member Hunt Club
  - Big Ten Hunt Club in Elgin of Kershaw County

Hunt clubs do not appear to be a problem for bacteria loadings in the watershed due to good practices being employed at the clubs with gut pits available for hunters to bury carcasses.

## **5.6 Other Sources**

### **5.6.1 Point Sources**

Individual NPDES permitted point sources were identified within the Twenty-five Mile Creek Watershed and Figure 12 depicts their locations.

The NPDES Industrial general permit, effective January 1, 2011, requires industrial permitted facilities which discharge to a TMDL watershed to sample their discharge and conduct analyses for the TMDL's pollutant of concern (POC) for at least a year following the effective date of the permit. The results of

these sampling activities can be requested from the industrial facility to evaluate which, if any, of the industrial facilities are point sources for bacteria loading.

In the Twenty-five Mile Creek Watershed, there are no active NPDES facilities that discharge bacteria. In the watershed, there were a number of lagoons which are no longer active. The homes that were using these lagoons have since been connected to a sewer system. The Kennecott Ridgeway Gold Mine (SC0041378), located on Bear Creek in Fairfield County, discharges process wastewater only. The Kennecott Ridgeway Gold Mine, located 25 miles north of Columbia in Fairfield County, South Carolina, is owned by Kennecott Minerals Company. The mine operated from 1988 to 1999 and consisted of two open pits, processing facilities and a tailings impoundment (Duckett, 2007). The Ridgeway site is currently being reclaimed for an estimated \$30 million. Over time, the two mine pits were filled with water, creating two 100-acre lakes connected by 90 acres of wetlands, and the 380 acre tailings storage facility that contained the finely ground rock remaining after the gold was removed, is now transformed into a tall grass prairie hosting numerous bird and wildlife species (Duckett, 2007). The remaining site is being recontoured and vegetated. Environmental monitoring of ground water and surface water will continue for 30 years by SCDHEC (MEC, 2012). As well, Kennecott has entered into a partnership with the nonprofit Southeastern Natural Sciences Academy to create the Ridgeway Center for Ecological Restoration utilized for environmental education and research (Duckett, 2007).

According to the TMDL, Elgin Estates Inc. (SC0032395) was a small wastewater treatment facility in the Twenty-five Mile Creek watershed. The WWTP was shutdown and had its permit inactivated December 31, 2000 due to its discharge exceeding permit limits for fecal coliform several times. Elgin Estates Inc. may have contributed to the impairment of Twenty-five Mile Creek when the TMDL was developed.

As well, there is an abandoned Lugoff Landfill (Superfund Site) located on the bank of Twenty-five Mile Creek near WQMS CW-080 of Kershaw County, SC that could potentially be contributing to the water quality impairments of Twenty-five Mile Creek. Currently, groundwater at the abandoned Lugoff Landfill is being monitored by SCDHEC.

While unknown at this time, there may be unpermitted point source discharges in the watershed. While stakeholders are out in the field, such discharges, if found, should be noted and addressed.

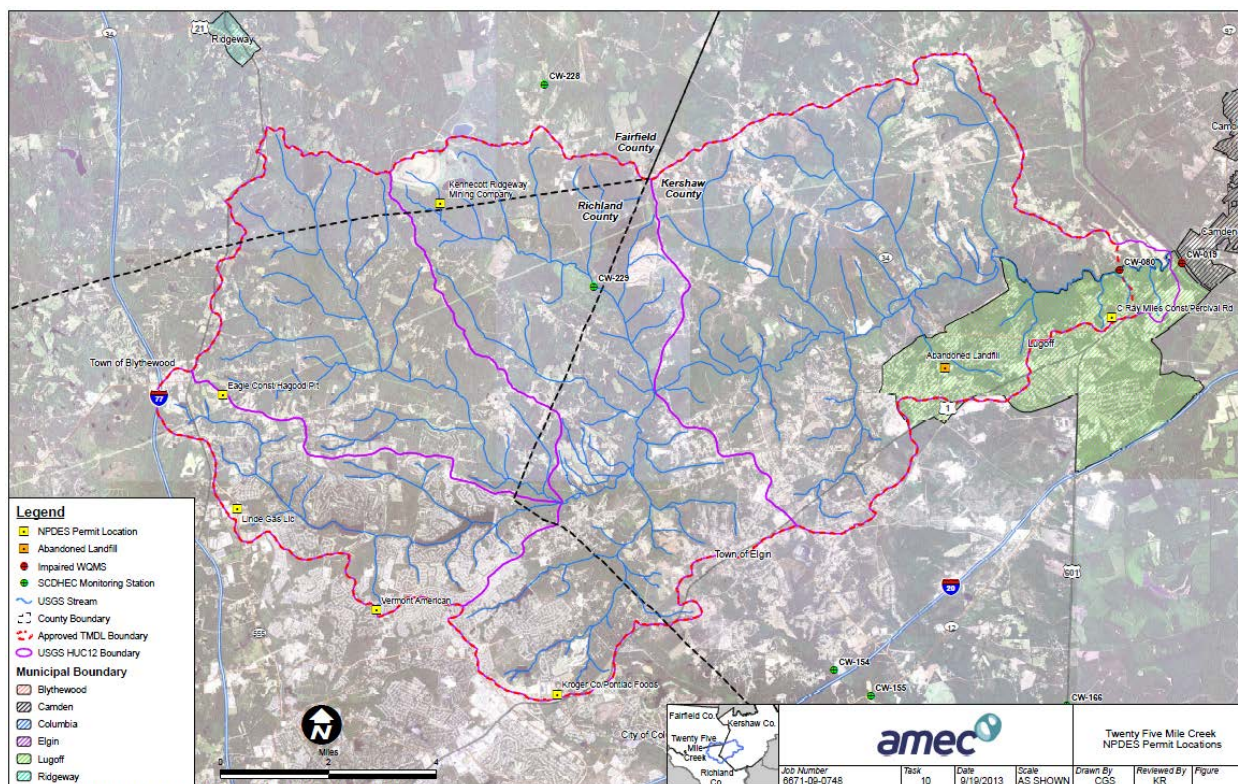


Figure 12. Twenty-five Mile Creek NPDES Permit Locations<sup>12</sup>

## 6 Watershed Restoration Goals & Objectives

- *What are the restoration goals?*

The goals for Twenty-five Mile Creek WBMP are to restore the stream to its statutory classification, protect the stream for the long term and involve stakeholders from the watershed. The following goals and objectives were established by the project steering committee and stakeholders at the several brainstorming meetings:

### Goal #1 - Improve Twenty-five Mile Creek's water quality so that it meets State water quality standards

- Ensure that Twenty-five Creek meets water quality standards for recreational use and aquatic life.
- Continue to monitor bacteria levels in Twenty-five Mile Creek (see Section 8.1 for proposed monitoring details).
- Ensure that Twenty-five Mile Creek Watershed provides good habitat for fish and other wildlife so that it can provide a connection to nature for watershed residents.

<sup>12</sup> See Appendix A for larger figure

**Goal #2 - Protect and maintain water quality, aquatic and wildlife habitat to ensure Twenty-five Mile Creek continues to meet state water quality standards.**

- Improve the management of stormwater runoff for existing development in an effort to improve water quality.
- Ensure zoning and ordinances and enforcement guide new development in a manner that protects Twenty-five Mile Creek.
- Coordinate efforts with other groups in the watershed focused on land conservation and protection strategies.

**Goal #3 - Build community support for the protection and enhancement of the land and water resources of the Twenty-five Mile Creek Watershed.**

- Develop an outreach program for citizens and businesses to promote and implement the Watershed Based Plans. Include one-on-one outreach and signage to educate residents on their role in implementing the WBPs.
- Strengthen ties with the local schools and local colleges to enhance education and participation in opportunities for community action.
- Perform outreach to residents, businesses, and contractors within the watershed to encourage environmental stewardship within the Twenty-five Mile Creek Watershed.
- Develop and establish a Twenty-five Mile Creek Workgroup to oversee Plans implementation and work towards long term health and ensure that the Watershed Based Plan goals are achieved.

## **7 Twenty-five Mile Creek Action Plan**

### **7.1 Action Plan**

#### **7.1.1 Urbanized Sources**

##### **7.1.1.1 Target Audience/Description**

**Target Audience:** Urbanized areas with increased impervious surfaces, such as:

- MS4 areas (Kershaw County MS4, Town of Elgin MS4, and Richland County MS4)
- Northeast Columbia, Richland County
- Towns of Blythewood, Elgin and Lugoff

**Description:** The Plan will target residential, commercial or industrial property owners and users to address urban runoff. For example, users of recreational facilities and public spaces as well as animal vet/supply stores, apartment complexes and residential subdivisions (and their Homeowners Associations) within the Twenty-five Mile Creek Watershed will be targeted for urban runoff education and BMPs.



### **7.1.1.2 Strategies/BMPs Needed**

Kershaw County and Richland County will use and supplement, as needed, programs already being implemented as part of MS4 permit compliance to address non-point source reduction from urban storm runoff in the Kershaw County, Richland County and the Town of Elgin MS4 portions of the watershed. Additional and new strategies to address urban runoff are being proposed under the 319 program and are listed below. As part of the 319 program, the Counties propose to expand the following programs already being implemented by the MS4s that have been successful at addressing urban runoff:

- Installation of approximately 15 pet waste stations. If a 319 Implementation grant is awarded, Kershaw and Richland Counties will provide pet waste stations in green spaces in residential subdivisions, apartment complexes, and public parks (such as ball fields) outside MS4 limits. Veterinary offices, pet supply and grooming stores mentioned in Section 5.1 (outside of the MS4) will also be possible locations for pet waste stations.
- Rain Barrel Program: Provide the first 10 rain barrels for willing participants, conduct rain barrel workshops on how to build one at home, possibly have a paint contest for rain barrels in school, etc. Potentially partner with Carolina Clear to help expand this program for the watershed.
- Storm drain tagging (approximately 2,000) on roads within the watershed with complementing educational program focused on reducing pet waste disposal in and around storm drains. See below for a photo of an example of a storm drain tag.



**Figure 13.** Example of a Storm Drain Marker

- Urban Riparian Planting/Stream Stabilization: As mentioned in Section 4.2.4, Stratton Hall Stream is approximately a quarter mile long stream that is actively degrading in Kershaw County near WQMS CW-080. Backyards that are adjacent to this stream potentially have bacteria loadings via pet waste and are in jeopardy of property damage/loss with the stream continually to degrade. This stretch of stream (and potentially similar locations within the watershed) will be targeted to recruit homeowners to participate in riparian planting/stream stabilization for their backyards.
- Rain gardens: The first 10 rain gardens (on average, approximately 200 sq. ft. in size) for residential homeowners could be provided on a cost-share basis between the homeowner and

their County. After the first 10, provide workshops and other educational materials to encourage property owners within the watershed to incorporate rain gardens on their lots.

- Kershaw County and Richland County address many urban runoff issues with the construction and post-construction minimum control measures as part of their MS4 permit compliance. As well, Kershaw County is currently in the process of updating their Zoning and Land Development Regulations (ZLDR) to incorporate methods and design practices that will decrease bacteria loadings.

Estimated bacteria load reductions from proposed urban BMPs for years 1 through 5 are displayed in Table 11 and is discussed in Section 8.2.

### ***7.1.1.3 Management Plan***

Project Management: Kershaw County, Richland County and Fairfield County, with the support of a project partners, will furnish project technical support, create and provide outreach and educational campaign/materials and Kershaw County will provide overall project coordination. Each County will act as the lead entity for all advocacy activities to their respective County throughout the outreach and implementation portions of this project.

Prioritization of Sites: With respect to prioritization, property owners in the floodplain of Twenty-five Mile Creek will be addressed first, and, areas in the watershed that are prone to urban runoff. As part of the screening process for potential participants, the location of the urban BMPs and where it drains will be considered compared to MS4 boundaries since systems which drain to the MS4 will not be included if a 319 Implementation Project is granted, but instead will be addressed by the MS4s' Illicit Discharge Detection and Elimination (IDDE) program.

- **Pet Stations:** target areas that tend to have a large concentration of dogs in common green spaces, such as residential subdivisions, vets/pet supply stores and apartment complexes mentioned previously in Section 5.1
- **Rain Barrels:** recruit participants in concentrated impervious areas such as MS4 areas, residential subdivisions, commercial properties, etc. to incorporate rain barrels on their property.
- **Storm Drain Markers:** Preferably mark roads with sidewalks so that storm drain markers can be read. Therefore, possible locations include subdivisions, parking lots, parks, etc.
- **Urban Riparian Planting/Stream Stabilization:** Prioritizing homeowners whose backyards are adjacent to the degrading Stratton Hall Stream.

- Rain Gardens: recruit participants in concentrated impervious areas such as MS4 areas, residential subdivisions, commercial properties, etc. to incorporate rain gardens on their property. Preferably sites with larger backyards/closer to Twenty-five Mile Creek will be targeted first.

#### **7.1.1.4 Outreach Needed**

Kershaw County and Richland County will use and supplement, as needed, the public outreach and education programs already being implemented as part of MS4 permit compliance to address non-point source reduction from urban storm runoff. Current outreach and future outreach regarding urban runoff for Kershaw and Richland County MS4s are included below:

##### Current Outreach:

- Kershaw County and the Town of Elgin’s MS4 Public Outreach Program: Kershaw County and the Town of Elgin’s intergovernmental agreement make up the Kershaw County Stormwater Management Program (SWMP). Under this program, the Kershaw SWMP complies with Minimum Control Measures 1 and 2 of the MS4 permit to address public education and outreach of urban sources with the following items:
  - Outreach materials (Stormwater bookmarks, stormwater brochures, booklets, etc), Stormwater Pollution Prevention Articles in the Elgin News and West Wateree Chronicle (Pet Waste article, Don’t Overwater Your Lawn article, etc.), Fairs and Events (Sparkleberry Fair), Storm Water Minutes posted in municipal buildings (Pick up Pet Waste, Properly Water Your Lawn, etc.), Storm Drain Marking, Blaney Elementary incorporated stormwater-related curriculum and activities, roadside litter clean-ups, etc.
- Richland County’s MS4 Public Outreach Program: Utilizes Carolina Clear to meet their Public Education MS4 requirements. Carolina Clear has broadly focused their public education and outreach on stormwater quantity and quality issues within urbanized areas of Richland County. Richland County’s public education and outreach of urban sources of pollution includes:
  - Social media with Facebook and Twitter, Public Service Announcement (“We all live downstream” commercial), Festivals and Events (Summer Celebration of Water, Sparkleberry Fair,), Workshops (Carolina Yards and Neighborhoods), Community River Cleanups (Rocky Branch, Gills Creek), Brochures and Outreach Materials (many Pet Waste brochures), two articles in *The State* newspaper, many newsletters, storm drain marking, rain barrel workshop, etc.

## Future Outreach:

### Recruitment

- Volunteers to install storm drain markers: Target Boyscout Troops, Students in the watershed, HOAs, etc. The second phase will utilize advertisements (radio stations, flyers/newsletters, newspaper ads, etc.) to recruit participants.
- Participants for rain gardens, rain barrel workshops and installation: First start with HOAs and Schools in the watershed for participation. The second phase will utilize advertisements (radio stations, flyers/newsletters, newspaper ads, etc.) to recruit participants.
- Urban Riparian Planting: As mentioned previously, respective Counties (in this case Kershaw County) will first aim to recruit homeowner's with backyards that are adjacent to the Stratton Hall Stream via letters sent to these homeowner addresses.

### Public Education

- Have local radio stations to participate in educational 'commercials' (Kershaw: possibly 102.7, Richland: possibly 92.1 The Palm) focusing on stormwater quality and quantity, with topics such as proper pet waste disposal, urban stormwater runoff, and the importance of stream buffers.
- Rain Barrel workshops (how to make one, have a rain barrel painting contest at schools)
- Coffee News or other local newsletters
  - Currently have support from a Lake Carolina HOA, The Elgin News and West Wateree Chronicle to put educational material in their newsletters and newspapers.
- Kershaw, Richland, and Fairfield County Websites: these websites will consider creating stormwater educational layouts with supporting urban runoff educational materials (i.e. articles and links).
- Facebook and Twitter accounts will be considered for Kershaw and Fairfield Counties to educate the public on urban sources of pollution.
- Workshops focusing on pet waste disposal and stream buffers for HOAs in watershed's subdivisions (such as creating a Citizen Advisory Group for the watershed).
- Establish community clean up events for Twenty-five Mile Creek.

## **7.1.2 Sanitary Sewer Overflows from Fat, Oil, and Grease (FOG)**

### **7.1.2.1 Target Audience/Description**

**Target Audience:** Residential and commercial generators of FOG with sanitary sewer connections

**Description:** All homeowners and businesses on sanitary sewer within the watershed that generate FOG are going to be targeted for outreach efforts. Figure 9 from Section 5.2 depicts known information about sanitary sewer and septic use areas in the watershed. As well, according to Palmetto Utilities, areas within the watershed that have frequent problems arising from FOG and rags include: Centennial Section of Lake Carolina subdivision, Colony Park subdivision, and the Summit subdivision.

### **7.1.2.2 Strategies/BMPs Needed**

As with the other components of this grant project, participation is voluntary and will be accomplished through a social marketing strategy and focused BMPs. The BMPs selected for this component include:

- Using outreach tools within the watershed to advertise the project and recruit homeowners for participation (further described in Section 7.1.2.4 below).
- Utilize Palmetto Utilities for their educational door hangers and the creation of ones similar.
- Attend and broaden Palmetto Utilities' educational presentations to homeowners on FOG.
- Create an educational commercial on how to properly dispose of FOG.
- Commercial generators of FOG within the watershed (i.e. restaurants): enforcement and inspection for commercial grease traps.
- As mentioned previously, Kershaw County and Fairfield County have a used cooking oil recycling program with Midlands Biofuels. However, the watershed needs to pilot a used cooking oil recycling program at the recycling facilities in the Richland County portion of the Twenty-five Mile Creek Watershed. Possible locations include Clemson's Sandhills Research and Education Center and the Blythewood Fire Station, however, the Blythewood Fire Station is not staffed so this location may not be suitable. Midlands Biofuels will provide the used cooking oil collection containers and provide pick-up service for the used cooking oil.
- Distributing Promotional Can Lids (see photo below) to residents to encourage the practice of not placing fats, oils and grease down the drain. These can lids can fit most food cans from 3 ounces to large family size cans. As well, promotional/educational FOG slogans can be printed on the lids.



- Upgrading Kershaw County WWTP: If the former Biocrude Facility in Lugoff, South Carolina (recently bought by BioCycle, LLC) does not re-open and/or accept commercial grease (i.e. from grease traps) and no other local (Midlands area) alternative for disposal of commercial grease becomes available, then Kershaw County will consider upgrading their WWTP to be able to accept grease.

Estimated bacteria load reductions from proposed sewer BMPs for years 1 through 5 are displayed in Table 11 and is discussed in Section 8.2.

### **7.1.2.3 Management Plan**

Project Management: Kershaw County, Richland County and Fairfield County, with the support of a project partners, will furnish project technical support, create and provide outreach and educational campaign/materials and Kerhsaw County will provide overall project coordination. Each County will act as the lead entity for all advocacy activities to their respective County by working directly with their local sewer and utility partners and SCDHEC Public Health throughout the outreach and implementation portions of this project.

Prioritization of Sites: With respect to prioritization, first priority will be areas with repeated SSO problems due to FOG, such as Centennial Section of Lake Carolina subdivision, Colony Park subdivision and in the Summit subdivision. Second priority areas will focus on urbanized ares in the floodplains of Twenty-five Mile Creek. Third priority will be to focus on restaurants in the floodplains of Twenty-five Mile Creek.

### **7.1.2.4 Outreach Needed**

Participation in the project is voluntary, and effective outreach will be crucial to the success of the project. The following outreach measures will be performed:

#### Current Outreach

- Kershaw County MS4 SWMP: have posted a Stormwater Minute for FOG in the MS4’s municipal buildings and the County accepts used cooking oil via Midlands Biofuels at Convenience Centers.
- Fairfield County: Accept used cooking oil via Midlands Biofuels at all of their Recycling Centers.

- Richland County MS4 SWMP: Richland County recently partnered with Midlands Biofuels for two of their recycling centers to accept used cooking oil. However, both of these locations are not in the watershed. Richland SWMP also plans to focus this upcoming year on bacteria pollutants by partnering with sanitary sewer providers to distribute material to homeowners on reporting sanitary sewer overflows and reducing FOG in pipes.
- Palmetto Utilities: distributes educational door hangers and conduct presentations to HOAs for SSO prevention due to FOG and rags.

### Future Outreach

#### Recruitment:

- Distribution of Promotional Can Lids at facilities and events within the watershed, such as Sparkleberry Fair at Clemson Sandhills, Podunk Festival, Local Races (i.e. Blythewood's Bike Race March 10<sup>th</sup>), school night events (where parents are involved), etc.
- Conduct surveys, make announcements at community meetings, and participation in local events within the watershed to advertise the project and recruit participation.
- Mention in local newspapers, newsletters, and radio stations the time/place of when promotional FOG can lids will be distributed.

#### Public Education:

- Distribute educational flyers for commercial generators of FOG (restaurants) within the watershed and possibly create Daily Checklists for these restaurants.
- Conduct surveys, make announcements at community meetings, and participation in local events within the watershed (some mentioned above) to advertise the project and recruit participation.
- Include educational materials in local newspapers and newsletters to prevent SSOs from FOG
  - Have support from Lake Carolina's HOA (Beth Brittingham to put educational information in their newsletter).
  - The Elgins News and West Wateree Chronicle
  - Target neighborhoods and apartments in urbanized areas to distribute educational material on FOG.
- Other social media methods, such as Facebook, Twitter, and the County's websites (for Kershaw, Richland and Fairfield) will be used for outreach to generate interest in the program.

- Advertisement by Counties Recycling Facilities and Midlands Biofuels regarding the new services for recycling used cooking oil. Facilities include:
  - Kershaw County: Elgin and Lugoff Centers
  - Richland County: Clemson’s Sandhills Research and Education Center and Blythewood Fire Station
  - Fairfield County: Ridgeway Recycling Center

Baseline information will be gathered in order to understand the level of knowledge of homeowners in the watershed relating to disposal of FOG. Kershaw County and its consultant will determine the best method of acquiring this baseline information regarding the knowledge, attitudes, and practice of homeowners in the watershed. Again, based on Palmetto Utilities services and problems, some targeted areas in the neighborhood have been determined. Once more baseline information is gathered, more focused research will be conducted.

Based on information obtained, a broader outreach effort will be conducted to all homeowners in the watershed. This will include the announcement of the distribution of the Promotional FOG Can Lids and the new services for recycling used cooking oil at various venues with good exposure to homeowners and businesses in the watershed.

### **7.1.3 Agricultural Sources – Livestock**

#### **7.1.3.1 Target Audience/Description**

**Target Audience:** Cattle/Horse Farms

**Description:** Agricultural property owners and operators within the watershed area are going to be targeted for outreach efforts. Figure 10 from Section 5.3 depicts the rural improved areas. Cattle/horse farms located in the floodplains of Twenty-five Mile Creek of the watershed will be the primary focus for BMP installation, although the program will be made available to any agricultural properties throughout the watershed. Many of the goals of the project (to reduce bacteria in the watershed) also meet some of the goals of the landowners (healthier animals and preserving the land for future generations). Lexington County, another 319 recipient in South Carolina, have found through their Hollow Creek 319 project that the biggest barriers to participation amongst farmers are a reluctance to change common practices they have performed for years, and resistance to perceived interference of their operations by government.

#### **7.1.3.2 Strategies/BMPs Needed**

Reduction of bacteria loading from agricultural land will be accomplished through cost share assistance on the installation of selected BMPs. The goal is to reduce livestock access to the streams, educate and assist farmers with manure management and stabilize soil. Because participation in the project is voluntary, and the landowners are traditionally somewhat skeptical of interference in their operations, effective outreach will be crucial in reaching the appropriate participants. In cooperation with NRCS and Soil Water Conservation Districts (SWCD) of Kershaw, Richland and Fairfield Counties, these outreach



efforts will strive to incorporate farms affected by improper livestock and/or farming practices into the project.

Kershaw County anticipates gaining the participation of and assisting approximately 20 total farms (livestock, poultry and crop farms) in the watershed through this project in years 1-5. This is approximately 30% of the 70 farms that has been estimated for the Twenty-five Mile Creek Watershed. Figure 10 and Appendix A show the 70 potential farms for targeting outreach for the agricultural component of this project. An aerial review of the watershed and selected farms with visible signs of animals (cattle, horses, animal feed operations, etc) was conducted. In addition to those targeted farms with animals, Kershaw County and its consultants AMEC also chose targeted crop farms after discovering crop farms that are actively participating in educational farm tours in the watershed, as detailed in the following Section 7.1.5.

Technical Service Providers (TSPs) will work through NRCS of Kershaw, Richland and Fairfield Counties, with the assistance of the SWCDs of the three counties, will work with the landowners to review their livestock operations, assess their resource concerns, develop Conservation Plans and recommend appropriate BMPs. Kershaw County staff and its consultant(s) will work with SWCDs of Kershaw, Richland and Fairfield Counties; NRCS of Kershaw, Richland and Fairfield Counties; and the landowners/operators to choose the appropriate BMPs and ensure they are installed and used correctly. An extensive set of BMPs can be used for different farm activities and resource conditions. Kershaw, Richland, and Fairfield County staff, consultants and project partners will consult the technical specifications and practice standards for applicable agricultural BMPs. The following BMPs will likely be used to filter or reduce the amount of animal waste entering Twenty-five Mile Creek and/or its tributaries, reference Table 12 for quantities proposed for the Plan:

1. Stream bank fencing will be installed to keep livestock out of floodplain.
2. Development of conservation and manure management plans for each participating farm.
3. Waste management/manure composting, particularly at horse farms.
4. Alternative water sources, such as groundwater wells and water troughs.
5. Soil stabilization of streambanks.
6. Vegetated buffers or setbacks will be planted along impacted stream beds.
7. Pasture Planting/Critical Area Stabilization.
8. Loafing sheds as an alternative to direct access to streams for livestock.
9. Cross fencing will be installed to promote rotational grazing.
10. Stream crossings may be installed to allow cattle to cross streams without loitering in them.

Estimated bacteria load reductions from proposed agricultural livestock BMPs for years 1 through 5 are displayed in Table 11 and is discussed in Section 8.2.

### **7.1.3.3 Management Plan for Agricultural Sources**

The following plan will be used to manage the agricultural portion of the project. All three agricultural sources addressed in this proposal (livestock, poultry, and cropland), which are further detailed in the following two pollution source sections, will be addressed with this management strategy:

1. Project Management: Kershaw County, Richland County and Fairfield County, with the support of a project partners, will furnish project technical support, create and provide outreach and educational campaign/materials and Kershaw County will provide overall project coordination. Each County will act as the lead entity for all advocacy activities to their respective County by working directly with their local agricultural and conservation agency partners throughout the outreach and implementation portions of this project.
2. Recruitment of Landowners: Kershaw, Richland and Fairfield Counties will coordinate efforts to recruit farmers in each County. Each County plans to get out into the community (e.g. public meetings, churches, fire departments, community centers, local activities) to elicit support from farming participants. Each County will combine direct communication with potential participants with local advertising (e.g. local network, flyer distribution, mailings) to recruit participants. Meetings will be conducted in the watershed to inform farmers about the Project as well as providing support and insight into other educational campaign messages and outreach techniques. The Counties plan to use success stories from Lexington County with their 319 Hollow Creek project, such as the farmers' endorsement in the Hollow Creek Farm Tour video ([http://www.youtube.com/watch?v=GpsZ2\\_sV8Rc](http://www.youtube.com/watch?v=GpsZ2_sV8Rc)), as an additional recruiting tool.
3. Prioritization of Sites: All landowners in the watershed who meet the criteria of needing agricultural BMPs will be recruited, despite their location in the watershed. However, with respect to prioritization, those farms in the floodplain of Twenty-five Mile Creek will be addressed first (farms based on Figure 10), and, if necessary, those outside of the floodplain will be addressed next.
  - Horse Farms close to the impaired WQMS CW-080
  - Long Creek Plantation Equine Center in Richland County: LCEC expressed interest in participating in Agricultural BMPs (such as Horse Manure Composting) if an implementation grant was awarded.
  - Farms with many livestock (25+ animals)
4. Development of Conservation Plans and Implementation: TSPs with the NRCS offices, assisted by the SWCDs, will have primary responsibility for helping the landowners develop conservation plans. Kershaw County will administer the 319 grant cost-share fund distribution to land users who successfully complete the installation of BMPs which support the project objectives. NRCS, assisted by SWCDs, will have primary responsibility for ensuring the technical integrity of all planned and installed BMPs. Kershaw County, assisted by its consultant(s) and the SWCDs, will have primary responsibility for developing and distributing the project message and educational campaign.

#### **7.1.3.4 Outreach Needed**

Kershaw County will use the same outreach plan to manage all three of the agricultural portions of the project, which are further detailed in the following two pollution source sections. Because participation in the project is voluntary, effective outreach will be crucial in the success of this project. It is fortunate

that the goal of the project (to reduce bacteria in the watershed) can be achieved by the same actions that meet some of the goals of the landowners (healthier animals and preserving the land for future generations).

SWCDs and NRCSs are familiar with farmers in the area and know the best locations and means to promote the program. Using the experience of SWCDs and NRCSs, targeted outreach efforts will be employed such as one-on-one interviews with local farmers and visits to individual farms. Kershaw County will use Lexington County's lessons learned from the outreach efforts from their Hollow Creek 319 grant project, such as recruiting participants to reach out to their neighbors and requesting to participate in already planned local community events, (church group meetings or volunteer fire department gatherings) instead of scheduling additional public meetings. Listening sessions at regularly scheduled meetings in the community could be the main outreach method utilized. This will allow the Counties to change its approach based on the types of farms and feedback. For example the barriers to change for poultry farmers may be different from the barriers to change for cattle farmers. Presentation of Lexington County's 319 Hollow Creek video during the listening sessions will educate farmers about bacteria loading of the watershed, best management practices that could reduce bacteria from agriculture related enterprises and demonstrate the benefits other Lexington County farmers saw through the program. The Farm Tour video which was also created for Lexington County's Hollow Creek 319 grant will also be used during these listening sessions and local festivals to recruit participants in this project.

After information is gained through the listening sessions, a broader outreach plan will begin. Other social media methods, such as Facebook, County websites (Kershaw, Richland and Fairfield), and Twitter, will be used for outreach for the project. Once interest has been generated in the program, Counties' respective NRCS will conduct site visits to further encourage farmers to voluntarily participate in the project and assist them in developing conservation plans. Site visits can include C.Ray Miles Farm in Kershaw County and the South Carolina Equine Park in Camden of Kershaw County. The C.Ray Miles Farm received a 319 grant installed agricultural BMPs. Kershaw County was awarded a 319 grant for the South Carolina Equine Park to perform a horse manure composting demonstration project.

## **7.1.4 Agricultural Sources – Poultry**

### **7.1.4.1 Target Audience/Description**

**Target Audience:** Poultry Farms

**Description:** The educational goals and proposed BMPs for this project are going to focus on the litter that is maintained at facilities for personal use (i.e. field application for feed crops). The BMPs will assist with upgrading and modernizing facilities and practices to meet both operational goals and Waste Management Plan requirements, which will also meet the program's goals of reducing bacteria loading from poultry operations.

Poultry owners and operators within the watershed area are going to be targeted for outreach efforts. Figure 10 depicts the rural improved areas. The poultry farm located in Kershaw County of the

watershed will be the primary focus for BMP installation, although the program will be made available to any agricultural properties throughout the watershed.

#### **7.1.4.2 Strategies/BMPs Needed**

Reduction of bacteria loading from agricultural land will be accomplished through a social marketing strategy and cost share assistance on the installation of selected BMPs. The goal of these BMPs for poultry farmers is to educate and assist farmers with proper methods for litter management by upgrading existing control measures of all the poultry operators and for the operator to install a litter composter. See below for examples of small- and large-scale composters.



**Figure 14. Example of Small Composter for Waste Management (Photo Source: O2Compost)**



**Figure 15. Example of Large Composter for Waste Management**

NRCSs, with the assistance of the SWCDs, will work with the landowners to review their operations, assess their resource concerns, review Waste Management Plans, develop Conservation Plans, as needed, and recommend appropriate BMPs. Kershaw County staff and its consultant(s) will work with SWCDs of Kershaw, Richland and Fairfield Counties; NRCS of Kershaw, Richland and Fairfield Counties; and the landowners/operators to choose the appropriate BMPs and ensure they are installed and used correctly.

The following BMPs will be recommended to filter or reduce the amount of poultry waste entering Twenty-five Mile Creek and/or its tributaries:

- Waste storage /coverage for litter removed from houses (such as stacking sheds or improved covering materials),
- Conservation and waste management plans for each participating farm,

- Waste composting. The goal of this project is to have at least one facility install a medium-sized litter composter. A small and large composter shown in the Figures above are also being used as part of the SC Equine Park 319 project in Kershaw County to reduce bacteria runoff from horse manure. The composted litter will provide the same nutrient benefit for field application but will have reduced bacteria and other pathogens.

Estimated bacteria load reductions from proposed agricultural poultry BMPs for years 1 through 5 are displayed in Table 11 and is discussed in Section 8.2.

### ***7.1.4.3 Management Plan for Agricultural Sources***

The management strategies and recruiting process outlined in the livestock agricultural portion above (Section 7.1.3.3) will be expanded to poultry farms as well, but the targeted audience will be adjusted.

### ***7.1.4.4 Outreach Needed***

The outreach strategy outlined in the livestock agricultural portion above (Section 7.1.3.4) will be expanded to poultry farms as well with additional advertising targeted specifically to poultry farms.

## ***7.1.5 Agricultural Sources – Cropland***

### ***7.1.5.1 Target Audience/Description***

**Target Audience:** Crop farms

**Description:** All farm owners and operators within the watershed area are going to be targeted for outreach efforts. Figure 10 depicts the rural improved areas. Croplands located in the floodplains of Twenty-five Mile Creek, along with three crop farms described below will be the primary focus for BMP installation, although the program will be made available to any agricultural properties throughout the watershed.

### ***7.1.5.2 Strategies/BMPs Needed***

The strategies and BMPs that will be used for croplands will be very similar to those used for other agricultural sources since the main bacteria loading source addressed will also be runoff, but from fertilization and harvesting practices as opposed to livestock. The goal for crop farmers is to educate and assist farmers with proper methods for fertilizer management, such as disking in turkey litter.

Each County's respective NRCS, with the assistance of their corresponding SWCD, will work with the landowners to review their operations, assess their resource concerns, and develop Conservation Plans and recommend appropriate BMPs. Kershaw County staff and its consultant(s) will work with SWCDs of Kershaw, Richland and Fairfield Counties; NRCS of Kershaw, Richland and Fairfield Counties; and the landowners/operators to choose the appropriate BMPs and ensure they are installed and used correctly.

The following BMPs will likely be used for croplands: soil stabilization, streambank stabilization, development of manure management plans for each participating farm, waste management/manure

composting, vegetated buffers or setbacks will be planted along impacted stream beds, and critical area stabilization.

Estimated bacteria load reductions from proposed agricultural cropland BMPs for years 1 through 5 are displayed in Table 11 and is discussed in Section 8.2.

### **7.1.5.3 Project Management for Agricultural Sources**

The management strategies and recruiting process outlined in the livestock agricultural portion above (Section 7.1.3.3) will be expanded to crop farms as well. As mentioned prior, agricultural lands located within, or close proximity, to Twenty-five Mile Creek's floodplain will be the primary focus for recruitment of BMP installation. Although, the program will be made available to any agricultural properties throughout the watershed. Other farms within the watershed that will be targeted as well include the crop farms listed below. These three farms participated in the 1<sup>st</sup> Annual Midlands Farm Tour on April 6-7, 2013. These farms within the watershed are actively participating in organic and sustainable agricultural practices and, therefore, may be willing to participate in this Plan.

1. Crooked Cedar Farm (91464 Lawhorn Road, Blythewood, South Carolina):  
Crooked Cedar Farm is a small family-run farm that uses organic practices to grow a variety of seasonal vegetables and perennial plants and flowers. The farm also has free-range chickens.
2. Paradise Acres Farm (374 Getts Road, Elgin, South Carolina):  
Paradise farms have free-range chickens and turkeys, goats, fruit orchards, and raised bed vegetable gardens.
3. Will-Moore Farms (1916 Three Branches Road, Lugoff, South Carolina):  
Wil-Moore Farms is a family farm where all of the animals are raised on a certified organic pasture. Along with cattle, Wil-Moore Farms have Tamworth hogs.

### **7.1.5.4 Outreach Needed**

The outreach strategy outlined in the agricultural - livestock portion above in Section 7.1.3.4 will be expanded to crop farms as well with additional advertising targeted specifically to croplands. Kershaw County and its consultant(s) will further refine the outreach message and strategy (i.e. workshops conducted at the farm, educational flyers) based on their feedback.

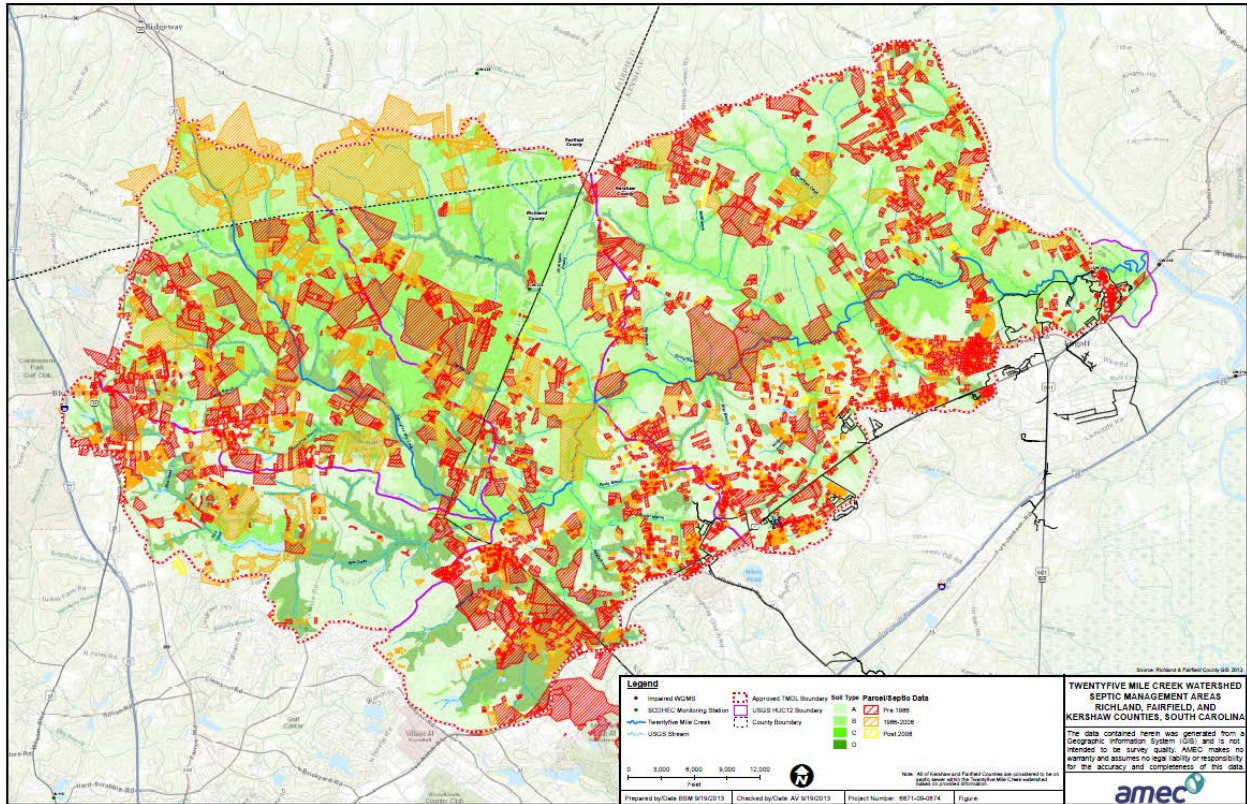
## **7.1.6 Septic Sources**

### **7.1.6.1 Target Audience/Description**

**Target Audience:** Property owners with failing septic systems

**Description:** All homeowners and businesses whose septic system is in need of repair and/or replacement within the watershed area will be targeted for outreach efforts, though homes located within the MS4 boundaries will be evaluated on a case-by-case basis for qualification for 319 funds. The

more rural northern portion of the watershed will be targeted first, with the help of using targeted areas deciphered from Figure 16 and Table 9 below for the initial outreach efforts. Kershaw, Richland and Fairfield County will reach out to Homeowner Associations, civic groups and the local chamber of commerce to spread the message to more property owners.



**Figure 16. Twenty-five Mile Creek Watershed Septic Management Areas for Richland, Fairfield and Kershaw Counties<sup>13</sup>**

An estimated 6,062 septic systems are in the Twenty-five Mile Creek Watershed. From this, parcels with septic were analyzed based on its Hydrologic Soil Group and the date the building was constructed. Dates categories include buildings with septic before 1986, between 1986-2008 and after 2008. Septic regulations and upgrades were made after 2008, therefore septic failures are most likely occurring on C & D soils and areas where septic systems were built before 2008. Of the 600 systems before 1986 and the 486 systems between 1986-2008; it is estimated that a total of 350 septic systems are failing in the Twenty-five Mile Creek Watershed.

<sup>13</sup> See Appendix A for larger figure

**Table 9. Estimated number of septic tanks in the Twenty-five Mile Creek Watershed**

<b>County</b>	<b>Number of Septic Tanks</b>	<b>Septic Systems on C &amp; D Soils before 1986</b>	<b>Septic Systems on C &amp; D Soils between 1986-2008</b>
Kershaw County	3,873	205	110
Richland County	2,018	378	376
Fairfield County	171	17	-
<b>Total</b>	<b>6,062</b>	<b>600</b>	<b>486</b>

**7.1.6.2 Strategies/BMPs Needed**

Counties will work with experienced SCDHEC personnel, local organizations, and septic tank contractors to target historic problem systems and problem areas. Based on septic information gathered, areas to target will include parcels with septic on poor infiltrated soils (HGS C and D) and parcels with old building dates, see Figure 16 and Table 9 above. As well, parcels with septic within the floodplains of Twenty-five Mile Creek will be prioritized for recruitment. Lexington County developed a process as part of the Hollow Creek 319 project, for identifying problem systems, informing and approving participants, properly documenting costs and reimbursements, and screening and contracting with local septic tank contractors that can be of use for Kershaw, Richland and Fairfield Counties to adopt for this project.

In addition, if failing septic systems are believed to be a continuing issue within the Twenty-five Mile Creek Watershed, Kershaw County will consider developing an Acceptable Septic System Letter to be applied County-wide at the time of a sale of a house (similar to a Termite letter).

Estimated bacteria load reductions from proposed septic BMPs for years 1 through 5 are displayed in Table 11 and are discussed in Section 8.2.

**7.1.6.3 Project Management for Septic Sources**

1. Project Management: Kershaw County, Richland County and Fairfield County, with the support of project partners, will complete all reporting requirements, conduct procurement activities, coordinate with SCDHEC and local septic providers for project technical support, create and provide outreach and educational campaign/materials and Kershaw County will provide overall project coordination. Each County will act as the lead entity for all advocacy activities to their respective County by working directly with the local community throughout the outreach and implementation portions of this project.
2. Prioritization of Sites: All landowners in the watershed who meet the criteria of needing septic repairs will be recruited, despite their location in the watershed. However, with respect to prioritization, those property owners in the floodplain of Twenty-five Mile Creek will be addressed first, as will areas that may be prone to septic failures due to poor soil infiltration and age of septic tank (based on Figure 16 and Table 9). As part of the screening process for potential participants, the location of the septic system and where it drains will be considered compared to MS4 boundaries since systems which drain to the MS4 will not be included if a 319 Implementation



Project is granted, but instead will be addressed by the MS4s' Illicit Discharge Detection and Elimination (IDDE) program.

3. Determination of Repair: The SCDHEC will assist the respective County with assessing septic problems. Routine maintenance (i.e. pump outs) is not included as part of this project. If awarded a 319 Implementation Grant, 319 funding will be used for repairs, replacements, or connection to sewer depending on the nature of the problem and location of the system.

#### **7.1.6.4 Outreach Needed**

Many septic problems and leaks are due to lack of or poor maintenance of the septic system. Outreach and education, including distribution of the SCDHEC septic maintenance folders, septic "reminder" magnets, and other items listed below (i.e. 'Future Outreach') will be used to address this problem and encourage septic owners to improve maintenance.

Current Outreach:

- Kershaw County MS4 SWMP: The program distributes SCDHEC's "Septic System Maintenance" information at their municipal buildings in the MS4 and local fairs and events.
- Richland County MS4 SWMP: Richland's SWMP distributes a postcard-style handout on septic systems. Richland County's SWMP is looking to expand this program in the upcoming year by working with septic tank service businesses.

Future Outreach:

The reduction of bacteria in the watershed through repair and replacement of failing septic systems also benefits homeowners through the elimination of odor problems, health issues, and increase in property values. The following outreach measures will be performed:

Recruitment of Property Owners with Failing Septic: Marketing materials (e.g. flyers, presentations at community meetings, video from Lexington County's 319 Hollow Creek project which includes endorsements from septic owners who participated, and word-of-mouth will be used to reach out to the local community to inform septic system owners about the Project as well as providing support and insight into educational campaign messages and outreach techniques.

- Conduct surveys, make presentations at community meetings, and/or listening sessions within the watershed to advertise the project and recruit homeowners for participation.
- Identify Homeowner Associations, civic organizations and local chambers of commerce in the watershed to spread the message to more property owners.
- Evaluate septic pump-out records obtained from local licensed contractors.

- Work with experienced SCDHEC personnel, local organizations, and septic tank contractors to target historic problem systems and problem areas.
- Tailor available outreach tools (e.g. flyers & video developed for Hollow Creek Water Quality Improvement Project which included homeowner endorsements of the septic program) for Twenty-five Mile Creek audience.
- Other social media methods, such as Facebook, Kershaw, Richland and Fairfield County websites, and Twitter will be used for outreach to generate interest in the Project.
- Distribution of SCDHEC’s “Septic System Maintenance” information and septic system management magnets (to provide homeowners guidance for when it is a good time to have their septic system cleaned out).

Baseline information will be gathered in order to understand the level of knowledge of homeowners in the watershed relating to septic tank maintenance and repairs. Kershaw County will work with its consultant(s) to determine the best method of acquiring this baseline information regarding the knowledge, attitudes, and practice of homeowners in the watershed. Once the baseline information is gathered, Counties will conduct more focused research through interviews at local community centers/churches and businesses located in the watershed.

Based on information obtained, a broader outreach effort will be conducted to all homeowners in the watershed. This will include the announcement of the cost share program at various venues with good exposure to homeowners residing in the watershed. It is anticipated that local non-profit organizations and septic tank contractors will assist with outreach efforts. The respective County and their staff will conduct site visits and interviews with homeowners to encourage participation in the cost share program and promote responsible septic tank maintenance practices. All individuals receiving assistance will be educated on proper septic tank maintenance. Follow up surveys will be conducted with homeowners in the last year of the program to determine if there has been a change in their attitudes, knowledge, and future maintenance plans regarding their septic systems.

### **7.1.7 Wildlife Sources**

#### **7.1.7.1 Target Audience/Description**

**Target Audience:** Landowners and hunters in and around the watershed

**Description:** Wildlife loading is dependent on herd types and densities can vary seasonally, and can decline due to changes in land use (i.e. more built-up lands, less agriculture and open/pasture space). Therefore it is difficult to implement measures to control/monitor wildlife (such as deer and hogs) that will always tend to migrate and hangout near water. However, based on AMEC’s experience in other SCDHEC 319 Projects, one target audience is deer hunters that are depositing dead carcasses directly into streams of the Twenty-five Mile Creek Watershed.

### **7.1.7.2 Strategies/BMPs Needed**

The reduction of bacteria loading from wildlife on forested land will mostly be accomplished through educating hunters to encourage proper disposal of carcasses. Estimated bacteria load reductions from proposed wildlife BMPs for years 1 through 5 are displayed in Table 11 and is discussed in Section 8.2.

- **Fine Signs:** Throwing carcasses in the creek or a ditch on the backside of the property has never been legal, and it is absolutely unacceptable. Illegal dumping of carcasses with associated fines will be posted on signs throughout the watershed. These signs will be installed at bridge crossings within the watershed where potential illegal dumping is occurring.
- **Bridge Crossing Cameras:** Two surveillance bridge crossing cameras will be installed (and rotated to varying bridge crossings) in the watershed to catch those who illegally dump carcasses in streams.
- **Constructed Disposal Pits** if needed anywhere, such as hunt clubs in watershed.

### **7.1.7.3 Management for Wildlife Sources**

1. **Project Management:** Kershaw County, Richland County and Farfield County, with the support of project partners, will complete all reporting requirements, conduct procurement activities, coordinate with SCDNR for project technical support, create and provide outreach and educational campaign/materials and provide overall project coordination. Each County will act as the lead entity for all advocacy activities to their respective County by working directly with the local community throughout the outreach and implementation portions of this project.
2. **Prioritization of Sites:** All hunters in and around the watershed will be targeted for educational outreach and participation in workshops on proper disposal of game and fish carcasses. This audience will also be made aware of the fines enforced for those who illegally dispose of carcasses in any stream in the watershed. As for prioritization of sites, installation of signs and surveillance cameras will be addressed first on Twenty-five Mile Creek bridge crosses as well as Bear Creek bridge crosses (near CW-229) where many carcasses were found instream. If necessary, other tributaries (such as ones near hunt clubs) will be addressed next.

### **7.1.7.4 Outreach Needed**

Effective outreach will be crucial in the success of this project. The goal of the project (to reduce bacteria in the watershed) can be achieved while meeting the goals of the landowners and hunters (to encourage wildlife to inhabit their land). All of these goals can be achieved by educating hunters on the benefits of proper disposal of game and fish carcasses.

#### Current Outreach

- Kershaw County MS4 SWMP: Stormwater Minute relating to proper disposal of game and fish carcasses was posted in the municipal buildings of the Kershaw County and Town of Elgin MS4.

- Richland County MS4 SWMP: Carolina Clear’s educational website article on ‘The Resident Canada Goose in South Carolina’.

### Future Outreach

#### Recruitment of Hunters:

- Marketing materials (e.g. flyers, local newspapers, presentations at community meetings, social media, etc.), attend current hunter workshops (such as Kershaw Conservation District’s Coyote and Feral Hog Workshop), and word-of-mouth will be used to reach out to the local community to inform hunters about the Plan as well as providing support and insight into educational campaign messages and outreach techniques (such as participation in Hunter Workshops, see below).

#### Public Education:

- Conduct Hunter Workshops on proper disposal of game and fish carcasses
- Brochures on proper disposal of game and fish carcasses
- Partner with SCDNR on creating and sharing educational material
- Give options for proper disposal of carcasses

Surveys and interviews with local hunters will be used to determine the level of knowledge of how improved hunting practices affect water quality. Interviews with the presidents of local hunting clubs, Lugoff Masonite Lodge, etc. will be conducted in order to gauge the level of interest in hunters on water quality issues and identify barriers to changing current hunting practices. Based on the information gathered through the surveys and interviews with hunters, Kershaw County staff, with the help of its partners and its consultants, will be able to develop an outreach program that would be most effective in encouraging hunters to change their behaviors. Counties will continue with their efforts to incorporate water quality education with the SC Department of Natural Resources (SCDNR) game management and hunter education programs using the information gathered in the surveys and interviews.

### **7.1.8 Point Sources**

Active and inactive NPDES point source facilities mentioned in Section 5.6.1 are all being regulated by SCDHEC and monitored regularly to meet compliance; and therefore will not be addressed in this Plan.

### **7.1.9 Future Protection Strategies**

#### **7.1.10 Develop a Twenty-five Mile Creek Workgroup to oversee Plan Implementation**

The Stakeholders involved with the creation of this Plan have become the foundation of the Twenty-five Mile Creek workgroup.

- The Leaders for this group include Kershaw County and its consultants, Richland County, Fairfield County, the Town of Elgin, Town of Lugoff and the Town of Blythewood.

- List of additional stakeholders by source
  - Urban: Carolina Clear, Central Midlands COG, Santee Lynches COG, SCRWA
  - Sewer: Kershaw, Richland and Fairfield’s Public Health (SCDHEC), Palmetto Utilities
  - Agricultural: Kershaw, Richland and Fairfield’s NRCSs and SWCDs
  - Septic: Kershaw, Richland and Fairfield’s Public Health (SCDHEC)
  - Wildlife: SCDNR, Kershaw, Richland and Fairfield’s SWCDs

## **7.2 Milestones**

Twenty-five Mile Creek does not currently meet State water quality standards due to recreational use impairments. The goal of this plan is for Twenty-five Mile Creek to meet State water quality standards by 2029 (15 years from 2014).

It is proposed that this goal can be accomplished by implementing various structural and nonstructural BMPs to reduce the bacteria loadings to Twenty-five Mile Creek.

Since it may take fifteen years for Twenty-five Mile Creek to meet State water quality standards, interim milestones may be tracked to measure progress on Plan implementation. Interim and long term measurable milestones are outlined in Table 10 below.

**Table 10. Twenty-five Mile Creek Bacteria WBP Measurable Milestones**

Years 1 to 5	
Action	Percent Complete
Secure funding adequate to complete restoration priorities identified in this Plan	30
Urban Sources:	30
Install 15 pet waste stations	
Install 10 rain barrels	
Install 10 rain gardens	
Install 2000 storm drain markers	
Outreach and Education	
Sewer Sources	30
Distribute 2000 promotional FOG can lids	
Recycle Used Cooking Oil: Midlands Biofuels	
Outreach and Education	
Agricultural Sources:	30
20 of 70 farms participate in structural and nonstructural BMPs	
Outreach and Education	
Septic Sources:	15
40 Septic Tank Repairs	
10 Sewer Connections	
Outreach and Education	
Wildlife Sources:	100
Install 2 bridge crossing cameras	
Install 30 bridge crossing signs	
Outreach and Education	
Biannual meetings with Twenty-five Mile Creek Workgroup	30
Update Councils within the watershed annually	30
Update County and Town websites quarterly	30
Update/Email stakeholders quarterly	30
Years 6 to 10	
Action	Percent Complete
Secure funding adequate to complete restoration priorities identified in this Plan	60
Urban Sources:	60
Install 15 pet waste stations	
Install 10 rain barrels	
Install 10 rain gardens	
Install 2000 storm drain markers	
Outreach and Education	
Sewer Sources	60
Distribute 2000 promotional FOG can lids	
Outreach and Education	
Agricultural Sources:	60
Additional 25 farms, totaling 45 of 70 farms participate in structural and nonstructural BMPs	
Outreach and Education	
Septic Sources:	57
100 Septic Tank Repairs	
50 Sewer Connections	
Outreach and Education	
Biannual meetings with Twenty-five Mile Creek Workgroup	60
Update Councils within the watershed annually	60
Update County and Town websites quarterly	60
Update/Email stakeholders quarterly	60
Years 11 to 15	
Action	Percent Complete
Secure funding adequate to complete restoration priorities identified in this Plan	100
Urban Sources:	100
Install 15 pet waste stations	
Install 10 rain barrels	
Install 10 rain gardens	
Install 2000 storm drain markers	
Outreach and Education	
Sewer Sources	100
Distribute 2000 promotional FOG can lids	
Outreach and Education	
Agricultural Sources:	100
Additional 25 farms, totaling 70 of 70 farms participate in structural and nonstructural BMPs	
Outreach and Education	
Septic Sources:	100
100 Septic Tank Repairs	
50 Sewer Connections	
Outreach and Education	
Biannual meetings with Twenty-five Mile Creek Workgroup	100
Update Councils within the watershed annually	100
Update County and Town websites quarterly	100
Update/Email stakeholders quarterly	100

**Table 11. Estimated bacteria load reductions to Twenty-five Mile Creek Watershed from proposed BMPs during years 1-5**

Loading Source	BMPs	% of Existing Loading	Existing Loading (cfu/day)*	Comments	Estimated % of participants	% of Load Removed by BMPs	% of total fecal from loading source removed	Estimated Loading Removed (cfu/day)
Urban Sources	*Total loading	2	1.04E+11					
	Pet waste stations	1	1.04E+09	Assume 50% the participants at dog parks will pick up and properly dispose pet waste in the stations	50%	95%	48%	4.92E+08
	Pet Waste Education	0.5	5.18E+08		10%	50%	5%	2.59E+07
	Rain barrels, rain gardens, storm drain markers, etc.	0.5	5.18E+08		2%	25%	1%	2.50E-03
Sanitary Sewer Overflows and Sewer Leaks	*Total loading	4	2.07E+11					
	Used Oil Recycling & FOG Promotional Can Lids			FOG blockages account for a total of 50 to 75% of all SSO's. <sup>1</sup> Assume 25% reduction of FOG to sanitary sewer resulting from program; Therefore, assume reduction in SSOs is 25% x 50%; Assume 100% of loading from SSOs to watershed;	12.5%	98%	12%	2.54E+10
Agricultural - Cattle & Poultry	*Total loading	85	4.40E+12					
	Fencing, alternate water locations, manure composting, etc.	80	3.52E+12	20 farms participate of 70 total farms in watershed; ~30% participation	30%	90%	27%	9.51E+11
Agricultural - Croplands	Manure management, soil stabilization	5	2.20E+11	Assume 20% of current farms participate	20%	80%	27%	5.94E+10
Septic Failures	*Total loading	5	2.59E+11					
	Septic Repairs/ Replacement	4	1.04E+10	Approximately 6,000 septic systems in watershed; Estimated septic systems failing = 350 systems; Assume 100% of loading from failing systems to watershed; 50 septic systems participate (40 septic repairs/10 sewer connections) ~ 14% of failing systems	14.0%	98%	14%	1.42E+09
	Septic Maintenance Education	1	2.59E+09	Assume 80% of failing septic system are due to maintenance issues; Assume education program will be 50% effective	80%	50%	40%	1.04E+09
Wildlife	*Total loading	4	2.07E+11					
	Bridge crossing cameras and signs, hunter workshops			Assume outreach will convince 30% of the hunters in the watershed will cease dumping carcasses in creeks	30%	98%	29%	6.09E+10
<b>TOTAL Reduction from Proposed BMPs</b>								<b>1.10E+12</b>

\*Existing Total Loading are based on TMDL calculations, not current conditions, unless noted otherwise

<sup>1</sup>NC State University's Fats, Roots, Oils, and Grease (FROG) in Our Centralized and Decentralized Sanitary Sewers. <http://www.ce.ncsu.edu/research/frog/>

**Table 12. Estimated Bacteria Project Costs During Years 1-5**

		Quantity	Single Cost	Total Price
Urban: Construction	Pet Waste Stations	15	\$ 125.00	\$ 1,875.00
	Rain Barrels	10	\$ 75.00	\$ 750.00
	Rain Gardens, Sq Ft	2,000	\$ 12.00	\$ 24,000.00
	Stream Stabilization Stratton Hall, Ln Ft	2,700	\$ 104.18	\$ 281,286.00
	Urban Riparian Planting, acres	72	\$ 6,180.00	\$ 444,960.00
Urban: Supplies	Pet Waste Bags			\$ 350.00
	Storm Drain Markers	2000	\$ 5.00	\$ 10,000.00
SSOs from FOG	Promotional FOG Can Lids	2000	\$ 1.00	\$ 2,000.00
	Midlands Biofuels	15	\$ -	\$ -
Agricultural: Construction	Stacking Shed at AFOs, Sq Ft	3,000	\$ 4.70	\$ 14,100.00
	Water Well	20	\$ 5,860.96	\$ 117,219.20
	Watering Facility	40	\$ 699.17	\$ 27,966.80
	Pipeline, Ln Ft	10,000	\$ 3.49	\$ 34,900.00
	Heavy Use Area Protection, Sq Ft	34,000	\$ 4.64	\$ 157,760.00
	Fencing, Ln Ft	36,000	\$ 2.45	\$ 88,200.00
	Mini Manure Composting Facility, Unit	20	\$ 2,000.00	\$ 40,000.00
	Large Manure Composting Facility, Unit	1	\$ 30,000.00	\$ 30,000.00
	Stream Crossing, Unit	2	\$ 4,000.00	\$ 8,000.00
	Pasture and Hayland Planting, Acres	200	\$ 286.52	\$ 57,304.00
	Loafing Shed, Sq Ft	44,000	\$ 3.78	\$ 166,320.00
	Conservation Plan	20	\$ 2,000.00	\$ 40,000.00
Septic: Construction	Septic Repairs	40	\$ 3,600.00	\$ 144,000.00
	Sewer Connection	10	\$ 15,000.00	\$ 150,000.00
Wildlife	Bridge Crossing Signs	30	\$ 90.00	\$ 2,700.00
	Bridge Crossing Cameras	2	\$ 3,600.00	\$ 7,200.00
	Hunter Workshops	3	\$ 1,000.00	\$ 3,000.00
Outreach and Education: Supplies	Postage			\$3,300.00
	Brochures & Copies			\$2,000.00
	Door Hangers/Flyers			\$500.00
	Newspaper Advertisement			\$1,500.00
	Supplies for Meetings			\$1,000.00
	Educational Videos			\$6,000.00
Promotional Items (such as septic magnets)			\$1,000.00	
Monitoring	Laboratory Analysis, per sample	140	\$ 45.00	\$6,300.00
	Petrifilm Sampling, per sample	500	\$ 2.00	\$1,000.00
	Petrifilm Equipment			\$1,000.00
Contracted Services	Project Management, Oversight and Reporting			\$100,000.00
			<b>Total</b>	<b>\$ 1,977,491.00</b>



**Table 13. Twenty-five Mile Creek Watershed Action Plan**

Action Item	Priority	Responsible Party							Funding/Labor Source					Cost Estimate	
		Kershaw County	Kershaw NRCS and SWCD	Richland County	Richland NRCS and SWCD	Fairfield County	Fairfield NRCS and SWCD	SC DHEC Public Health	SC DNR	SC DHEC	NRCS Cost Sharing	Other Grants or partners	Municipal		Landowner
<b>Urban Sources</b>															<b>\$763,221.00</b>
1. BMPs															
a. Pet Waste Stations	H	X	X	X	X			X			X				
c. Rain Barrels	L	X	X	X	X			X			X	X	X		
d. Storm Drain Markers	H	X	X	X	X			X			X				
e. Stratton Hall Stream Stabilization															
f. Urban Riparian Planting	H	X						X		X	X	X	X		
g. Rain Gardens	L	X	X	X	X			X			X	X	X		
2. Outreach and Education															
a. Pet Waste Education Materials	H	X	X	X	X			X			X				
b. Urban Runoff Education Materials	H	X	X	X	X			X			X				
c. Presentation to HOAs and Schools on SW Runoff	M	X	X	X	X			X			X				
d. Local Events and Meetings	M	X	X	X	X			X			X				
e. Rain Barrel Education Materials	L	X	X	X	X			X			X				
f. Rain Garden Education Materials	L	X	X	X	X			X			X				
<b>Sanitary Sewer Overflows from FOG</b>															<b>\$2,000.00</b>
1. BMPs															
a. Promotional FOG Can Lids	H	X	X	X	X			X			X				
b. Midlands Biofuels Used Cooking Oil Containers	H	X	X	X	X					X					
c. Restaurant Grease Trap Inspection/Enforcement	L	X	X	X	X		X				X				
2. Outreach and Education															
a. FOG Educational Materials	H	X	X	X	X			X			X				
b. Presentations to HOAs (w/ Palmetto Utilities)	M	X	X	X	X			X			X				
c. Local Events and Meetings	M	X	X	X	X			X			X				
<b>Agricultural Sources</b>															<b>\$781,770.00</b>
1. Livestock BMPs															
a. Stream bank fencing	H	X	X	X	X	X	X	X	X	X	X	X	X	X	
b. Conservation and Manure Management Plans	H	X	X	X	X	X	X	X	X	X	X	X	X	X	
c. Waste Management/Manure Composting	H	X	X	X	X	X	X	X	X	X	X	X	X	X	
d. Alternative Water Sources (GW Wells and Water Troughs)	H	X	X	X	X	X	X	X	X	X	X	X	X	X	
e. Vegetated buffers or setbacks	H	X	X	X	X	X	X	X	X	X	X	X	X	X	
f. Pasture Planting/Critical Area Stabilization	H	X	X	X	X	X	X	X	X	X	X	X	X	X	
g. Loafing Sheds	H	X	X	X	X	X	X	X	X	X	X	X	X	X	
h. Cross fencing	H	X	X	X	X	X	X	X	X	X	X	X	X	X	
i. Stream crossings	H	X	X	X	X	X	X	X	X	X	X	X	X	X	
2. Poultry BMPs															
a. Waste Storage/Coverage for Litter	M	X	X	X	X	X	X	X	X	X	X	X	X	X	
b. Conservation and Manure Management Plans	M	X	X	X	X	X	X	X	X	X	X	X	X	X	
c. Waste Management/Manure Composting	M	X	X	X	X	X	X	X	X	X	X	X	X	X	
3. Crop Farm BMPs															
b. Conservation and Manure Management Plans	H	X	X	X	X	X	X	X	X	X	X	X	X	X	
c. Waste Management/Manure Composting	H	X	X	X	X	X	X	X	X	X	X	X	X	X	
e. Soil Stabilization of streambanks	H	X	X	X	X	X	X	X	X	X	X	X	X	X	
g. Pasture Planting/Critical Area Stabilization	H	X	X	X	X	X	X	X	X	X	X	X	X	X	
4. Outreach and Education															
a. Agricultural Educational Materials for Farmers	H	X	X	X	X	X	X	X			X				
b. Create Video for Participants (similar to Hollow Creek)	H	X	X	X	X	X	X	X			X				
c. Local Events and Meetings	M	X	X	X	X	X	X	X			X				
<b>Septic Sources</b>															<b>\$294,000.00</b>
1. BMPs															
a. Repair Failing Septic Systems	H	X	X	X	X	X	X	X			X	X	X		
b. Septic Tank Inspections and Pumpouts	H	X	X	X	X	X	X	X			X				
2. Outreach and Education															
a. Septic Tank Educational Materials	H	X	X	X	X	X	X	X			X				
b. Create Video for Participants (similar to Hollow Creek)	H	X	X	X	X	X	X	X			X				
c. Local Events and Meetings	M	X	X	X	X	X	X	X			X				
<b>Wildlife Sources</b>															<b>\$12,900.00</b>
1. BMPs															
a. Bridge Crossing Signs (Fines)	H	X	X	X	X	X	X	X	X		X				
b. Bridge Crossing Cameras	H	X	X	X	X	X	X	X	X		X				
2. Outreach and Education															
a. Hunter Workshops	H	X	X	X	X	X	X	X	X		X				
b. Hunter Educational Materials	M	X	X	X	X	X	X	X	X		X				
c. Local Events and Meetings	M	X	X	X	X	X	X	X	X		X				
* Note: Educational Materials will include handouts , websites, social media, etc.															
<b>TOTAL BMP Costs</b>												<b>\$1,853,891.00</b>			
<b>Outreach and Education Supplies</b>												<b>\$15,300.00</b>			
<b>Monitoring Costs</b>												<b>\$8,300.00</b>			
<b>Contracted Services Costs</b>												<b>\$100,000.00</b>			
<b>GRAND TOTAL PROJECT COSTS</b>												<b>\$1,977,491.00</b>			

## **8 Measures of Success**

### **8.1 Monitoring Plan**

#### **8.1.1 SCDHEC Monitoring of CW-080**

According to the *2013 State of South Carolina Monitoring Strategy*, CW-080 and CW-229 are inactive monitoring sites. Therefore, the SCDHEC monitoring results from 2008 are the latest official data available for the Twenty-five Mile Creek Watershed. Kershaw County will consider monitoring CW-080 to evaluate the effectiveness of implementation efforts in reducing the bacteria load in the watershed.

#### **8.1.2 MS4 Bacteria Sampling**

The new SCDHEC SMS4 permit will likely require TMDL monitoring by MS4s. Because the permit is still being drafted at this time, the exact monitoring requirements are still unknown. However, it is likely that the permit will require the monitoring to represent a percentage (for example 25%) of each MS4 in a TMDL watershed. Therefore, Town of Elgin, Kershaw County and Richland County MS4s will consider the possible monitoring plans once this permit is issued.

The following locations will be considered first for TMDL monitoring by Town of Elgin, Kershaw County and Richland County (as shown on Figure 8 in Section 4.2.1.3):

- CW-229,
- Location 18/19: Twenty-five Mile Creek at Twenty-five Mile Creek Road,
- Location 20: Rice Creek at Kelly Mill Road,
- Location 27: Bridge Creek at Cherokee Boulevard,
- Location 26: Sandy Branch at Kelly Mill Road,
- Location 28: Sandy Branch at Wildwood Lane, and
- CW-080

#### **8.1.3 Bacteria Monitoring Methods**

Two types of monitoring will be considered for bacteria;

- Laboratory e.coli or fecal coliform analyses (depending on availability of certified lab) at the locations listed in Section 8.1.2.
  - E.coli = MPN Method
  - Fecal coliform = Standard Method 9222D
  - Suggest: quarterly sampling (with a rain event)
- Petrifilm™ Sampling (e.coli and fecal coliform) at various locations throughout the watershed to narrow down sources for recruitment and implementation efforts.

Utilizing these two methods will provide municipalities with flexibility to obtain as much information as needed at a cost-effective rate. Laboratory results will provide higher accuracy at a higher cost, whereas

Petrifilm™ sampling is a screening tool to help locate hotspots within the watershed at a much lower cost per sample.

\*Note: Details about bacteria sampling procedures can be found in Appendix D for SCDHEC's Wastewater Sampling SOP.

## **8.2 Bacteria Loading Sources**

### **8.2.1 Evaluation Method**

In addition to evaluation of monitoring data proposed above, the success of this Plan, per source, will be evaluated based on:

#### Urban Sources

- the number of pet waste stations installed
- the number of pet waste bags used
- the number of marked storm drains
- the number of rain barrels distributed/voluntarily installed
- the number of rain gardens incorporated in the watershed
- the amount of urban riparian buffers planted

Follow up surveys will be conducted in the last year of the Plan to determine if there has been a change in attitudes, knowledge and disposal methods of pet waste.

#### Sewer Sources

- The number of participants within the watershed that receive Promotional FOG Can Lids
- The quantity of used cooking oil collected at Counties recycling facilities
- The measured reduction in the number of reported SSOs

Follow up surveys will be conducted in the last year of the Plan to determine if there has been a change in attitudes, knowledge and disposal methods for FOG.

#### Agricultural Sources

##### 1. Livestock Farms

- the number of cattle/horse farmers within the watershed who participate in outreach initiatives
- the number of cattle/horse farms that develop conservation and manure management plans
- the number of conservation plans, with their associated BMPs, that are implemented at cattle/horse farms

## 2. Poultry Farms

- The number of poultry farms within the watershed that participate in outreach initiatives
- The number of BMPs for waste management that are implemented

## 3. Crop Farms

- The number of crop farms within the watershed to participate in outreach initiatives
- The number of crop farm owners who develop conservation plans
- The number of BMPs that are implemented at crop farms

Follow up survey will be conducted in the last year of the Plan to determine if there has been a change in attitudes, knowledge, and future conservation efforts regarding agricultural practices.

### Septic Sources

- The number of property owners within the watershed that participate in outreach activities
- The number of failing septic systems that are repaired or replaced

### Wildlife Sources

- The number of hunters that participate in outreach activities
- The number of surveillance cameras installed
- The number of bridge crossing signs installed
- The number of illegal dumpers caught/penalized

Follow up surveys will be conducted in the last year of the Plan to determine if there has been a change in attitudes, knowledge and disposal methods of game and fish carcasses.

## **8.2.2 Anticipated Results**

### Urban Sources

Reduction of bacteria loading from urban runoff is anticipated to be achieved from installation of pet waste stations, storm drain marking, rain garden and rain barrel participation, urban riparian planting and the education programs associated with these BMPs. Assuming 50% of participants at dogs parks will utilize pet waste stations and 10% of the pet waste education will be effective, an estimated  $4.92E+08$  CFU/day and  $2.59E+07$  will be reduced in the Twenty-five Mile Creek Watershed, respectively. An estimated smaller participation of 2% for rain barrels, rain gardens and storm drain markers resulted in an estimated  $0.0025$  CFU/day to be reduced in the watershed by this Plan for years 1 through 5. See Table 11 for more details of the estimated load reductions to Twenty-five Mile Creek Watershed from proposed BMPs during years 1 through 5.

### Sewer Sources

Assuming that FOG blockages account for a total of 50 to 75% of all SSO's (NCSU) and a 25% reduction of FOG to sanitary sewer will result from this program, it is estimated that 2.54E+10 CFU/day will be reduced in the Twenty-five Mile Creek Watershed by this Plan for years 1 through 5. See Table 11 for more details of the estimated load reductions to Twenty-five Mile Creek Watershed from proposed BMPs during years 1 through 5.

### Agricultural Sources

Based on a calculation using the anticipated participation in the Plan and estimated bacteria loading from livestock and poultry (approximate participation of 30% of farms), it is estimated that 9.51E+11 CFU/day will be reduced in the Twenty-five Mile Creek Watershed by this Plan. It was also estimated that 5.94E+10 CFU/day loading would be reduced from the watershed's existing loading if proposed Crop Farm BMPs were implemented for years 1 through 5 (about 20% participation). Table 11 above provides details of the estimated load reduction calculations to Twenty-five Mile Creek Watershed from proposed BMPs during years 1 through 5.

### Septic Sources

Based on a calculation using the anticipated participation for both septic maintenance education and septic repairs/replacements and estimated loading from failing septic systems, it is estimated that 2.46E+09 CFU/day will be reduced in the Twenty-five Mile Creek Watershed by this Plan. See Table 11 for more details of the estimated load reductions to Twenty-five Mile Creek Watershed from proposed BMPs during years 1 through 5.

### Wildlife Sources

Based on a calculation using the anticipated participation in the Plan and estimated bacteria loading from wildlife sources (approximate outreach will convince 30% of hunters to cease dumping carcasses in waterbodies), it is estimated that 6.09E+10 CFU/day will be reduced in the Twenty-five Mile Creek Watershed by this Plan. See Table 11 for more details of the estimated load reductions to Twenty-five Mile Creek Watershed from proposed BMPs during years 1 through 5.

## **9 Funding Opportunities**

### **9.1 Grant Funding**

#### Nonpoint Source Grants Programs (319 Grants)

Description: The primary objective of NPS projects is to prevent or reduce nonpoint source pollutant loadings entering water resources so that beneficial uses of the water resources are maintained or restored. South Carolina receives an annual grant allocation from EPA to implement NPS abatement

strategies as described in the state's NPS Management Program (PDF-1.3M). A portion of these funds are passed on through a competitive grant process to stakeholder groups, government entities, or other agencies interested in conducting projects that reduce or prevent NPS water pollution through the implementation of an approved TMDL. These funds are known as Section 319 grants and they pay up to 60% of eligible project costs, with the applicant providing a 40% non-federal match.

#### US EPA/ National Fish and Wildlife Foundation: 5 Star Grants

Description: Open to any public or private entity engaging in community-based restoration. Request for Proposals are expected in October with proposals due in February. Grant amounts are \$10,000 to \$40,000 (typically in \$20,000 to \$25,000 range in South Carolina). Partnerships are required with at least 5 organizations. No matching is required, but is strongly encouraged to have at least a 1:1 match, and competitive projects often have 2:1 match (including in-kind match). Five Star grants provide modest financial assistance on a competitive basis to support community-based wetland, riparian, and coastal habitat restoration projects that build diverse partnerships and foster local natural resource stewardship through education, outreach and training activities. Since 2010, there is a new emphasis on urban projects.

#### NRCS Environmental Quality Incentives Program (EQIP)

EQIP is a voluntary program that provides financial and technical assistance to agricultural producers to help plan and implement conservation practices that address natural resource concerns and for opportunities to improve soil, water, plant, animal, air and related resources on agricultural land and non-industrial private forestland. In addition, a purpose of EQIP is to help producers meet Federal, State, Tribal and local environmental regulations.

In South Carolina, EQIP will pay 75 percent of the costs of eligible conservation practices under the general sign-up. Historically Underserved who are Limited Resource, Socially Disadvantaged, and Beginning Farmers are eligible for 90 percent cost share. A ranking tool is used to prioritize applications based on the resource concerns that each county selected, typically farms within an approved TMDL watershed and farms that are part of a 319 implementation grant are ranked high to receive EQIP funds.

#### NRCS Wildlife Incentive Program (WHIP)

WHIP is a voluntary program for conservation-minded landowners who want to develop and improve wildlife habitat on agricultural land, nonindustrial private forest land, and Indian land. Provides funding to:

- Promote the restoration of declining or important native fish and wildlife habitats
- Protect, restore, develop or enhance fish and wildlife habitat to benefit at-risk species
- Reduce the impacts of invasive species on fish and wildlife habitats
- Protect, restore, develop or enhance declining or important aquatic wildlife species' habitats
- Protect, restore, develop or enhance important migration and other movement corridors for wildlife

- WHIP funds could be used for habitat restoration and protection within Twenty-five Mile Creek, invasive species removal and buffer restoration, and preserve other wildlife habitat within the stream corridor

#### Community Development Block Grant (CDBG)

The South Carolina Community Development Block Grant (CDBG) Program is designed to provide assistance to units of general local government in improving economic opportunities and meeting community revitalization needs, particularly for persons of low and moderate income. The CDBG program has been funded through the State since 1982 by the U.S. Department of Housing and Urban Development (HUD) under the Housing and Community Development Act of 1974, as amended (Title I). The three overarching goals of the CDBG program are to provide decent housing, economic opportunities and a suitable living environment. Within the context of these goals, each project must also meet one of three outcomes identified by HUD: affordability, accessibility, or sustainability.

The most likely use for CDBG funds in the Twenty-five Mile Creek Watershed would be assistance with the septic repairs and/or upgrades for low-income families. However, in the watershed, CDBG funds are not available at this time. CDBG priorities may change, so this option may be pursued if available in the future.

#### Palmetto Pride Enforcement Grants

The Enforcement Grant from Palmetto Pride is a competitive grant that provides funding to South Carolina litter control and law enforcement agencies for the purchase of necessary equipment and training needed to assist with the enforcement of litter laws. Recipients of the Enforcement Grants have been awarded in the \$2,000-\$2,500 range. The Twenty-five Mile Creek Watershed could use this grant to help pay for the Bridge Crossing Signs for Illegal Dumping of Animal Carcasses.

## **9.2 Self-Supporting Funding**

#### Stormwater Utility Fee

Self-supporting funding (such as a stormwater utility) is not currently envisioned although such mechanisms will be explored if milestones and goals are not met as anticipated since the large structural BMPs would require significantly higher levels of funding.

#### Landowner Support

If grant opportunities are made available for implementation of this Plan, landowners will be required to provide a match (up to 40%) for installation of certain BMPs (such as agricultural, septic, and riparian plantings). In order to meet this match, some landowners may be able to perform in-kind labor as a way to match these funds.

## 10 Technical Assistance

If awarded a 319 Implementation Grant, Kershaw County requests that SCDHEC return to measuring water quality parameters (such as bacteria and macroinvertebrates) at CW-080 on a monthly basis.

NRCS, one of many valuable partners in this project, will help recruit agricultural landowners, develop Conservation Plans and offer recommendations for agricultural BMPs. NRCS also administers the EQIP cost share program. The landowners may apply for EQIP funds, in order maximize the effect of the 319 grant funds. TSPs and SWCDs will assist NRCS with conservation plans and BMP inspections.

The U.S. Department of Housing and Urban Development (HUD) administers the Community Development Block Grant Program, which assists low- and moderate-income persons. At this time, CDBG funds are not available in the watershed. However, if CDBG priorities change, this option may be pursued, if available, in regard to supplementing potential 319 grant funds for septic repairs. Assistance from CDBG coordinators within this watershed will be pursued in order to help maximize the effect of potential 319 grant funds.

In addition to the cooperation of NRCSs, SWCDs, HUD Kershaw County will administer the implementation project with the help of many supporting organizations which may include: Richland County, Fairfield County, the Town of Elgin, Town of Lugoff, Town of Blythewood, Carolina Clear, Central Midlands COG, Santee Lynches COG, SCRWA, SCDHEC Public Health, Palmetto Utilities, and SCDNR. The participation of these groups will have a large impact on the ability to conduct an effective and efficient social marketing campaign.

Kershaw County Stormwater will outline portions of the project to be conducted by their consultant, AMEC Environment & Infrastructure, Inc. These tasks are anticipated to be related to project oversight, reporting, and social marketing.

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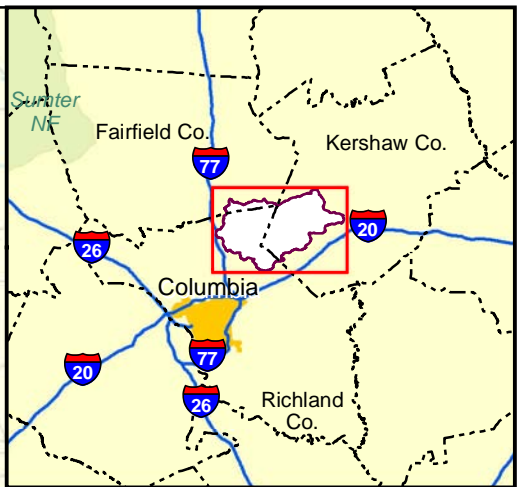
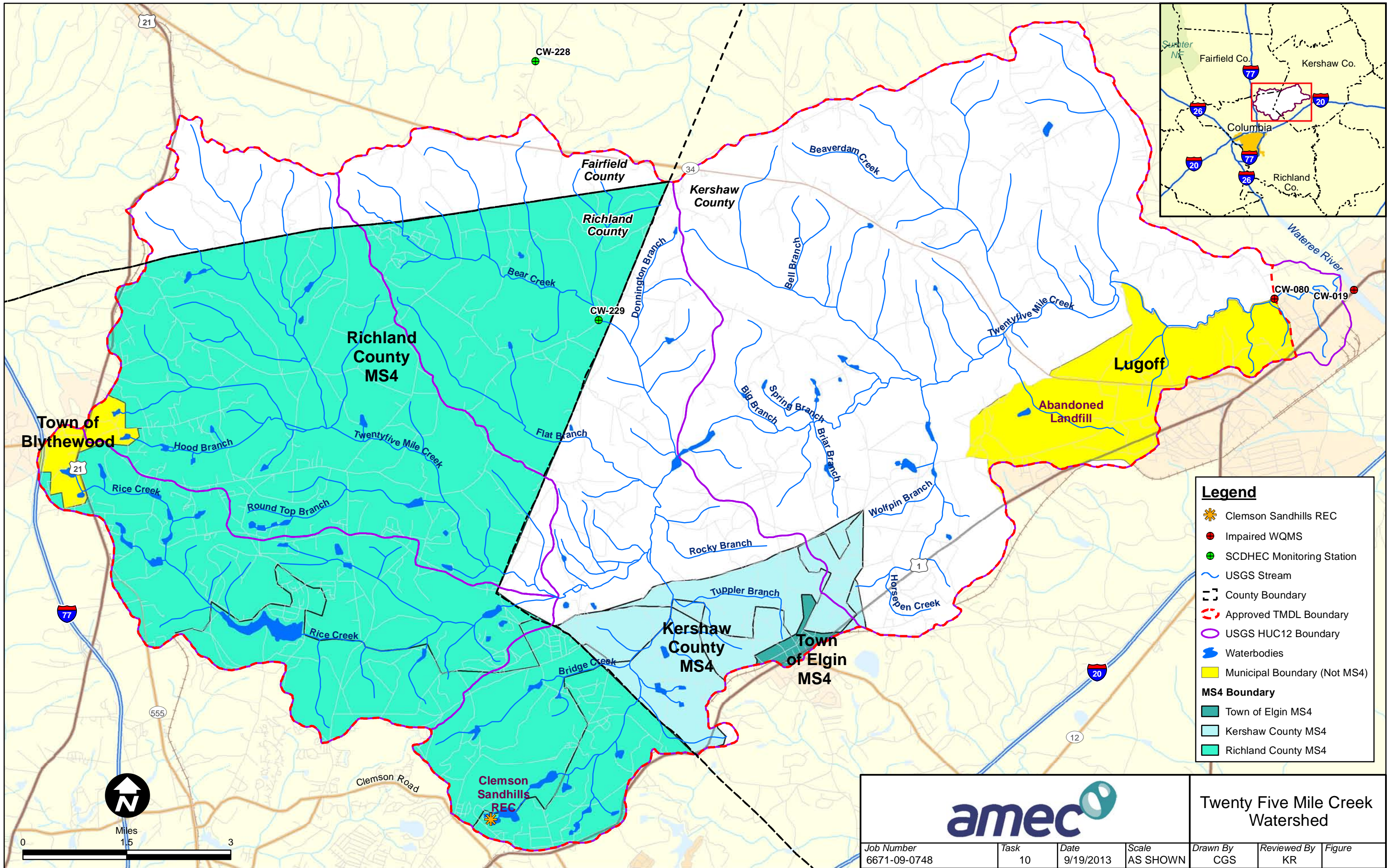
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## **APPENDICES**

## **Appendix A**

### **Figures**

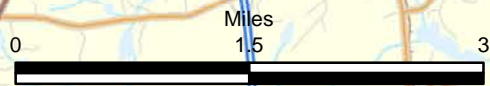


**Legend**

- Clemson Sandhills REC
- Impaired WQMS
- SCDHEC Monitoring Station
- USGS Stream
- County Boundary
- Approved TMDL Boundary
- USGS HUC12 Boundary
- Waterbodies
- Municipal Boundary (Not MS4)

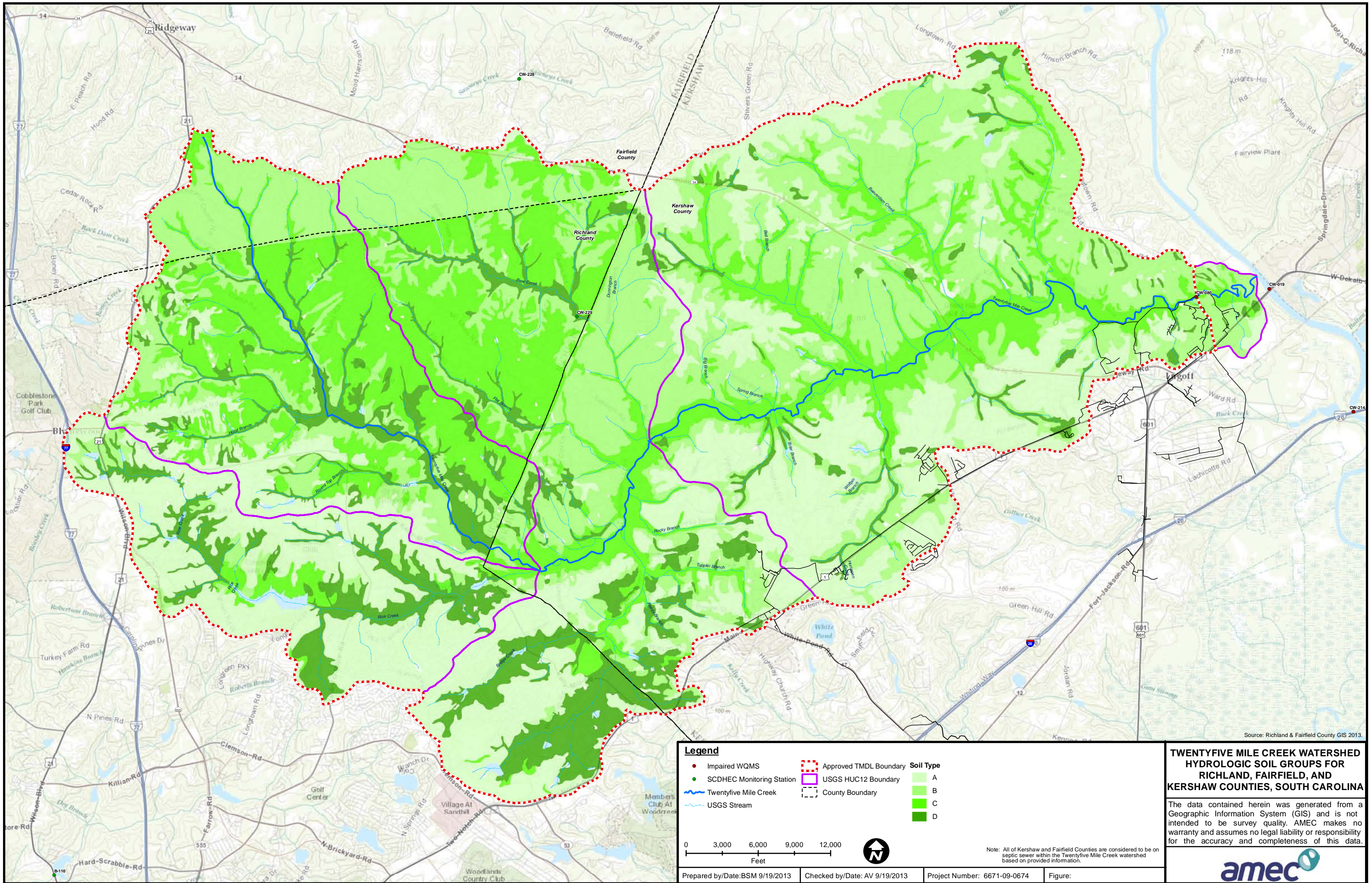
**MS4 Boundary**

- Town of Elgin MS4
- Kershaw County MS4
- Richland County MS4



**Twenty Five Mile Creek Watershed**

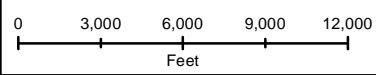
Job Number 6671-09-0748	Task 10	Date 9/19/2013	Scale AS SHOWN	Drawn By CGS	Reviewed By KR	Figure
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Source: Richland & Fairfield County GIS 2013.

**Legend**

- Impaired WQMS
- SCDHEC Monitoring Station
- Twentyfive Mile Creek
- USGS Stream
- ▭ Approved TMDL Boundary
- ▭ USGS HUC12 Boundary
- ▭ County Boundary
- Soil Type**
- A
- B
- C
- D



Note: All of Kershaw and Fairfield Counties are considered to be on septic sewer within the Twentyfive Mile Creek watershed based on provided information.

**TWENTYFIVE MILE CREEK WATERSHED  
HYDROLOGIC SOIL GROUPS FOR  
RICHLAND, FAIRFIELD, AND  
KERSHAW COUNTIES, SOUTH CAROLINA**

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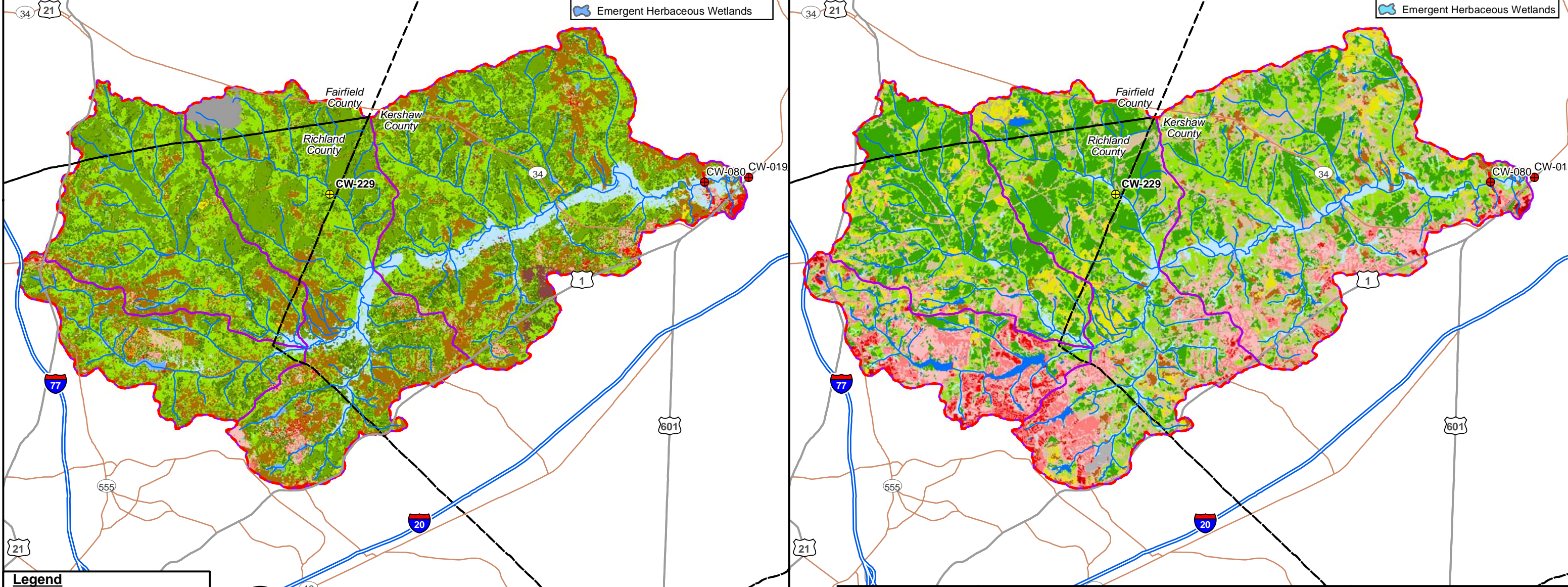


USGS 1992 Classification	Acres	% of Basin
Open Water	624.2	0.8
Low Intensity Residential	1473.2	1.8
High Intensity Residential	209.2	0.3
Commercial/Industrial/Transportation	633.1	0.8
Bare Rock/Sand/Clay	192.0	0.2
Quarries/Strip Mines/Gravel Pits	677.9	0.9
Transitional	480.7	0.6
Deciduous Forest	27530.1	34.5
Evergreen Forest	18171.6	22.8
Mixed Forest	10022.7	12.6
Pasture/Hay	655.6	0.8
Row Crops	14399.8	18.1
Urban/Recreational Grasses	190.1	0.2
Woody Wetlands	4447.1	5.6
Emergent Herbaceous Wetlands	11.2	0.0
<b>Grand Total</b>	<b>79718.5</b>	<b>100.0</b>

USGS 1992 Classification
Open Water
Low Intensity Residential
High Intensity Residential
Commercial/Industrial/Transportation
Bare Rock/Sand/Clay
Quarries/Gravel Pits
Transitional
Deciduous Forest
Evergreen Forest
Mixed Forest
Pasture Hay
Row Crops
Urban/Recreational Grasses
Woody Wetlands
Emergent Herbaceous Wetlands

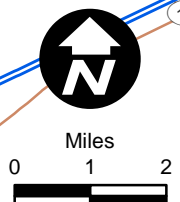
USGS 2006 Classification	Acres	% of Basin
Open Water	1041.1	1.3
Developed, Open Space	8938.2	11.2
Developed, Low Intensity	5130.0	6.4
Developed, Medium Intensity	1332.0	1.7
Developed, High Intensity	155.5	0.2
Barren	411.1	0.5
Deciduous Forest	16931.0	21.2
Evergreen Forest	20525.7	25.7
Mixed Forest	2768.2	3.5
Shrub/Scrub	611.6	0.8
Grassland	10567.8	13.3
Pasture/Hay	4384.6	5.5
Cultivated Crops	1601.0	2.0
Woody Wetlands	5174.6	6.5
Emergent Herbaceous Wetland	146.0	0.2
<b>Grand Total</b>	<b>79718.5</b>	<b>100.0</b>

USGS 2006 Classification
Open Water
Developed - Open Space
Developed - Low Intensity
Developed - Medium Intensity
Developed - High Intensity
Barren
Deciduous Forest
Evergreen Forest
Mixed Forest
Shrub/Scrub
Grassland/Herbaceous
Pasture Hay
Cultivated Crops
Woody Wetlands
Emergent Herbaceous Wetlands



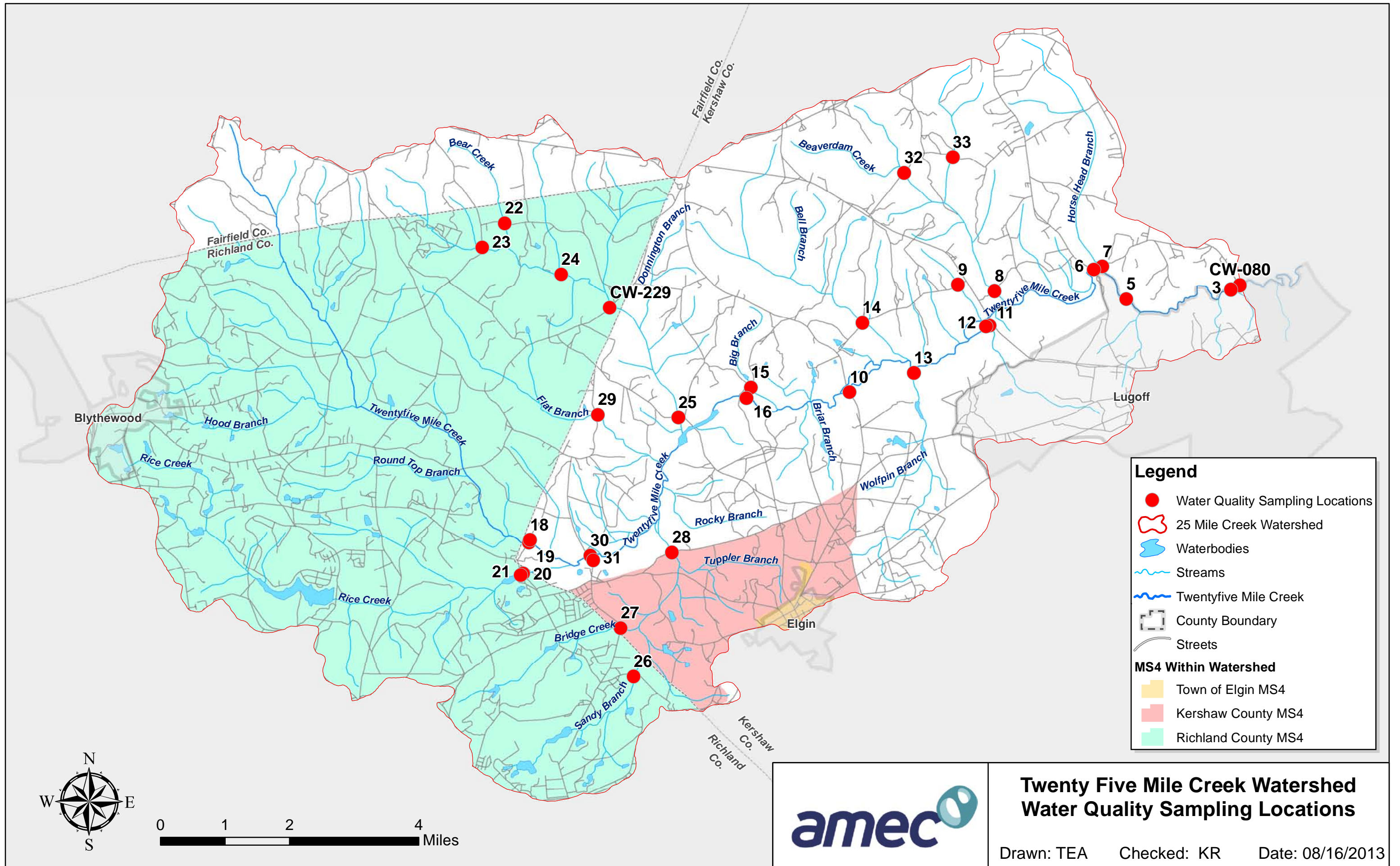
**Legend**

- Impaired WQMS
- SCDHEC Monitoring Station
- USGS Stream
- County Boundary
- Approved TMDL Boundary
- USGS HUC12 Boundary



Twenty Five Mile Creek Sub-basin  
Land Use Change from  
1992-2006 USGS NLCD

Job Number 6671-09-0748	Task 10	Date 9/19/2013	Scale AS SHOWN	Drawn By CGS	Reviewed By KR	Figure
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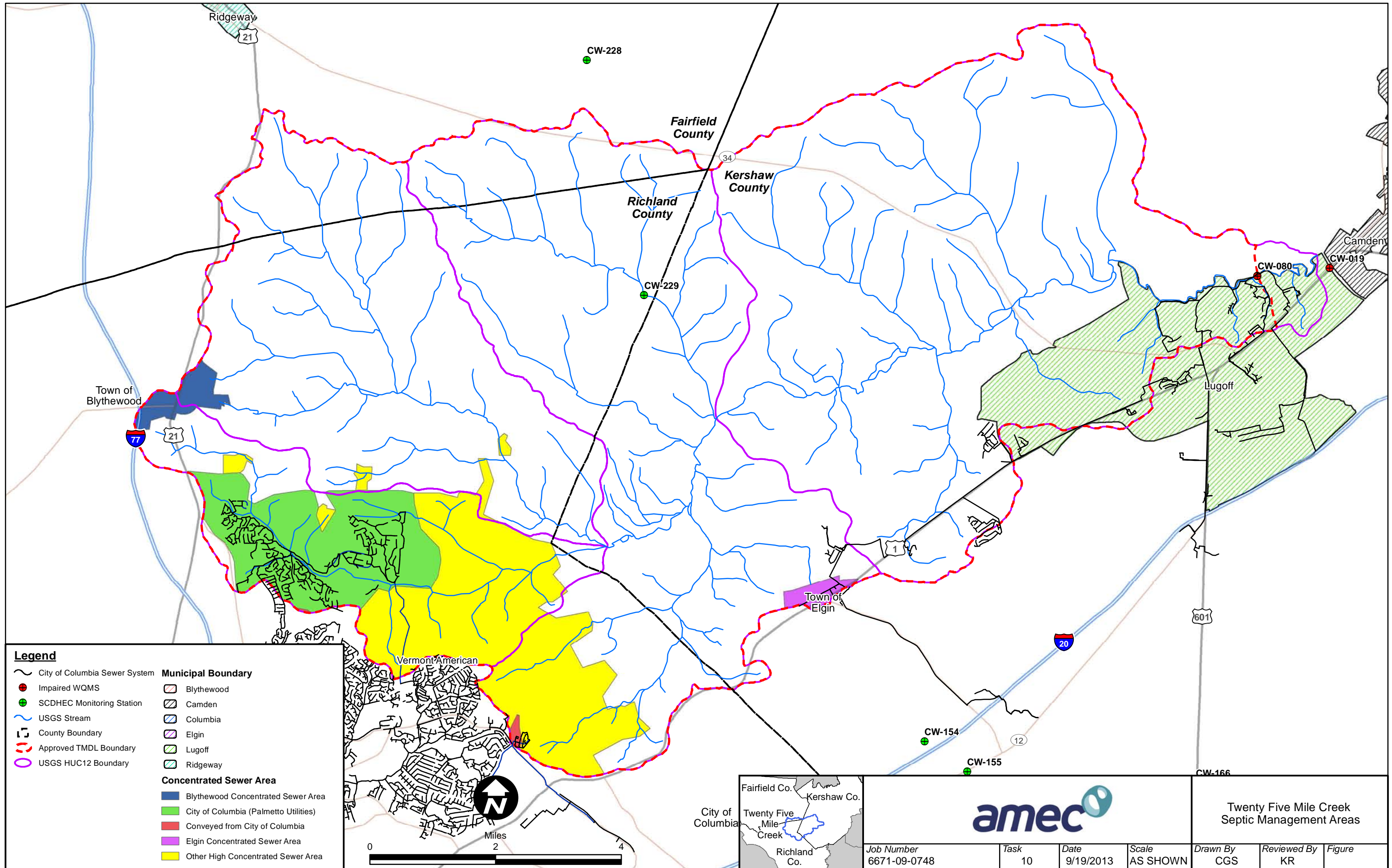


**Legend**

- Water Quality Sampling Locations
- 25 Mile Creek Watershed
- Waterbodies
- Streams
- Twentyfive Mile Creek
- ▭ County Boundary
- Streets

**MS4 Within Watershed**

- Town of Elgin MS4
- Kershaw County MS4
- Richland County MS4



**Legend**

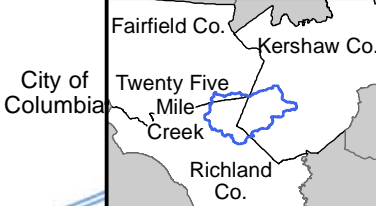
- City of Columbia Sewer System
- Impaired WQMS
- SCDHEC Monitoring Station
- USGS Stream
- County Boundary
- Approved TMDL Boundary
- USGS HUC12 Boundary

**Municipal Boundary**

- Blythewood
- Camden
- Columbia
- Elgin
- Lugoff
- Ridgeway

**Concentrated Sewer Area**

- Blythewood Concentrated Sewer Area
- City of Columbia (Palmetto Utilities)
- Conveyed from City of Columbia
- Elgin Concentrated Sewer Area
- Other High Concentrated Sewer Area



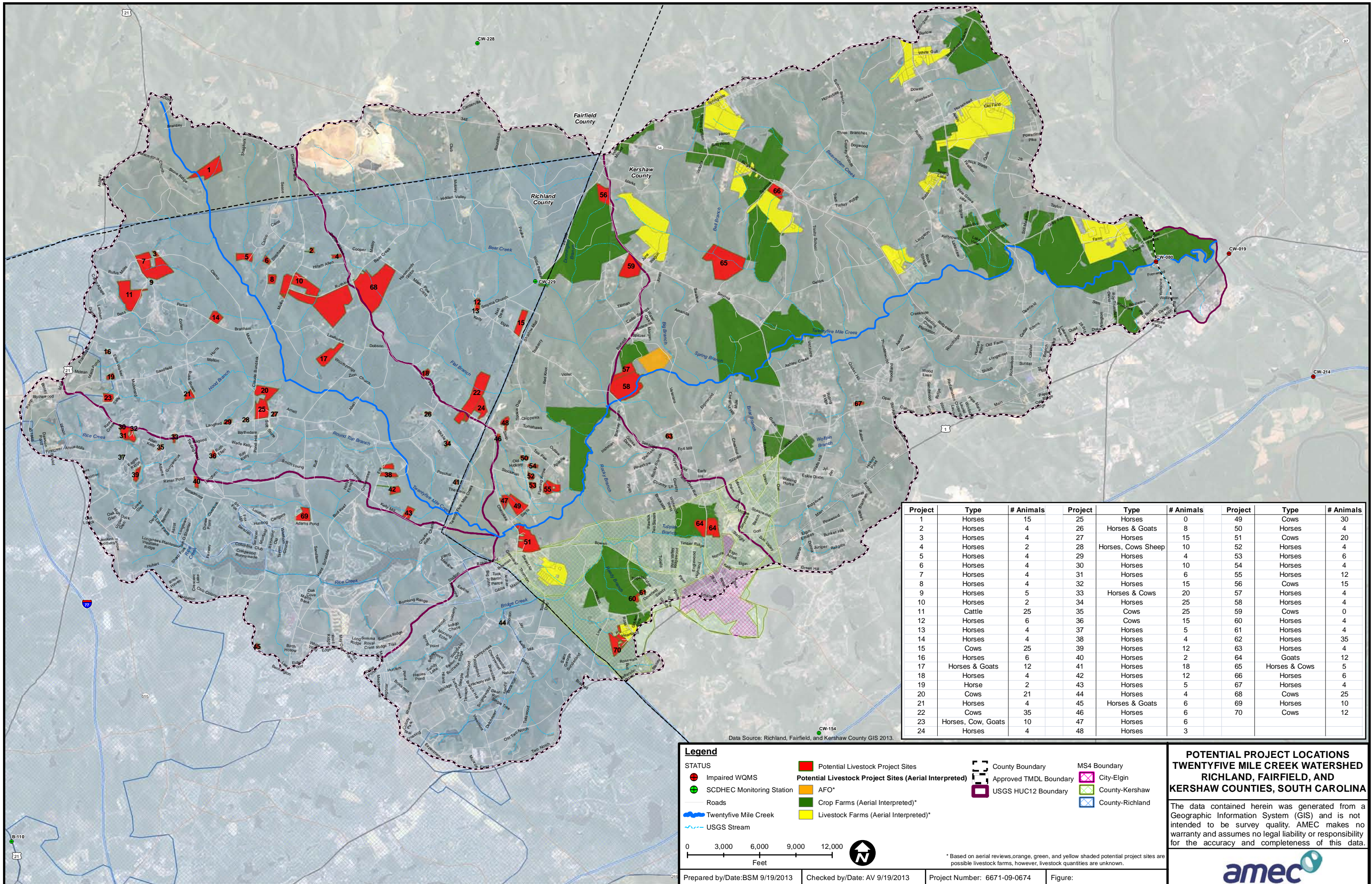
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Job Number 6671-09-0748	Task 10	Date 9/19/2013	Scale AS SHOWN
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**Twenty Five Mile Creek Septic Management Areas**

Drawn By CGS	Reviewed By KR	Figure
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Project	Type	# Animals	Project	Type	# Animals	Project	Type	# Animals
1	Horses	15	25	Horses	0	49	Cows	30
2	Horses	4	26	Horses & Goats	8	50	Horses	4
3	Horses	4	27	Horses	15	51	Cows	20
4	Horses	2	28	Horses, Cows Sheep	10	52	Horses	4
5	Horses	4	29	Horses	4	53	Horses	6
6	Horses	4	30	Horses	10	54	Horses	4
7	Horses	4	31	Horses	6	55	Horses	12
8	Horses	4	32	Horses	15	56	Cows	15
9	Horses	5	33	Horses & Cows	20	57	Horses	4
10	Horses	2	34	Horses	25	58	Horses	4
11	Cattle	25	35	Cows	25	59	Cows	0
12	Horses	6	36	Cows	15	60	Horses	4
13	Horses	4	37	Horses	5	61	Horses	4
14	Horses	4	38	Horses	4	62	Horses	35
15	Cows	25	39	Horses	12	63	Horses	4
16	Horses	6	40	Horses	2	64	Goats	12
17	Horses & Goats	12	41	Horses	18	65	Horses & Cows	5
18	Horses	4	42	Horses	12	66	Horses	6
19	Horse	2	43	Horses	5	67	Horses	4
20	Cows	21	44	Horses	4	68	Cows	25
21	Horses	4	45	Horses & Goats	6	69	Horses	10
22	Cows	35	46	Horses	6	70	Cows	12
23	Horses, Cow, Goats	10	47	Horses	6			
24	Horses	4	48	Horses	3			

**Legend**

- STATUS**
  - Impaired WQMS
  - SCDHEC Monitoring Station
  - Roads
  - Twentyfive Mile Creek
  - USGS Stream
- Potential Livestock Project Sites**
  - Potential Livestock Project Sites
  - Potential Livestock Project Sites (Aerial Interpreted)
  - AFO\*
  - Crop Farms (Aerial Interpreted)\*
  - Livestock Farms (Aerial Interpreted)\*
- Boundaries**
  - County Boundary
  - Approved TMDL Boundary
  - USGS HUC12 Boundary
  - MS4 Boundary
  - City-Elgin
  - County-Kershaw
  - County-Richland

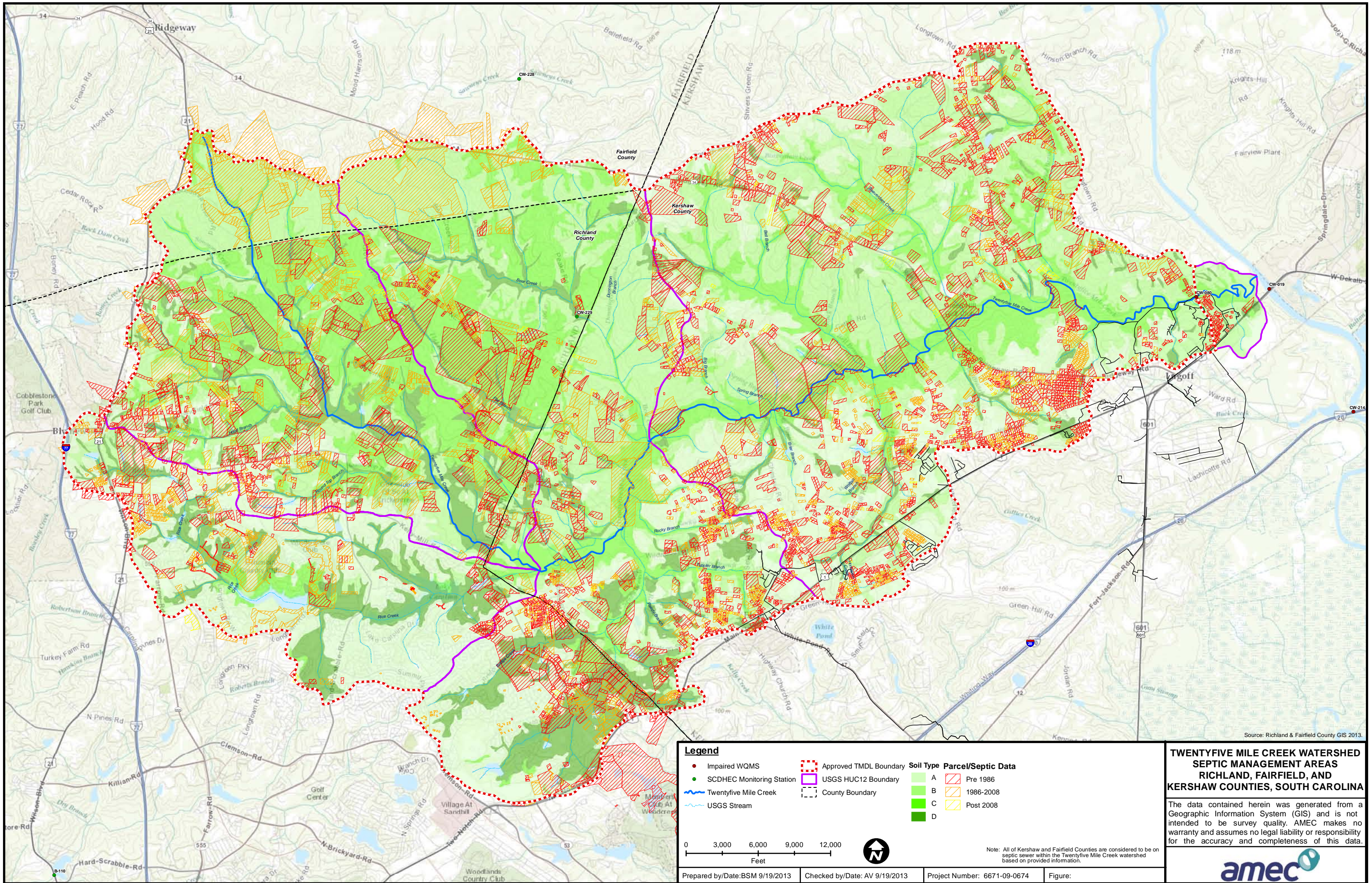
0 3,000 6,000 9,000 12,000 Feet

\* Based on aerial reviews, orange, green, and yellow shaded potential project sites are possible livestock farms, however, livestock quantities are unknown.

**POTENTIAL PROJECT LOCATIONS TWENTYFIVE MILE CREEK WATERSHED RICHLAND, FAIRFIELD, AND KERSHAW COUNTIES, SOUTH CAROLINA**

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**amec**

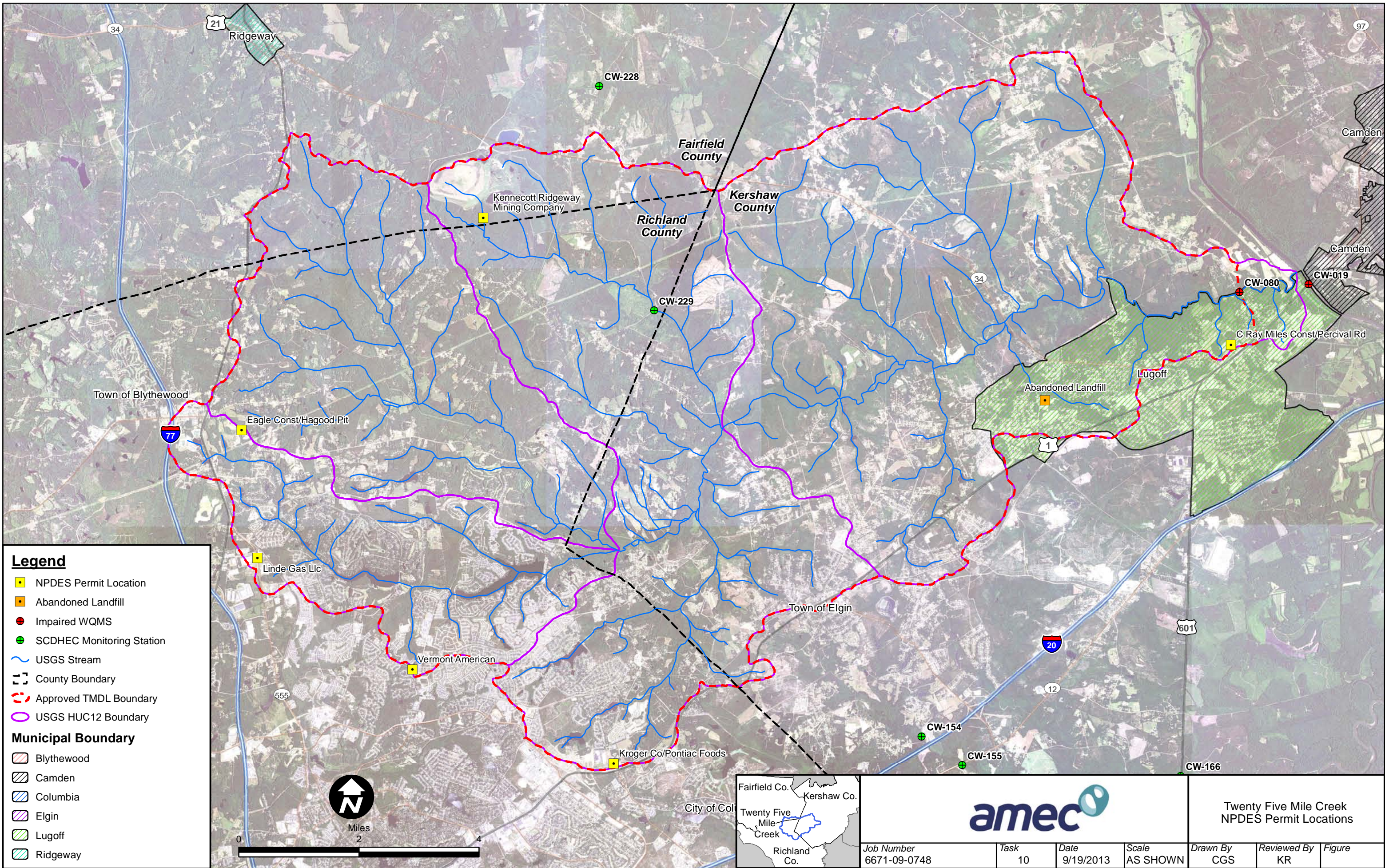


**TWENTYFIVE MILE CREEK WATERSHED SEPTIC MANAGEMENT AREAS RICHLAND, FAIRFIELD, AND KERSHAW COUNTIES, SOUTH CAROLINA**

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Source: Richland & Fairfield County GIS 2013.



**Legend**

- NPDES Permit Location
- Abandoned Landfill
- Impaired WQMS
- SCDHEC Monitoring Station
- ~ USGS Stream
- - - County Boundary
- - - Approved TMDL Boundary
- USGS HUC12 Boundary

**Municipal Boundary**

- ▨ Blythewood
- ▨ Camden
- ▨ Columbia
- ▨ Elgin
- ▨ Lugoff
- ▨ Ridgeway

		<b>Twenty Five Mile Creek NPDES Permit Locations</b>				
					Job Number 6671-09-0748	Task 10

**Appendix B**  
**Brainstorm Meeting Summaries**

*Urban Sources Brainstorming Session*  
*Agricultural Sources Brainstorming Session*  
*Septic Sources Brainstorming Session*  
*Wildlife Sources Brainstorming Session*  
*Public Brainstorming Sessions*  
*Final Stakeholders Brainstorming Session*

All,

Thank you to those who attended yesterday's meeting and contributed to our first brainstorming session. You all provided a lot of input on potential sources of urban pollution in Twentyfive Mile Creek watershed and have given us some good information to do more research. Below is our recap of yesterday's meeting. Please let us know if you we missed anything or if you have any questions or new ideas.

**Fecal Coliform Sources:** indicator of pathogens (found in human and animal waste)

1. Sanitary Sewer Overflows (SSOs)

- We are going to put in an FOI (Freedom of Information) request to DHEC and the Office of Regulatory Staff in order to obtain SSO data from Richland and Kershaw Counties. This will help us to determine whether SSOs are an issue in this watershed, and if so, what the cause of the SSOs were (Fats, Oils and Greases (FOG) or other).
- Find out if any apartment complexes in the watershed are contributing to SSOs caused by FOG. Possibly subdivisions as well.
- It was noted that the odor at the pump station at the pump station near the soccer fields in Elgin (and Woodcreek Farms) is not a surface water quality issue.
- We plan to invite private sewer companies to the septic brainstorm session.

2. Pet Waste

- 2 vets in Kershaw County (Elgin Veterinary Hospital off Pine St, Wateree Animal Hospital)
- 2 dog washing/grooming facilities (one being Doggy Do's, do you all have the name of the second?).
- As far as we know, there are no dog parks in the watershed. Maybe there are spaces in subdivisions where pets gather? Keep your eyes and ears open for the possibility.
  - It was mentioned that the Turtle Creek subdivision (near Clemson Sandhills REC) has a lot pets and the neighborhood backs up to a wetland preserve. Can you all think of any other neighborhoods that would have a large concentration of dogs? Possibly Lake Carolina?
- According to Mary Caflish, she found 2 vets in Richland County. Mary, are these in the watershed? If so, what are their names and locations?
- Want to look into the dogs that are held at Hunting Clubs across the watershed. Not sure if this would categorize as an Urban source, but is a good source to look in to.
- Again, will want to see if there are any pet waste problems at apartment complexes. Even though they may have installed pet waste stations, may need to emphasis public education and outreach at certain complexes. Gregory Sprouse mentioned a database resource that could help us with a list of apartment complexes in the watershed, and possibly those that accept dogs.
- Equestrian clubs/communities/centers with subdivisions, such as Longcreek Plantation. Can you all think of any others in the watershed?

3. Water Fowl

- Canada Geese were discussed, but expect that they are not a major contributor to fecal load in the watershed and difficult to address.

**Macroinvertebrate Sources:** indicator of stream health.

1. Toxicity

- We do not want to rule out any possible toxicity impairments caused by abandon landfills and abandon gas stations.
- Will need to research if there are any Superfund sites in the watershed.
  - We know that there is a reclamation mine in Fairfield County (**Kennecott Ridgeway Mine**). Operations at this precious metal mine ceased in 1999, the Kennecott Mineral Company implemented a successful reclamation and closure plan designed to minimize environmental impacts on the site's land. Since the end of mining operations, all previously disturbed land surfaces have been subsequently reclaimed and restored, or retained for future sustainable uses. Also, in October 2002, Ridgeway signed a Memorandum of Understanding with the Southeastern Natural Sciences Academy to create the Center for Ecological Restoration on the site of the reclaimed mine. The Center focuses on providing environmental education and research about sustainable programs for economic growth, balanced with environmental protection. Hence, I think it's safe to assume that this site is not of concern as a pollution source to Twenty-five Mile Creek.

2. Nutrients

- Fertilizers in yards, nurseries, and golf courses. We were able to locate one nursery directly upstream of the water quality monitoring station CW-080, 2 golf course within the watershed, and have a good idea of the dense subdivision in Northeast Columbia that we could target.

3. Alteration in Hydrology:

a. Increased Runoff

b. Sediment Loads

- **This is the area that we need more input from you all.** As suggested by DHEC's macroinvertebrate specialist, he believes that the increase in urban areas (such as the upper portions of the watershed) have altered the natural hydrology of the watershed with increased runoff volumes and their faster rates, as well as increased sediment loads, to enter Twenty-five Mile Creek. Therefore, we need to know if there are any problematic areas (such as increased impervious areas) that are causing higher concentrated flows and erosion.
- Gregory Sprouse has data on the number of permits for single family homes and commercial properties in the watershed, which could be useful in determining whether urbanization has likely worsened the problem since DHEC's macroinvertebrate testing in 2007.
- During our "windshield tour" of the watershed we did notice some erosion along the railroad embankment in Blythewood, about which we told Michael Criss.

**Non-Urban Sources** mentioned for discussion at future brainstorm sessions:

- USC Equestrian Team which trains at One Wood Farm – just outside of 25-mile creek watershed, but a good opportunity for distribution of education materials

- Unofficial horse trails on undeveloped property east of I-77, but just outside of watershed.
- Planning for Bike Trails in Kershaw County (include horse trails?)
- Information gathered by Upstate Forever and City of Pickens regarding dumping of deer carcasses after cutting the heads off.

This was the first brainstorming session of five. We plan to have brainstorming sessions for agriculture sources, septic, wildlife, and a public meeting. As mentioned yesterday, you are all more than welcome (encouraged) to come to any of the sessions that will be held in the future. We will soon let you know when the Agriculture brainstorming meeting will be scheduled. Again, thank you for your input yesterday, we made great progress! Please contact either myself ([katherine.resler@amec.com](mailto:katherine.resler@amec.com)) or Angela ([angela.vandelay@amec.com](mailto:angela.vandelay@amec.com)) if you can think of anything else to add to this list that we have all developed. For your aid, we have attached an aerial map of the watershed (the one we had displayed yesterday). Also attached is the project's list of stakeholders and their contact information.

Please let us know if we have missed anything or if you have any questions/concerns.

Thanks,  
Kelli

**Kelli Resler, EIT**  
**Staff Water Resources Professional**

**AMEC** Environment and Infrastructure  
720 Gracern Road, Suite 132, Columbia, SC 29210, USA  
Tel (803) 798-1200, Fax (803) 750-1303  
[katherine.resler@amec.com](mailto:katherine.resler@amec.com)  
[amec.com](http://amec.com)

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All,

Thank you to those who attended Monday's meeting and contributed to the second brainstorming session for agricultural activities. You all provided a lot of input on potential sources of agricultural pollution in Twenty-five Mile Creek watershed and have given us some good information to conduct more research. Below is our recap of Monday's meeting. Please let us know if we missed anything or if you have any questions or new ideas.

We had a lot of discussions pertaining to an actual implementation grant for this project, however I first want to focus on what was accomplished or what needs to be done to write these watershed based plans for fecal coliform and macroinvertebrates.

In order to develop the plans, we need to quantify the following:

- Approximate # of livestock farms and the approximate # of livestock in the watershed
- Approximate # of horse farms and the approximate # of horses in the watershed
- Approximate # of Agriculture Feed Operations (AFOs) and approximate # of poultry in the watershed
- Approximate # of crop farms in the watershed

#### **Agricultural Sources and Resources to Consider:**

- NRCS said that they could provide the # of farms and # of animals in current and past conservation plans/contracts within the watershed to help with the quantification of the parameters listed above.
- Michael Criss may be able to help us contact the USC Equestrian team, which is just out of the watershed in Blythewood, but may have information for # horses and # horse farms in the Twenty-five Mile Creek watershed.
- Chanda and Buddy (RSWCD) may be able to get a list of large animal vets in the watershed, who may be able to help us with numbers and/or contacts of farms in the watershed.
- It was deduced that the watershed encompasses smaller hobby farms (compared to ones in Camden). Therefore, if we could find out some numbers such as # of animals/ per farm, averages can be assumed in order to estimate agricultural pollutant loads in the watershed.
- If there are no other options, we can use parcel data and possibly aerials and to help determine # of farms in the watershed.
- It would be very helpful if we could determine # of crop farms in the watershed, along with what crop farms spread turkey litter. It was mentioned that this may be a big source in Kershaw County, especially around Lugoff.
  - Could contact Dave Wilson with Bureau of Water at DHEC to get a list of permits for litter (i.e. those who spread it, brokers, etc.)
  - Dana Reeder has Holly Welch of SC Forestry Commission's (Piedmont) contact information

#### **Discussions on the possibility of an Implementation Grant(s):**

- The current 319 grant deadline for developing the watershed based plans is September 2013. However, the RFP for an implementation grant may come out this summer. Kershaw County



would like to complete these watershed based plans before then so they can apply for the implementation grant.

- IF Kershaw County is awarded an implementation grant, the grant time period would likely be 3 years. Also, this would be a “partial implementation grant proposal”, so that not all BMPs will be applied for at the same time. Therefore, we don’t have to apply and implement all BMPs written in the watershed based plans at one time.
- **Money:**
  - One 319 requirement is “...eighty percent (80%) of Federal 319 funds must be directed solely towards on-the-ground BMP implementation.”
  - A second 319 requirement is: “... a minimum non-federal match of forty percent (40%) of the total cost of the project (Grant funds requested = 60%, non-federal match = 40%, total project cost = 100%).”
  - The grant is typically set-up for 40% of every BMP to be paid by non-federal funds (farmer or septic homeowner); and 80% of the Federal match is required to be spent on in-the ground BMPs. Therefore, approximately 90% of the entire implementation project budget (money & labor) will be for construction. That leaves ~10% for project management, social marketing/recruitment, reporting, supplies, and Technical Service Providers (if it is necessary) – which could still add up to \$30k-\$60k.
  - It was discussed that the NRCS agents are extremely busy and can only work on farms that qualify for the EQIP program. These farmers are typically referred to a Technical Service Provider, who charge for their time and we will have limited access to them. This is a situation we will address when we submit for an implementation grant.
  - Property owners are also likely to qualify for EQIP for some of their practices, so it may be a joint situation (1 farm, 1 Conservation Plan, some BMPs covered by EQIP and others covered by 319).
- **Stakeholder participation:**
  - Would need help with the recruitment of local farmers, development of conservation plans, and inspection to confirm proper BMP installation. Logistics for the conservation plans & inspections are discussed under “Money” above.
  - Encouraged to contact Bill Melvin and Rafael Mendez with Lexington County, who provide these services to both Hollow Creek 319 grant and Twelvemile 319 grant.
- **Marketing techniques to recruit participants:**
  - Again, utilize local large animal vets
  - Brochures/signs for local feed stores
  - Clemson Extension agents
  - Farm magazines or district letters
    - Farm Service Agency (FSA) to advertise in their letters
  - County Council members may know local farmers and can help recruit for their participation
  - Local meetings to attend and present
- One BMP 319 Implementation grant was awarded in Kershaw County to a farm in the adjacent Spears Creek Watershed (C. Ray Miles Farm). Could potentially use this farm for demos/Farm Tours.

#### **Other Items Discussed:**

- Septic Tank Failures:
  - Assessor for septic data (Buddy Atkins, RSWCD, to help get his contact information)

- Collect soils data for the watershed (i.e. use Web Soil Survey). Soils data may help use deduce what areas may have more failures. For example, Richland County's portion of the watershed mostly consists of the Lakeland soil series (sand), which may facilitate more septic tank failures.
- If awarded implementation grant (with septic failures being a source in this watershed), to recruit participants, may want to contact realtors in the area to distribute grant information. Kershaw County is considering making an "acceptable septic" letter a requirement before sale of a home (similar to a termite inspection letter). This would encourage participation in the grant.
- Urban Sources:
  - Look into construction activities that may be in noncompliance with their SWPPPs (Stormwater Pollution Prevention Plans) such as The View (although this subdivision does not appear to be in 25 Mile Creek watershed).
  - It was requested that we overlay concentrated urban areas and water hydrant layer (RC) to help with septic and sewer estimations.
- Forestry:
  - Another source to consider for macroinvertebrate impairments could be timber clear cuts in Fairfield County and northern Richland County. Dana Reeder has Holly Welch of SC Forestry Commission's (Piedmont) contact information. It was mentioned that they have a 40 foot buffer requirement, but are not inspected/supervised for compliance.

Thank you again for your participation Monday in the Agricultural Brainstorm Session, we made great progress with your input! The remaining sessions we plan to hold include, septic, sewer, wildlife, and a public meeting. Again, you are all more than welcome (encouraged) to come to any of the sessions that will be held in the future. We will soon let you know when the Septic brainstorming meeting will be scheduled.

Please contact myself ([katherine.resler@amec.com](mailto:katherine.resler@amec.com)) or Angela Vandelay ([angela.vandelay@amec.com](mailto:angela.vandelay@amec.com)) if you can think of anything else to add to this list that we have all developed. Also let us know if we have missed anything or if you have any questions/concerns.

Thanks,  
Kelli

**Kelli Resler, EIT**  
**Staff Water Resources Professional**  
**AMEC** Environment and Infrastructure  
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All,

Thank you to those who attended Thursday's meeting and contributed to the third brainstorming session on septic tanks. You provided a lot of input on potential sources of failing septic tanks in the Twenty-five Mile Creek watershed and have given us some good information to conduct more research. Below is the recap of Thursday's meeting. Please let me know if I missed anything or if you have any questions or new ideas.

### Septic Sources / Pathogen Load Calculations

- Parcel septic information from County GIS
  - Richland County - Buddy Atkins, RSWCD / Quinton Epps, RC have submitted a request for sewer/septic data by parcel in RC
  - Kershaw County does not have septic data by parcel, so we will have to use the "concentrated sewer areas" that we have gathered.
  - Fairfield County – the portion of Twentyfive Mile Creek watershed in FC is assumed to be septic.
  - AMEC will use this data to create a map with parcel septic information on soils layer. Soils data may help us deduce what areas are more likely to have more failures. For example, Richland County's portion of the watershed mostly consists of the Lakeland soil series (sand), which are less likely to have septic failures.
  - DHEC confirmed at Thursday's meeting that this would be helpful data for estimating problematic areas and confirming load calculations.
- AMEC will request from Leonard Gordon available septic tank repair reports in the watershed from the past 2 years.
- Jim Raymond and Steve Edwards to remind septic contractors to complete/submit repair reports
- Jim Raymond and Steve Edwards, could you clarify whether contractors are supposed to turn in repair reports only if the septic system installed used alternative products, or if they are supposed to turn one in for all repairs?
- Jim and Steve told us that septic contractors are required to keep logs of the septic tanks they pump out, but these logs are not submitted to DHEC (if they are even completed regularly) and it would be a lot of manual entry to compile this data in a spreadsheet. The idea is to look for repeat pump-outs, which would indicate problems, but this was determined to be too time consuming for the small amount of information.

- AMEC will also request from DHEC a list of denials for septic permit requests.

#### Discussions on the possibility of an Implementation Grant(s):

- Money:
  - Participants will pay 40% match for a septic tank repair/replacement or tie-in to sewer, unless CDBG is an option (see next bullet) and/or a sliding scale is used (such as lower incomes qualify for a 20% match or 0% match)
  - CDBG
    - Richland County CDBG – According to Valeria Jackson, the census tracts in the RC portion of the watershed do not meet the income requirements to qualify, so CDBG funds will not be available.
    - Kershaw County & Fairfield County CDBG – According to Martha Whitaker, CDBG funds are available only for running sewer lines to an area of  $\geq 51\%$  low/moderate income and cannot be used to pay any fees. CDBG funds cannot be used for septic repairs or replacement, only for sewer tie on. If a subdivision meets the  $\geq 51\%$  low/moderate income (through an income survey) and has 70% commitment to tie on, and meets the cost reasonableness ( $< \$10,00$  per unit) and meets the minimum \$50k maximum \$500k requirements, it is possible to submit an application (annual application request due 3/15) for a grant with a 10% local match.
- Stakeholder participation:
  - DHEC will conduct inspections and issue repair permits for those who seek and qualify to participate in the 319 grant for a septic repair/replacement/sewer tie-in.
  - AMEC will look into the need/possibility/method training septic companies (how to inspect, what to look for, etc)
  - AMEC will look into the need/possibility/method to educate builders to avoid clearing/disturbing the proposed septic area (i.e. drainfield) during construction.
- Marketing techniques to recruit participants:
  - Can advertise on Kershaw County's radio station, 102.7 (not only to recruit septic tank participants, but other watershed participants as well, such as farmers.)
  - Discussed at the previous meeting, to recruit participants, may want to contact realtors in the area to distribute grant information. Kershaw County is considering making an "acceptable septic" letter a requirement before sale of a home (similar to a termite inspection letter). This would encourage participation in the grant.

### Other Items Discussed:

- Jim Raymond to send the text/reference of the state regulation stating that if sewer is available and have a septic failure, cannot repair septic, must tie into sewer.
- Another source of pathogens could be FOG (fats, oils, and greases) from restaurants in Kershaw County. It was understood that at one point grease from grease traps had to be shipped to Aiken or Augusta for treatment. Due to the long distance, there is a risk of illegal dumping in the watershed (either on the ground or in storm drains or even in sewer manholes, which could result in SSOs). The extra time required to drive grease to Aiken or Augusta could cause delays in other homeowners getting their septic system pumped out. However, we are told that a company called Biocrude in Lugoff will accept grease. AMEC will conduct more research to determine whether this is a sufficient facility for acceptance and treatment of grease.
- Kershaw was awarded a grant to build a septic receiving station at the waste water treatment plant. Project is out for bid for construction.

Thank you again for your participation Thursday in the Septic Sources Brainstorm Session, we made great progress with your input! The remaining sessions we plan to hold include wildlife and a public meeting. Again, you are all more than welcome (encouraged) to come to any of the sessions. We will soon let you know when the Wildlife brainstorming meeting will be scheduled.

Please contact myself ([angela.vandelay@amec.com](mailto:angela.vandelay@amec.com)) or Kelli Resler ([katherine.resler@amec.com](mailto:katherine.resler@amec.com)) if you can think of anything else to add to this list that we have all developed. Also let us know if we have missed anything or if you have any questions/concerns.

Thanks,  
Angela

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All,

The Wildlife Brainstorm Session, held on April 17th, was attended by Dudley Britt (DNR), Johnny Stowe (DNR), Mary Calfish (Carolina Clear) and myself (AMEC) to discuss the issue of Wildlife in Twenty-five Mile Creek watershed. The following is a summary from the meeting.

### **Brochures**

Johnny and Dudley like the "Proper Carcass Disposal" brochure that Lexington County and AMEC created for Hollow Creek Watershed. However, they firmly believe that if some hunters do not have an accessible and legal place to dispose of carcasses, they may dump them illegally. They suggested that a similar brochure (which would need to be updated for Kershaw, Richland and Fairfield County landfill rules) be distributed at points of license (rather than only at the hunter education classes - which are heavily attended by young hunters, as well as at the Farmer's Market at Clemson Extension and Sparkleberry Fair. They also suggested that the DHEC brochure detailing how to build a gut pit be distributed as well.

### **Disposal Options**

Angela is looking into landfill options/costs/hours for disposal of carcasses by individuals. The permitting of the rendering facility in Lugoff was not approved by Kershaw County Council, so this will not be a disposal option.

### **DOT**

It was questioned where DOT puts the animal carcasses they remove from the sides of the roads. Angela talked to the Richland County DOT and Kershaw County DOT and learned that they dispose of carcasses in the municipal landfill on Screaming Eagle Road and Kershaw County landfill, respectively.

### **Hunt Clubs**

Johnny and Dudley do not believe that hunt clubs are a problem because many have their own gut pits for disposal. They believe that the "urban hunter" who may hunt on public or private lands, often on the weekend when landfills may be closed, is possibly the cause of illegal carcass dumping.

### **Deer Processors**

The question arose whether Deer Processors are permitted and/or inspected by DHEC. It was also questioned what deer processors do with the carcasses. Angela to find out.

### **Fishing**

It was mentioned that there are a lot of commercial fishermen on the Wateree River. It was also mentioned that DNR's Fisheries Department would be a good stakeholder, both for the carcass disposal issue and the macrinvertabrate issue in general.

### **Wild Hogs**

One of the biggest problems that SCDNR is having is wild hogs, which are reproducing at an exponential rate, have no natural enemies in SC, and carry 2 especially bad diseases (swine brucellosis and pseudorabies). Their habit of "wallowing in the mud" has a direct affect on water quality. DNR is strongly encouraging hunter to kill as many wild hogs as they can to control their population.

**Other wildlife**

Canada Geese, and racoons were also discussed.

**Other organizations**

SCWDS (Southeast Cooperative Wildlife Disease) has top notch scientists, vets and PhDs regarding diseases in wildlife, Wildlife Health Lab and APHIS (Animal & Plant Health Inspection Service) may also be resources.

If you have any additional ideas or questions regarding wildlife sources of fecal coliform or macroinvertebrate impairments in Twenty-five Mile Creek watershed, please let me know.

Thank you,

Angela

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To all attendees,

Thank you so much for attending the Twenty-Five Mile Creek Watershed public meeting(s) on April 17th and 18th, as well as for your interest and input in addressing the water quality issues in the watershed. Attached are the slides from the presentation, detailing the watershed characteristics, the impairments and how the watershed based plans will address the bacteria and macroinvertebrate impairments. The following list includes the input provided by all of the attendees at both public meetings. As we mentioned at one of the public meetings, the creek doesn't know County boundaries - it's all one watershed and we are developing the Watershed Based Plans with that perspective as well.

1. Dog Park at Lake Carolina - potential location for pet waste stations. If you know of other areas where dogs congregate, such as apartment complexes, please let us know.
2. Releasing water from Lake Carolina dam - concern about erosive flows.
3. It was mentioned that a lot of farms have closed in the watershed, such as the cotton industry. However, crop and livestock farms are still active and predominant in the watershed. We are working with the National Resource Conservation Service, Soil Water Conservation District, and US Farm Agency and are aware of quite a few farms in the watershed.
4. It was mentioned that animals (both wildlife and livestock) have lived in this watershed for a long time and a member of the audience felt that animals are not the cause of the impairments. Although it is true that animals have lived in the watershed for a long time, the problem that has arisen is how humans are affecting the animals' habitats and behaviors. For example, urban growth is concentrating wildlife in smaller, more congested areas, thereby increasing the concentration of bacteria in or near the streams. Also, larger concentration of livestock on smaller farms causes destabilization of vegetation and soil from the trampling of livestock. This causes erosion and faster transport of bacteria to the creek.
5. It was commented that shellfish, beavers and otters have been observed in Twenty-five Mile Creek.
6. A lot of timber clear-cutting is occurring, especially near Quail Creek Subdivision.
7. Two chicken farms were mentioned: Monroe Farms and Prestige Farms.
8. Concern was expressed about the former County landfill and the possibility that it is leaching into Twenty-five Mile Creek. Dana Reeder, Kershaw County Public Works Director, is aware of this issue. They are monitoring this area and are working with DHEC on any findings.
9. A few members of the audience have seen white foam in the creek. We encouraged the audience to call the County when they have suspicious observations in the creek such as this (likely surfactant) so that the County can come and investigate while it is occurring. The Richland and Kershaw Counties' and Town of Elgin's MS4 permit requires them to investigate potential illicit discharges. The Kershaw County number is: (803)425-7191. The Richland County number is: (803)929-6000.
10. While discussing septic issues in the County, the subject of the rendering facility that closed down in Lugoff was mentioned. At this time, it does not appear that this rendering facility is going to re-open. Kershaw County is looking into the possibility of upgrading their wastewater treatment plant to be able to accept grease (from grease traps at restaurants) in order to discourage illegal dumping of grease into sewer manholes or storm drains, etc. Currently, it appears that the closest facility that will accept grease is Augusta.
11. Dumping of carcasses was agreed to be an issue. A member of the audience suggested that wildlife cameras at bridge crossings (~\$100 each) would be an effective way to catch those who are doing it so that fines can be issued. It was also mentioned that signs with fines for illegal



dumping would help. This issue and the potential BMPs to prevent this problem can be addressed in the plans.

12. Several attendees were interested in receiving the DHEC Septic Maintenance Folder. We have mailed one to those who expressed interest and we've attached them to this e-mail. They are also available at the Elgin Library, Elgin Town Hall and Kershaw County Government Building in Camden. If you would like one mailed to you, please let me know. Several attendees were not aware that a septic tank needed to be pumped out unless/before there is a problem. DHEC recommends that a 1000 gallon tank in a house with 4 people be pumped out every 3 years (the table with recommendations for various tank sizes and occupancy is in the Septic System Homeowner's Guide). Pumping out a septic tank is a preventative maintenance task similar to changing the oil in your car, and if you don't do it regularly, it can result in a very costly repair or replacement. The topic was also brought up about sewer lines being extended to current septic areas. This is a financial and logistical decision that the County has to make.
13. It was mentioned that Coopers Pond neighborhood has sediment loading issues, and that a private property upstream was dumping their backhoes into Rhimer Pond. Again, when you see issues such as heavy sediment loads in a pond, please contact the County so that they can investigate. The Kershaw County number is: (803)425-7191. The Richland County number is: (803)929-6000.
14. It was mentioned that the pump station at Kelly Mill Road and Old Kelly Mill Road has a strong odor. Although an odor is not necessarily a sign that there are surface waters being polluted. However, this is the type of issue that should be reported to the County at the time of occurrence so that they can investigate.
15. It was commented that, although Kershaw County accepts almost everything at their recycle centers, Richland County is not as easy or willing to accept many recyclables.
16. It was also asked whether we would consider using volunteer monitoring, which of course we said yes; we will look into this matter.

Again, we strongly encourage you to report your concerns to the appropriate County! And, we thank you for your interest and input! We were able to get great information from you all to conduct additional research of pollutant sources in the watershed and potentially address these items in the watershed based plans. If you would like to provide more input about water quality concerns in the Twenty-five Mile Creek Watershed or gather more information about the grant, please feel free to contact me.

Also, Kershaw County plans to organize a **Citizen Advisory Group** for the Kershaw County and Town of Elgin MS4. If you are a resident or business owner in the Elgin area of Kershaw County and **would like to participate in the Citizen Advisory Group, please let me know.**

Thank you again for your input!

Angela Vandelay

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Dear Twenty-five Mile Creek Watershed Stakeholders,

Thank you again to those who could attend the Twenty-five Mile Creek Watershed stakeholder meeting on June 25<sup>th</sup>. Below is a summary of the meeting held on 6/25/13, including some action items for various stakeholders. An important date to mention is the **grant deadline of September 23<sup>rd</sup>** - both Watershed Based Plans must be finished before that date! We will be getting drafts of the WBPs out to the stakeholders in the next month or so for your review and input. We want to be sure to include concerns and proposed ideas for all three counties, so please take the time to read and provide input on the WBPs. DHEC was extremely pleased with the information that we have been able to gather (thanks to our stakeholders!) and with the cooperation among all of our stakeholders. Thank you again for all of your help!

### Macroinvertebrate Impairment

- Good news! DHEC has agreed to re-sample for macroinvertebrates in 25 Mile Creek at CW-080. Due to the rainy weather (resulting in abnormal creek levels), they are not sure whether they will be able to do so before the Watershed Based Plans need to be completed (September 23rd). But, because no TMDL has been written for macroinvertebrates in Twenty-five Mile Creek yet, this could potentially lead to the stream being delisted for macroinvertebrates prior to a TMDL being written (a very good thing). But, if the results confirm that it is still impaired, we will have written a solid plan for addressing likely macroinvertebrate sources.
- The former Lugoff Municipal Landfill was mentioned again as a potential source of the macroinvertebrate impairment. It is being monitored by DHEC and Kershaw County is involved.
- Dirt roads (and ditches along dirt roads with lacking vegetation) in KC may be contributing to macroinvertebrate impairment. May include sediment tubes and/or hydroseeding in WBP. Dana started using a ditching attachment to avoid ripping up vegetation when ditches are being cleaned out.
- Kershaw County will consider temperature and volume monitoring (outside of grant) to see how these may be affecting macroinvertebrates.

### Bacteria Impairment

- Include in WBP
  - public education about the need to pick-up turkey litter in Watershed Based Plan.
  - contacting realtors and home inspectors for recruitment of septic homeowners
  - cameras at road crossings to see who is dumping carcasses (in addition to signs with # to report). Seven Gaither says Fairfield uses "Groundhog" brand cameras. Palmetto Pride is a potential grant to pay for these
  - RC SWCD suggested a "Hog and Beaver Management" workshop to educate the public.
- Kershaw County is building a septic receiving station at their WWTP to accept septic (by the end of 2013) – currently septic waste has to be shipped to Florence or Aiken.
- Kershaw County accepts used cooking oil at recycle centers (Midlands Biofuel).

- Disposal of grease (from grease traps at restaurants) remains an issue (closest place to dispose is in Aiken). A rendering facility is supposed to open-up on Shop Road, but will likely take 2 years or more.
- Animal control (County?) incinerates for \$30/carcass. Screaming Eagle landfill will accept carcasses at the cost of \$60/carcass. Kershaw County C&D landfill will accept carcasses, but bad location (Cassett) and very limited hours (especially on the weekends when hunting occurs)

#### Action items for AMEC/stakeholders

- **AMEC** will investigate the Lake Carolina dam releases (procedure, consequences, necessity, etc)
- **Steven Gaither** will try to get monitoring results from Kennecott abandoned mine.
- **AMEC** has located the Kershaw County parcel data to complete the farm map using information provided by RC SWCD. AMEC (and **RC SWCD**?) will pursue crop farm and additional livestock farms from aerial and previous windshield survey for WBP.
- **Buddy Atkins** will pursue complete sewer/septic data for RC. We may be able to use the age of the building to determine potential septic areas. We can also use age of commercial buildings to determine areas built before SW regulations.
- Dana stated that there are approximately 800 sewer customers in the KC portion of 25 Mile Creek Watershed. **AMEC** is looking into a way to determine the total # of parcels with buildings so we can subtract the number of sewer customers to calculate the number of septic systems in the KC portion of the watershed.
- KC (**Dana Reeder/Russell Wright**) to provide locations of former lagoons and potential SSOs in the watershed.
- RC (**Quinton Epps**) to consider doing some monitoring in the NW portion of Richland County.
- **AMEC** to contact C. Ray Miles to ask if we can use his farm as a demonstration (perhaps video) to incorporate in WBP.
- **AMEC** to determine dates of hydraulic soil group used in septic/soils map (strange lines in soil type at County lines)
- **AMEC** will research all landfills in the 3 counties to determine all disposal options/costs/hours, etc
- **AMEC** to contact processors to learn how they dispose of carcasses.

Thank you,

Angela

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## **Appendix C**

### **2010 Stratton Hall Stream Assessment**

**KERSHAW COUNTY SWMP  
TECHNICAL MEMORANDUM 10-3  
STRATTON HALL STREAM STABILIZATION  
LUGOFF, SC**

An unnamed tributary to Twenty-five Mile Creek in the Stratton Hall neighborhood of Lugoff, SC is actively degrading between Wellington Drive and Cambridge Lane. If left alone, it will likely continue to degrade. Possible consequences include bank failure that could undermine power poles and fences, expose portions of a sanitary sewer line, cause loss of property, and degrade aquatic ecology. The following is a summary of observations made during a site visit and recommendations to improve stream stability.

Observations made during a site visit of the stream corridor on May 26, 2010 indicate that immediately downstream of Wellington Drive road crossing, the channel is deeply incised. There is evidence of past channel dredging along the back of the lots on Hampton Court. Excavated material appears to be deposited on top of the right bank (looking downstream). A sanitary sewer easement runs parallel to the stream on the right bank and power poles are located on the left bank through this upstream (US) reach. Riparian vegetation is primarily herbaceous as a result of utility easements being sprayed or mowed to keep them clear for maintenance crews. Aerial sewer laterals cross the creek to the main sewer line on the right side of the channel, which cause constrictions on the channel. Some yards adjacent to the stream have fences on top of the left bank.

The bed is primarily made up of clay, and some river gravel and cobble has fallen in from the banks to create some bed features. Bank material is primarily made up of three individual layers. The uppermost layer is comprised of organic coated sands. These overlay rounded river rock deposits, which overlay a clay layer. Fresh water seeps flow out of the clay near the boundary with the river rock. The channel bed is made up of clay and it is limiting or slowing the vertical degradation of the stream. Typical views of the upstream segment of this stream reach are highlighted in the following two photographs. Photo 1 illustrates the clay bed. Photo 2 illustrates the unstable vertical banks and layered bank materials. The river rock that falls in from these banks is transported downstream and is being distributed into new bed features.



**Photo 1**



**Photo 2**

In the middle segment of this stream reach, the channel starts to widen and bank heights start dropping. No more dredge material is evident on the top of the right bank. The left bank (looking downstream) opens up and has developed a more stable angle of repose. Riparian vegetation is still mostly herbaceous. Power poles shift from the left bank to the right bank in this section of stream. A typical view is shown in Photo 3. Note that the right bank is actively eroding and river rock covers the bed. Moving further downstream, the channel is starting to develop a gentle meander pattern in the low flow channel as evidenced in Photo 4. It is actively eroding portions of the right bank eating into yards and exposing power poles, as shown in Photo 5. Bank heights continue to drop in the downstream direction.



**Photo 3**



**Photo 4**



**Photo 5**

In the most downstream segment of this channel, the bank heights have dropped significantly, a new floodplain is forming within the widened channel and flows have slowed down where the slope has flattened out. Fine particles are accumulating in these areas. Power poles are on the right side of the stream channel. The sanitary sewer still runs along the right side of the stream channel, however, there is no easement over it in this segment and homeowners have placed utility buildings over the sanitary sewer line. Similar to upstream segments, several lots have fences at the top of bank along the back of their property. Riparian

vegetation is still primarily herbaceous. Typical photos of this segment are shown below. Photo 6 shows sheds over the sanitary sewer on the right side of the stream. Photo 7 shows the accumulation of fines in slack water areas. Vegetation is encroaching in the stream bed due to very low flow velocities and the presence of fine bed materials.



**Photo 6**



**Photo 7**

In summary, bank heights and channel slope are much steeper in the upstream segments of this reach and tend to drop or get flatter in the downstream direction. Channel width also increases in the downstream direction. Riparian vegetation is largely herbaceous due to mowing in the sanitary sewer easements, spraying under the power lines, and lawn from yards extending to the top of bank. Aerial sewer lines cause flow constrictions and in some cases debris jams. Some bank failures are noted, particularly in the upper and middle stream segments. These failures are due to either geotechnical instability of vertical banks or lateral migration of the stream channel as it dissipates energy and creates a new floodplain. Bed material changes over the length of this stream reach. It is dominantly clay in the upstream reaches. The clay is limiting the rate of vertical degradation of the stream bed. Sand, gravel and cobble that enters the upper reach is generally transported to the middle and lower stream reaches. The middle reach has more gravel and cobble deposits as the stream has less energy to transport these particle sizes due to decreasing slope. At the downstream limit of this stream reach, bed material is sandy with some gravel and organic matter. Because there are three distinct stages of channel evolution present in this study reach, the solutions applied to stabilize this stream reach must be tailored to address the unique causes and effects acting on these segments.

Potential solutions to address bank instability issues and protect property and utilities are as follows:

1. Create stable channel geometry suitable for each segment of stream within the reach from Wellington Drive to Cambridge Lane.
  - a. In the upper stream reach where space is limited, structures (such as a crib wall or rock structure) or bioengineering (soil wrapping and planting) may be required to stabilize banks.
  - b. Where there is room, lay back the banks to a stable angle, create a floodplain, and vegetate using woody, native vegetation to the maximum extent practicable.

- c. Install some grade control structures, such as log or rock vanes with energy dissipaters, to prevent further vertical degradation of the stream bed.
    - d. Create stable planform geometry for a meandering low flow channel in low slope areas.
  2. Move power lines exposed or threatened by channel erosion. It may also help to move power poles in order to install bank protection or lay back banks to a stable angle.
  3. Educate stakeholders using this corridor about the role of riparian vegetation, the importance of not dumping yard waste or slash into the stream channel, and channel processes that could affect their property or the utilities within this corridor. This includes residents, the power company, and the sanitary sewer maintenance crew.
  4. Where there is landowner cooperation, move some fences to create space for stream stabilization activities.
  5. Control stormwater runoff from the contributing watershed by incorporating stormwater best management practices (BMPs) in new development and retrofit BMPs in existing developments when opportunities arise.

**The following grant opportunities are possible sources of funds for the stream stabilization:**

1. **National Fish and Wildlife Foundation - Five Star Restoration Matching Grants Program.** Request for Proposals is expected in October with proposals due in February. Grant amounts are \$10,000 to \$40,000 (typically in \$20,000 to \$25,000 range in South Carolina). Partnerships are required with at least 5 organizations. No matching is required, but is strongly encouraged to have at least a 1:1 match, and competitive projects often have 2:1 match (including in-kind match). Five Star grants provide modest financial assistance on a competitive basis to support community-based wetland, riparian, and coastal habitat restoration projects that build diverse partnerships and foster local natural resource stewardship through education, outreach and training activities. For 2010, there is a new emphasis on urban projects. Contact information is: Lacy Reimer Alison, lacy.alison@nfwf.org, National Fish and Wildlife Foundation, 1133 15th Street, NW, Suite 1100, Washington, SD 20005, (202) 857-0166.
1. **South Carolina Department of Health and Environmental Control (SCDHEC) Section 319 Non-Point Source Grants.** According to recent conversations with SCDHEC, they do not look favorably on stream stabilization projects alone for 319 Grants. It is possible that a stream stabilization project could be approved as a part of an "Implementation of a Watershed-Based Plan" for an impaired watershed. The Twenty-five Mile Creek has an approved Total Maximum Daily Load (TMDL), which is a higher priority to the grant committee over impaired waterbodies with no approved TMDL. The Twenty-five Mile Creek TMDL requires a 71 % reduction in the existing fecal coliform load to the creek. According to the TMDL, the non-point sources contributing to the load are primarily wildlife, land application of manure, grazing animals and failing septic systems. It would be a worthwhile conversation to approach SCDHEC about an implementation project including this stream restoration project.



Request for Proposals is expected in December with proposals due in February. Grant amounts vary widely, but implementation projects average around \$300,000. A 40% match (including in-kind donations) is required. 319 Grants provide financial assistance for Nonpoint Source (NPS) Water Pollution Control Projects that reduce NPS contributions to South Carolina waterbodies. Contact information is: Meredith Murphy, [murphymb@dhec.sc.gov](mailto:murphymb@dhec.sc.gov), SCDHEC Bureau of Water, SC Nonpoint Source Coordinator, Division of Water Quality 2600 Bull Street, Columbia, SC 29201, (803)898-4222.

DRAFT

## **Appendix D**

### **SCDHEC Wastewater Sampling SOP**

## SECTION 7 WASTEWATER FACILITY AND AMBIENT MONITORING

### SECTION OBJECTIVES:

- To provide guidance for the proper collection of wastewater facility and ambient monitoring samples.
- To provide guidance for ensuring that the sample collected is representative of the material or medium being sampled;
- To provide guidance for sample handling and preservation techniques;
- To provide guidance for properly identifying the collected samples and documenting their collection in permanent field records;

### 7.1 Introduction

This guidance is for *routine* sampling of wastewater treatment facilities and ambient monitoring. Special studies require an approved study plan. The wide variety of conditions existing at different wastewater treatment facilities always requires that some judgment be made regarding the methodology and procedure for collection of representative samples of the wastewater. There are, however, basic rules and precautions generally applicable to all wastewater sample collection.

### 7.2 Preparation and General Considerations

Proper planning for sampling of a treatment facility is essential to ensure that the facility is sampled correctly. Some important considerations are as follows:

- Selection of the facility to be sampled. (Consult monitoring schedule and/or regional office water pollution manager).
- Coordination with laboratory supervisor and facility evaluator. Sampling staff work schedules may have to be adjusted to insure samples are received by the Lab within the allowable holding times and other lab procedures.
- Review of all existing data from the National Pollutant Discharge Elimination System (NPDES) permit or other permit, facility evaluations, enforcement orders, etc. including Water Pollution Control (WPC) views, Environmental Facility Information System (EFIS), maps of sampling locations, etc.
- Performance of field reconnaissance, if needed, or consultation with personnel having knowledge of the facility that is scheduled.

- Preparation of a work schedule as to what equipment is needed and what parameters will be sampled (NPDES or other permit should always be available in the field).
- The necessary equipment should be inspected for cleanliness and made sure that the said equipment is in proper working order before leaving the Region office.
- Consider weather forecast and possible affects on sampling (ask operators about flow increases due to inflow and infiltration).
- Before installation of sampling equipment, the owner/ operator should be notified. Split sampling should be encouraged with the owner/operator except in the cases of unannounced inspections.
- Each parameter to be sampled, as described in the NPDES or other permit, should be appropriately collected in the proper container, properly preserved, and the sample chain-of-custody maintained.
- When collecting samples or installing sampling equipment, field investigators always wear a new pair of the appropriate protective gloves (disposable latex gloves, rubber gloves, etc.) to prevent contamination of the sample and reduce exposure.
- At no time shall sampling equipment other than DHEC's be used for sample collection to determine permit compliance.

The above mentioned considerations are applicable to all facility sampling. It should be standard practice before entering into a facility sampling activity that all personnel involved have reviewed the above points.

### 7.3 Site Selection

Routine wastewater facility samples should be collected at the location(s) specified in the NPDES permit. Documentation, such as a map indicating the approved sampling locations, should be retained to insure samples are collected at proper locations. Some considerations for obtaining a representative wastewater sample include the collection of the sample where the wastewater is well-mixed, the collection of the sample at or near the center of the flow channel, and the collection of the sample at approximately 40 to 60 percent of the water depth where turbulence is at a maximum and the possibility of solids settling is minimized. Skimming of the water surface or dragging the channel bottom with the sampling probe should be avoided. However, allowances should be made for fluctuations in water depth due to flow variations. In some instances, the sampling location specified in the permit, or the location chosen by the permittee, may not be adequate for the collection of a representative wastewater sample. In such cases, the field investigator should collect a representative sample at the point that the investigator feels is best in addition to the location specified in the permit. Record any deviations in the field log book. When chlorination is used for disinfection, TRC samples must be taken at the end of the disinfection process, prior to dechlorination (as well as specified by the permit). If flow is split **between** two or more chlorine contact chambers before chlorine is added, then TRC residual should be checked in each contact chambers (not just after the flow recombines). **This should be done each time that a fecal coliform sample is taken.** Samples for **Toxicity** testing should be taken at or as close to the discharge point as possible, and may include effluent from multiple outfalls if 2 or more outfalls mix before being discharged. Documentation should be entered in the field logbook. If no site is specified in the permit, samples should be collected at the last accessible

representative site following the final treatment process and prior to discharge to the receiving stream. At certain facilities, additional measures may have to be employed to obtain samples in areas of limited access. Recommendations for any changes in sampling location should be given to the appropriate permitting division in the Central Office.

#### 7.3.1 Influent:

Preferably, influent wastewaters are sampled at points of highly turbulent flow in order to insure proper mixing. However, in many cases the most desirable location is not accessible. In all cases, samples should be collected upstream from any recirculated plant supernatant and sludges and the sample collected should be completely untreated.

#### 7.3.2 Effluent:

Effluent samples should be collected at the site specified in the permit, or if no site is specified in the permit, at the most representative site downstream from all entering wastewater streams prior to discharge into the receiving waters. If a conflict exists between the permittee and inspector regarding the source being sampled or the location of the most representative site, follow the procedures previously described under "Site Selection".

#### 7.3.3 Ambient Monitoring (Surface Water) Sampling Site Selection:

Streams and lakes are monitored routinely at specified locations. Care must be taken to locate the exact location using landmarks such as marker buoys or bridge mid-points. In streams, the samples must be taken from an area that is well mixed and where the stream is deep enough to submerge sampling equipment. Unless predetermined stations have been established then the location is to be recorded as percent from right bank.

The following factors should be considered in the selection of surface water sampling locations:

- Study objectives;
- Water use;
- Point source discharges;
- Nonpoint source discharges;
- Tributary locations;
- Changes in stream characteristics;
- Type of stream bed;
- Depth of stream;
- Turbulence;
- Presence of structures (weirs, dams, etc.);
- Accessibility; and
- Tidal effect (estuarine).

Before any sampling is conducted, an initial reconnaissance should be made to locate suitable sampling locations. Bridges and piers are normally good choices as sites since they provide ready access and permit water sampling at any point across the width of the water body. However, these structures may alter the nature of water flow and thus influence sediment deposition or scouring. Additionally, bridges and piers are not always located in desirable locations with reference to waste sources, tributaries, etc. Wading for water samples in lakes, ponds, and slow-moving rivers and streams must be done with caution since bottom deposits are easily disturbed, thereby resulting in increased sediments in the overlying water column. On the

other hand, wadeable areas may be best for sediment sampling. In slow-moving or deep water, a boat is usually required for sampling. Sampling station locations can be chosen without regard to other means of access if the stream is navigable by boat, especially in estuarine systems where boats frequently provide the only access to critical sampling locations.

Water environments are commonly separated into two types:

- Flowing water, including estuarine environments, rivers, creeks, and small to intermittent streams; and
- Water that is contained, with restricted flow including lakes, ponds, and manmade impoundments.

#### 7.3.4 Ambient Water Quality Monitoring Locations:

A network of ambient monitoring stations has been established throughout South Carolina to assess water quality trends across the State. Specific sampling stations, their locations, and parametric coverage at those stations are presented annually in the State of South Carolina Monitoring Strategy (12).

In addition to ambient water quality monitoring, the guidelines and methodologies presented in this manual are followed for intensive water quality surveys, lake studies, and any other special water quality studies conducted by DHEC.

In order for the ambient stations to be monitored effectively, proper planning and organization is necessary throughout the sampling program. Guidelines presented here will not only assist monitoring personnel in meeting their responsibilities but also will provide consistency in sampling procedures throughout the State.

## 7.4 Sample Types

Sample types include split, duplicate, blank, grab, and composite. For NPDES sampling, two types of sampling techniques are used: grab and composite. For these procedures, the NPDES permit specifies the appropriate sample type. The NPDES permit should be carefully reviewed for the proper sampling type, location and time period specified before setting up the sampler. A complete description of all NPDES sampling procedures and techniques is presented in the NPDES Compliance Inspection Manual (1).

### 7.4.1 Split Sample

A split sample is any effluent, stream, sediment, or other media sample that is divided with a facility owner, facility operator, other regulatory agency personnel, or any other person that is not associated with DHEC. Split samples should always be offered to the responsible party's representative when present. In order to protect the integrity of the split sample, the following procedure must be followed:

There must be an adequate volume of sample before a split can be made. It may be necessary for the other party to request a split in advance of the sampler set-up in order to insure this. No additional sample can be added to a composite once the sampling cycle has been initiated and/or completed. A signature of acceptance must be obtained from the party receiving the sample before the split sample is released. If the party or representative that is requesting the split sample is not present to receive the sample and provide the necessary signature, then no samples will be split. The signature of the party must be placed in the Comments Section of the Field Quality Control Logbook, along with the date, time, type of sample that is split, and

identification of the party's association with the split sample (e.g., agency name, facility name, consulting firm). If split samples are analyzed on-site for insitu parameters such as pH and residual chlorine, the other party should be observed whenever possible to insure proper analytical procedures are being performed. The results by both parties should be recorded in the field logbook. **Only DHEC results should be recorded on the inspection chain of custody form.** All samples can be split except for those parameters noted in the following section.

#### 7.4.2 Split Samples for Bacteria

Typically split samples for bacteria are not provided, but a duplicate sample may be offered. If the permittee or other party insists on splitting a bacteria sample, the following procedure may be used with proper advance arrangements:

Split samples for fecal coliform bacteriological testing must be taken from a sterilized DHEC sample container only. Proper procedures are:

1. Collect the routine fecal coliform sample using a sterile 250ml bottle containing declorinating agent.
2. Shake the sample thoroughly by inverting back and forth at least 25 times to insure complete mixing of the contents.
3. Transfer sample into two (2) 125 ml disposable sterilized containers containing declorinating agent.
4. One bottle may be given to the facility representative requesting the split sample. The facility representative must sign in the field logbook before receiving the split sample from the DHEC inspector.
5. Follow routine procedures for preserving and transporting sample back to the lab.

#### 7.4.3 Duplicate Samples

A duplicate sample is two or more samples collected from the same source at the same time. The following is a list of parameters that, if requested as a split sample, must be collected as a grab sample and described in the Field Quality Control Logbook as a duplicate sample:

Sulfide  
Oil and Grease  
Organic Halides  
Purgeable Organics (Volatile Organics)  
Bacteria (see 7.4.2 for special split samples)

#### 7.4.4 Field Blank Samples

DHEC uses two types of field blank samples. The first type, which is for ambient sampling for volatile organics, is a blank sample that is collected from the laboratory deionized water system carried into the field as a sample and returned to the Laboratory for analyses. The second type of field blank sample consists of deionized water that is taken into the field in a properly cleaned glass container. This type of blank is for organic sampling at treatment facilities. From this deionized water, a portion is pumped through the wastewater sampler and discarded. The remaining portion of deionized water is then pumped through the sampler and collected into the particular organic sample container specific to the analyses to be conducted.

#### 7.4.5 Grab Samples

A grab sample is a discrete sample collected at a specific point and at a particular instance in time.

Grab samples are:

- used to characterize the medium or material at a particular instant in time; and,
- always associated with instantaneous wastewater flow data.

Grab sampling is conducted when:

- specified by the NPDES permit
- the water or wastewater stream is not continuous (e.g., batch discharges or intermittent flow);
- the characteristics of the water or waste stream are known to be constant or nearly so;
- the sample is to be analyzed for parameters whose characteristics are likely to change significantly with time, i.e., dissolved gases, bacteria, etc.;
- the sample is to be collected for analysis of a parameter such as oil and grease where the compositing process could significantly affect the observed concentration relative to the true concentration; and,
- data on maximum/minimum concentrations are desired for a continuous wastewater stream.

Samples that will always be collected as a grab type and parameters that will always be analyzed from such include:

pH  
Temperature  
Dissolved Oxygen  
Sulfide  
Cyanide  
Total Phenol  
Volatile Organics  
Organic Halides  
Ortho Phosphorus  
Hexavalent Chromium  
Phenol  
Oil and Grease  
Bacteria  
Chlorine Residual  
Salinity  
Specific Conductance  
Total Dissolved Phosphorus  
Dissolved Metals



Except where otherwise specified in Section 7.7(Special Sample Collection Procedures), grab samples may be collected by submersing the sample container in the waste stream, catching effluent as it flows over a weir, using a composite sampler set for continuous flow. When possible, the sample should be collected directly into the appropriate sample container. The container should not be overfilled if preservatives are present in the container. If the material to be sampled cannot be physically reached, an intermediate collection device may be used. When the sample container must be lowered into the waste stream, either because of safety or impracticality (manhole, slippery effluent area, etc.), care must be taken to avoid contamination. The most desirable sampling location is the area of greatest mixing. Quiescent areas should be avoided. The sample container should be plunged into the wastewater using a swooping motion with the mouth facing upstream

When analyzing grab samples in the field, holding times, usually fifteen (15) minutes, must be adhered to. The time the sample is collected and the time the sample is actually analyzed must be noted in the logbook and field lab form. Although one sample maybe collected for use in several analyses, if all tests cannot be completed within the holding time allowed, then another sample must be collected and times documented separately.

## **7.5 Manual Stream Sampling**

Manual sampling is normally used for collecting grab stream samples and/or for immediate in-situ field analyses. The best method to manually collect a sample is to use the actual sample container which will be used to transport the sample to the laboratory; this eliminates the possibility of contaminating the sample with an intermediate collection container. In general, samples are manually collected by first selecting a location in the stream that is well mixed and then dipping the container in the water so the mouth of the container faces upstream. The container should not be overfilled if preservatives are present in the container.

If the stream cannot be physically reached by the sampling personnel, an intermediate collection container can be used. The sample is then collected by lowering a properly cleaned plastic, glass, or stainless steel container (type of container used depends on the parameter being sampled) into the water to be sampled. If this is done, however, the container used to collect the sample must be properly cleaned (Appendix B.2.2) and must be made of a material that meets the requirements of the parameter(s) being investigated. The container may be attached to a pole, chain, rope, or string and then lowered into the stream. Samples are collected manually by tipping the collection container in the stream to a depth of 0.3 meters. Samples for oil and grease, bacteria, phenols, volatile organic compounds, and sulfides analyses must always be collected directly into the sample container.

The most widely used piece of equipment used for collecting grab samples is a dissolved oxygen (D.O.) dunker. A D.O. dunker consists of a stainless steel bucket with a removable top that has at least one, generally two, filler holes with rubber tubing that should extend to the bottom of the dunker.

During sample collection, the collection container should be allowed to submerge to approximately 0.3 meters below the water surface until it fills completely. Care should be taken not to allow the collection container to disturb the sediment in shallow streams to preclude introduction of solids into the sample. The collection container should be rinsed thoroughly with deionized water after each sample is collected to avoid transferring pollutants from one sample to another sample.

### **7.5.1 Preparation and Sample Collection:**

When preparing for stream or lake monitoring sample collection, the collector should organize a list of those stations to be sampled and the parameters required for each station. All necessary sample containers should be obtained with care taken to select the proper containers for the parameters required. If pre-labeled, the containers can be segregated, by station, and placed in the sampling vehicle so they will be convenient to the collector during the sample collection. Sample containers as well as sampling equipment should be

secured and controlled access maintained to prevent contamination or tampering. It is recommended that extra containers be kept in the vehicle in case of accidental loss or breakage of the prepared containers. A quantity of ice sufficient to keep the samples at or below the required 6°C should be in each cooler used to transport the samples back to the laboratory. Bacteria samples should be preserved in a separate cooler (i.e., Little Oscar or other small cooler) to prevent contact and/or contamination through submergence of the sample bottle in water. All nutrients, metals, mercury, chlorides, and bacteria sample bottles will be placed in Whirl-Pak bags or zip lock plastic bags at the time of collection. The bags should be securely sealed, and the sample will then be preserved in ice at 6°C. Bags will be reused and discarded only when they can no longer be securely sealed or become punctured. No sample bottle should ever be allowed to become submerged in water within a cooler. Dirty coolers should be cleaned following procedures in Appendix C.5.9.

When sampling any stream station, the sample should be collected from an area in the stream that is well mixed and where the stream is deep enough to submerge sampling equipment. Unless predetermined stations have been established then the location is to be recorded as percent from right bank. For sampling purposes, the right bank is observed when facing upstream at the sampling site.

Bacteriological, organic, and oil and grease samples must be collected from the stream directly into their respective containers. These containers are specially prepared and the investigator must be careful not to contaminate the sample bottle by touching the inside of the container or the inside of the lid of the container. If the stream cannot be physically reached by the sampling personnel, the container may be attached to a pole, chain, rope, or string and then lowered into the stream.

Once the samples have been collected, those requiring laboratory analyses should be mixed thoroughly and poured into the proper bottles and preservatives added as required. Proper preservation for samples is discussed in **Appendix A**.

#### 7.5.2 Profile Sampling:

The procedure outlined here will provide acceptable techniques and consistency for profiling water quality parameters. Profile sampling is conducted by DHEC on selected lakes, reservoirs and marine stations and some large river locations throughout the State. The purpose of profile sampling is to evaluate the quality of the water column being sampled.

Profile readings for field parameters should start at the top (0.3 meters) of the water column and descend at one meter intervals from the surface to the bottom. The bottom depth should be recorded to the nearest half-meter, i.e., 3.5 meters. At each measurement (each meter) at least one minute is required for the meter probes to equilibrate. The sampling times that are recorded for profile sampling must be in ascending order, i.e., 10:00, 10:01, 10:02 (see Section 19.4.6 for example of profile sheet). At selected secondary stream stations and during selected special studies, profile data are required at the top, middle and bottom of the water column. In these cases it is necessary to determine the bottom depth before profile measurements can begin at the top of the water column. The middle depth should be recorded to the nearest half-meter.

If it is necessary to add additional weight for the probes to overcome water currents, an independent suspension cable must be used. When additional weights are used while profiling for conductivity/salinity, care must be taken to keep the weights at least 6 inches away from the probe.

### 7.6 Composite Samples

A **composite sample** is usually associated with wastewater treatment facility sampling. The following guidance is given for the use of composite samples:

1. Composite samples are used when:
  - required by the NPDES permit
  - average constituent or waste concentrations are of interest; and,
  - always associated with continuous flow data.
  - the wastewater stream is continuous;
  - it is necessary to calculate mass per unit time loadings;
  - analytical capabilities are limited.

There are two types of composite samples: those composited by time and those composited by flow. DHEC uses three major compositing procedures at wastewater treatment facilities. These three procedures are automatic flow proportional, time composite, and manual flow proportional.

#### 7.6.1 Flow Proportional Composite Sampling:

For DHEC purposes a **flow proportional composite** sample is usually collected over a 24-hour period and contains a number of discrete samples with constant volumes collected at a frequency proportional to the flow rate during the compositing time. Routine facility composite sampling is commonly flow proportional.

1. A flow proportional composite sample is used when:
  - Required by the permit
  - wastewater flow is highly variable (greater than +/-15 percent of the average daily flow).
2. A flow proportional composite sample will be collected as follows:
  - continuously and proportional to the waste stream flow;
  - with constant sample volume and the time between samples proportional to waste stream flow; or,
  - with a constant time interval between samples and a sample volume proportional to flow at the time of sampling.
  - A flow meter is used in conjunction with the automatic sampler to initiate the sample collection at a frequency proportional to the flow rate. The flow meter and sampler program times are synchronized to start at the same time. Start times can be programmed into the sampler to achieve this. The internal clocks for both devices should match.

#### 7.6.2 Use of Automatic Samplers:

Automatic samplers may be used to collect composite or grab samples when several aliquots are to be collected at frequent intervals or when a continuous sample is required. For composite sampling applications, the automatic samplers may be used to collect time composite or flow proportional samples. In the flow proportional mode, the samplers are activated by a compatible flow meter. Flow proportional samples can also be collected using an automatic sampler equipped with multiple containers and manually compositing the individual sample portions proportional to the flow (1) (see Section 7.6.7). However, in most cases this method is no longer used as “Discrete” automatic samplers have been replaced with “Composite” samplers that are programmed in conjunction with a flow meter to properly flow-proportion the collection in the field.

Prior to leaving the region office it is important to check the automatic sampler and related appurtenances for proper operation and complete components. Batteries, if needed, should be fully charged. Locks, cables, security tape, etc. should be available.

### Maintenance

The fuse for the ISCO sampler should be checked before and after each sampling. Also, a desiccant is located on the side or top of the instrument panel. This desiccant is originally blue and should be checked each time the sampler is used. If the desiccant should turn pinkish in color, replace with fresh desiccant. Desiccant can be renewed by drying in a drying oven at 103°C to 105°C overnight. The desiccant should be allowed to cool in an airtight container before use. The 12-volt batteries to be used with the sampler; should be checked prior to leaving the office. If facility power is to be used, every effort should be made to guard against accidental or intentional power disruption.

After each sampling activity the ISCO automatic sampler should be thoroughly cleaned and the operation checked (forward, reverse, auto, etc.) the same day that it is returned to the laboratory. When the sampler is not in use it should be stored in an environmentally-controlled atmosphere.

During each field trip, prior to initiating the automatic sampler, the rinse and purge-pump-purge cycle shall be checked at least once. The pumping volume should be checked at least once using a graduated cylinder or other calibrated container prior to initiating the sampler. For flow proportional sampling, the flow pacer that activates the sampler should be checked to insure that it operates properly.

Upon return from a field trip, the structural integrity of the sampler should be examined and repaired, if necessary. The desiccant will be checked and replaced, if needed. The operation (forward, reverse, automatic, etc.) will be checked and any required repairs will be made and documented.

Specific operating instructions, capabilities, capacities, and other pertinent information for automatic samplers are included in the Programming Guides for ISCO Flow Meters and Samplers (2) available in each regional office, or the respective operating manuals. These manuals should be kept for reference (3). Manuals may also be obtained from the ISCO website: <http://www.isco.com/products>

Due to the heavy workload of wastewater monitoring and the adaptability of automatic samplers to many sampling requirements, these automatic samplers are used extensively. Automatic samplers presently being used by DHEC include ISCO model 2710 and 3710 samplers, but older models may still be available as back-up units.

Volume calibrations must be performed during the initial setup at each facility to ensure that at least 100 ml's of sample is collected per sample, that bottles will not overflow, that sufficient sample is available for manual flow proportioned composites, and that aliquot volumes are known to determine total volume and frequency of sample collections from ISCO 1870, 2870 and 3230 flow meters. Graduated cylinders should be used to perform volume calibrations. **Calibrations must be entered in the Field Quality Control Logbook** (see Section 8.15.7). Once the composite sample has been collected at wastewater facilities, the temperature must be read in the field and recorded in the appropriate space provided in the field logbook.

Automatic flow proportional composite sampling is currently being accomplished by use of the ISCO flow meters in conjunction with ISCO automatic samplers. The Stevens flow recorder is no longer used. When using the Model 2870, 3230 or 4230 flow meter, the ISCO sampler is triggered through an electronic pulse to collect a pre-determined volume of sample after a variable time for which a certain flow has passed a reference point. Samples are to be collected over the entire period indicated by the NPDES permit. Standard procedure is to collect at least 100 ml's of sample per aliquot. For compliance purposes, a guideline of collecting approximately 50 sample aliquots with a volume of between 100ml and 150 ml per aliquot would provide sufficient volume and representativeness of sample (provides approximately two

gallons of sample). **The sample period must match the required period specified in the permit (e.g. 24 hours).** However, for guidance, if it can be determined that the sampler will not collect another sample before the full 24-hour period is reached, the sampler can be robbed early. Otherwise, the full 24-hour period (or as specified by the permit) for sample collection should be observed.

In order to prevent the automatic sampler from continuing to run after the 24-hours or other desired time, an alternate shut-off procedure has been developed. This will allow for the complete sampling period to be completed in accordance with the permit, and allow some extra time for personnel to get to the site to retrieve the samples. This guidance document should be available in each regional office.

Once programmed and the sampler started, it should run on its own, automatically collecting flow-proportioned samples. It is not necessary to collect an initial manual sample at the beginning of the cycle.

The actual number of individual samples or aliquots retrieved over the specified collection time must be recorded in the Field Quality Control Logbook (see Section 19.4.6). Likewise, the volume of the individual samples must be obtained and recorded in the field logbook. The compositing frequency in gallons must be obtained by dividing the average daily flow (based on flow records, operator input, weather forecasts) by the number of individual samples or aliquots desired (in our case, approximately 50). The compositing frequency must be entered in the field logbook. The nominal volume of the collection container and its material must be noted (e.g. glass or plastic and its size). The sampler identification or SCDHEC Asset Number is to be included in the logbook.

For additional information on automatic compositing procedures, refer to the various ISCO instruction manuals (5,6,7) or at their website: <http://www.isco.com/products>. Instructions for use of flow meters associated with composite sampling are in Section 16.

The automatic sampler should be checked against the manufacturer's specifications and documented whenever one or more of the sampler functions appears to be operating improperly.

Automatic samplers must meet the following requirements:

- Sampling equipment must be properly cleaned to avoid cross-contamination which could result from prior use (see Section Appendix C for cleaning procedures).
- No plastic or metal parts of the sampler shall come in contact with the water or wastewater stream when parameters to be analyzed could be impacted by these materials.
- The automatic sampler must be capable of providing adequate refrigeration during the sampling period. This can be accomplished in the field by using ice and shade covers when necessary.
- The automatic sampler must be able to collect a large enough sample for all parameter analyses.
- The individual sample aliquot must be at least 100 milliliters. (Reference 12)
- The automatic sampler should be capable of providing a lift of at least 20 feet and the sampler should be adjustable since the volume is a function of the pumping head.
- The pumping velocity must be at least 2 ft/sec to transport solids and not allow solids to settle.

- The intake line leading to the pump must be purged before each sample is collected and sloped away from the sampler to minimize any sagging in the line that would prevent proper draining. The tubing should be appropriately secured to railing, etc. where necessary.
- The minimum inside diameter of the intake line should be 1/4 inch.
- An adequate power source should be available to operate the sampler for the time required to complete the project. Facility electrical outlets may be used if available.

### 7.6.3 Conventional Sampling (Inorganic Parameters):

Conventional sampling includes all inorganic parameters (e.g., BOD<sub>5</sub>, TSS, COD, nutrients, and metals) that can be collected using an automatic sampler.

New tubing (Silastic, or equal, in the pump and either Teflon or Tygon, or equal, in the sample train) -must be used for any municipal or industrial compliance sampling inspection.

Installation procedures include cutting the proper length of tubing, positioning it in the wastewater stream, and sampler programming. Protective gloves should be worn to reduce exposure and to maintain the integrity of the sample.

For a flow proportional sample, the sampler should be programmed to collect a minimum of 100 milliliters for each sample aliquot with the interval predetermined based on the flow of the monitored wastewater stream.

At the end of the compositing period, the sample collected should be properly mixed and transferred into the respective containers, followed by immediate preservation, if required. For routine inspections, the permittee should be offered a split sample.

### 7.6.4 Low Level Metals:

When an automatic sampler is used for collecting samples for low level metals analyses in addition to extractable organics, the entire sampler collection system should be rinsed with organic/analyte-free water, and an equipment blank should be collected for metals and organics. Approximately one gallon of rinse water should be pumped through the sample tubing into the composite container and discarded. Nitric acid must be added to the metals blank container for proper preservation. The sampler may then be positioned in the appropriate location and the sampler program initiated.

If the sampler tubing is attached to a metal conduit pipe, the sampler intake tubing should be carefully installed upstream and away from the conduit to prevent metals contamination. This can be accomplished by clamping the tubing upstream of the conduit using laboratory clamps and wrapping the submerged portion of conduit pipe with a protective barrier (e.g., duct tape). **Currently, SCDHEC does not have the capability to collect and analyze samples for low level metals.**

### 7.6.5 Extractable Organic Compounds, Pesticides, and PCBs:

When an automatic sampler is used for collecting samples for the analyses of extractable organic compounds, pesticides, and/or PCBs, the installation procedures include cutting the proper length of new Teflon<sup>7</sup> tubing, rinsing of the entire sampler collection system with organic/analyte free water, and collection of appropriate blanks for organic compounds analysis. For quality control of composite samples that are to be

collected for organic analyses, a blank must be collected prior to beginning sampling. The following procedure is to be used when collecting the blank sample:

1. Approximately two and one-half gallons of deionized water must be taken into the field in a properly cleaned container (see Appendix C for cleaning procedures for organic sample containers) capped with aluminum foil.
2. Once the sampler has been set up at the sampling site, pump approximately two gallons of deionized water through the sampler and discard.
3. The remainder of deionized water (approximately one-half gallon) should then be pumped into the sampling container that is being used during the sampling inspection. This deionized water will be used for the blank samples. If sequential bottles are used, it will be assumed that all bottles are clean and only enough bottles needed to collect the necessary blank samples should be used.
4. The deionized water should then be decanted into the particular organic sample containers specific to the analyses to be conducted.
5. The blank sample should be iced immediately and returned to the laboratory for analyses of the organic parameters on the NPDES or other discharge permit.

#### 7.6.6 Time Composite Sampling:

A time composite sample is one containing a number of equal-volume discrete samples taken at equal time intervals over the compositing period as specified by the NPDES permit. The time composite definition is sometimes used where water or wastewater flows do not vary more than  $\pm 15$  percent of the average daily flow rate.

1. Time composite samples will be used where wastewater flows are constant or are considered for all practical purposes to be constant. (within  $\pm 15\%$  of average daily flow)
2. A time composite sample will be collected as follows:
  - continuously; or,
  - with constant sample volume and a constant time interval between samples.

The time composite procedure is conducted using various model ISCO samplers with constant sample volume and a constant time interval between samples, usually one sample per hour over the time period specified in the permit. For time composite sample, the sampler should be programmed to collect at least 100-milliliter aliquots at a frequency that provides a representative sample and enough sample volume to conduct all required analyses. The compositing frequency in minutes must be recorded in the Field Quality Control Logbook (see Section 19.4.6).

#### 7.6.7 Manual Flow Proportional Sampling:

For special studies, process control evaluations, criminal investigations or identification of possible unpermitted activities, etc., manual flow proportional samples using a “discrete or sequential” sampler may be collected. The automatic sampler is fitted with 24 individual bottles that allow observation of individual aliquots throughout the sampling period. The following is a step-by-step procedure for manual flow proportional sampling using a recording flow meter and an ISCO automatic sampler with sequential bottles:

### First Day Procedures

1. Automatic sampler and flow recorder should be installed at the proper sampling location. Calibrate the sample volume to ensure adequate sample for compositing.
2. The sampling sequence and flow recorder should start at the same time. This is very important, as each sample volume is based on the flow at the time it was collected.
3. Initiate sample No. 1 at the time the sampler is installed. You will need to return after 23 hours to service the sampler and composite the samples. At that time there should be a total of 24 samples.

### Second and Third Day Procedures

1. Switch the automatic sampler to the OFF position.
2. Remove the flow chart from the recorder. Determine each hourly head/flow reading that corresponds with each sample. Find the instantaneous flow for each hourly sample. Sum these instantaneous flow volumes to obtain the total daily flow.
3. Using the instantaneous hourly flow in million gallons per day (mgd), divide by the total daily flow in mgd. Once this fraction has been determined for all twenty-four hourly flows then multiply by the total volume that is desired. This multiplication must be performed for each hourly instantaneous flow to produce the volume of sample for that sample aliquot.
4. Each of the determined volumes of the collected samples are combined to produce the manual flow proportioned composite sample. The individual samples must be thoroughly mixed before pouring the aliquots into the composite container.
5. Discard any excess sample, rinse sample collection bottles if needed and return to the automatic sampler. Repeat sampling procedure on the third day making certain to start sampler and flow recorder at the same time.

#### 7.6.8 Automatic Sampler Security:

Field investigators should take whatever steps are necessary to prevent tampering with DHEC equipment. A lock or custody seal must be placed on the sampler to prevent tampering. However, this does not prevent tampering with the sample collection tubing. If required, seals may be placed on the sampling pole and tubing line to further reduce tampering possibilities.

## **7.7 Special Sample Collection Procedures**

### 7.7.1 Organic Compounds and Metals:

Trace organic compounds and metals detection limits are usually in the parts per billion or parts per trillion range, so extreme care must be exercised to insure sample integrity.

All containers, composite bottles, tubing, etc., used for sample collection for trace organic compounds and metals analyses should be prepared as described in Appendix C.



When possible, the sample should be collected directly into the appropriate sample container. If the material to be sampled cannot be physically reached, an intermediate collection device may be used. This should be a Teflon, glass, or stainless steel vessel on a pole or rope or Teflon tubing via a peristaltic type pump and a Teflon vacuum container attachment which converts a sample container into a vacuum container. The device which is used should be cleaned as described in Appendix C.

For quality control of composite samples that are to be collected for organic analyses, a blank must be collected prior to beginning sampling (as described in Section 7.6.5).

When the sample container must be lowered into the waste stream, either because of safety or impracticality (manhole, slippery effluent area, etc.), care must be taken to avoid contamination.

#### 7.7.2 Bacteriological:

Samples for bacteriological analyses must always be collected directly into the prepared glass or plastic sample container. The sample container should be kept unopened until it is to be filled. When the cap is removed, care should be taken not to contaminate the cap or the inside of the bottle. The mouth should be directed against the current. See Section 7.4.2 for special procedures for splitting bacteria samples. See **Appendix A** for preservation procedures and holding times. Staff collecting shellfish waters, recreational waters, and ocean waters should also reference **Section 8**.

#### 7.7.3 Immiscible Liquids/Oil and Grease:

Oil and grease may be present in wastewater as a surface film, an emulsion, a solution, or as a combination of these forms. Since it is very difficult to collect a representative sample for oil and grease analysis, the inspector must carefully evaluate the location of the sampling location. The most desirable sampling location is the area of greatest mixing. Quiescent areas should be avoided. The sample container should be plunged into the wastewater using a swooping motion with the mouth facing upstream. Care should be taken to insure that the bottle does not over fill during sample collection.

Because losses of oil and grease will occur on sampling equipment, an automatic sampler should not be used to collect samples for oil and grease analysis. Individual portions collected at prescribed time intervals must be analyzed separately to obtain the average concentrations over an extended period.

#### 7.7.4 Volatile Organic Compounds:

Samples to be analyzed for volatile organic compounds (VOCs) are collected in 60 ml. amber glass vials with screw caps with a Teflon<sup>7</sup> lined silicone disk in the cap to prevent contamination of the sample by the cap. The disks should be placed in the caps (Teflon<sup>7</sup> side to be in contact with the sample) in the laboratory prior to the beginning of the sampling program.

When sampling for VOCs, triplicate vials should always be collected from each location. Two field blanks are also required per cooler per sampling day. Sodium thiosulfate for chlorine removal is added to the VOC vials prior to shipment from the Central Laboratory. Vials should be filled to the threads with sample. Add three drops of 1:1 HCL from the dispenser provided. Fill the vial completely with sample without overflowing to ensure no headspace or air bubbles remain. The cap is then applied and some overflow is lost, but air space in the bottle is eliminated. After capping, turn the bottle over and tap it to check for bubbles; if any are present, repeat the procedure using a new bottle. Place sample on ice or refrigerate at 4° C from time of collection. Insert special procedures for heavy flow conditions or access difficulties utilizing a 250 VOC bottle as an intermediate collection device for VOC samples at WWTPs.

Sampling containers with preservatives should be pre-labeled prior to any field activities. This will reduce the chances of confusion during sampling activities by the investigation team. Sample preservation, containers, holding times, and sample volumes are listed in **Appendix A**.

#### 7.7.5 Toxicity:

Effluent sampling for the purpose of aquatic toxicity testing should always be conducted as specified by the toxicity limitations in Part III of the current NPDES permit. The type of sample required by the permit is determined by the type of test to be conducted. An acute test will require a grab sample and a chronic test will require 24-hour composite samples.

New polyethylene Cubitainers→ (brown, collapsible containers), new milk jugs, and properly cleaned glass jars may be used to contain toxicity samples. Grab samples may be collected by submersing the sample container in the waste stream or catching effluent as it flows over a weir. If this is not practical, grab samples may be collected using a clean glass jar which has been rinsed with 20% nitric or hydrochloric acid, then rinsed with acetone, or using a composite sampler set for continuous flow. If there is no other option, the sample may be collected with a dunker. If possible, use the dunker to hold a glass jar as a sampler container. If the dunker is used as the sampler container, it must be noted on the Field Parameter sheet (DHEC 2186).

When taking grab or composite samples, the composite sampler may be fitted with Nalgene→ or Tygon→ suction line tubing, but the pump tubing must be medical grade silastic or equivalent silicone tubing. The collection jar in the sampler must be a properly cleaned glass jar. **TOXICITY SAMPLES MUST NEVER CONTACT LATEX RUBBER TUBING, SINCE IT LEACHES ZINC, WHICH IS HIGHLY TOXIC TO THE TEST ORGANISMS.**

Toxicity samples should be taken at the discharge point or as close to it as possible, and may include effluent from multiple outfalls if two or more outfalls mix before being discharged.

1. Acute tests require a single two liter sample. Ship acute samples in either a new milk jug, Cubitainer→ or clean glass jar. Fill the container completely.

Chronic tests require three separate two liter samples, which are taken Monday, Wednesday and Friday. Collect chronic samples in either a new milk jug, Cubitainer→, or clean glass jar. Fill the container completely.

2. No preservative is added to the sample.
3. Pack the sample in ice. Do not use cooling packs. The sample must be transported to the laboratory in an ice chest containing enough ice to cool it to and maintain a 6°C temperature.

## 7.8 Sample Preservation - See Appendix A

## 7.9 Sample Identification, Control, and Documentation

The success of any environmental monitoring program depends to a great degree on the capability to provide valid data and to be able to systematically demonstrate the validity of the data. It is essential that laboratories involved in the collection of primary evidence provide written procedures to be followed whenever evidence samples are collected, transferred, stored, analyzed, or destroyed. These procedures must provide for an accurate written record which systematically traces the possession of the sample within the laboratory organization from receipt of the sample to release of the data. The Chain of Custody procedures

that will be discussed must be fully employed to fulfill the legal requirements of the South Carolina Department of Health and Environmental Control.

All sample identification, chain-of-custody records, receipt for sample forms, calibration records, analytical records, and field records should be recorded with waterproof, non-erasable ink. If errors are made in any of these documents, corrections should be made by crossing a single line through the error and entering the correct information. Correction fluid must not be used. All corrections should be initialed and dated. If possible, all corrections should be made by the individual making the error.

If information is entered onto logbooks and sample tags or sample containers using stick-on labels, the labels should not be capable of being removed without leaving obvious indications of the attempt. Labels should never be placed over previously recorded information. Corrections to information recorded on stick-on labels should be made as stated above.

#### 7.9.1 Sample and Evidence Identification:

The method of sample identification used depends on the type of sample collected. Samples collected for specific field analyses or measurement data are recorded directly in bound field logbooks or recorded directly on the Chain-of-Custody Record, with identifying information, while in the custody of the samplers. Examples include pH, temperature, conductivity, dissolved oxygen, and residual chlorine. Samples collected for laboratory analyses are identified by using standard sample labels which are attached to the sample containers. In some cases, particularly with biological samples, the sample labels may have to be included with or wrapped around the samples. The following information shall be included on the sample label using waterproof, non-erasable ink:

- field identification or sample station number;
- sample identification number;
- preservatives used; and
- the general types of analyses to be performed (tape on some containers).

Additional information about the sample should be recorded in a bound field logbook. The following information shall be included in the bound field logbook using waterproof, non-erasable ink:

- sample identification number;
- date and time of sample collection (compositing period if sample is a composite);
- designation of the sample as a grab or composite;
- type of sample (drinking water, wastewater, soil, etc.) or program area when applicable;
- brief description of sampling location, if pertinent;
- signature of the sample collector;
- field parameter (pH, dissolved oxygen, residual chlorine, temperature, conductivity, turbidity) analytical results; and

- relevant comments (e.g. readily detectable or identifiable odor, color, toxic properties, sheen, etc).

The field logbook may also include field instrument calibration information. If so, the information recorded should allow a person reviewing the records to recount the calibration events. Refer to **Section 14** for proper calibration and field parameter analysis procedures.

If a sample is split with a facility or other party representative, the recipient should be provided (if enough sample is available) with an equal weight or volume of sample. The split sample should be clearly marked or identified with a stick-on label, and a comment should be made in the field logbook.

Labels for blank or duplicate samples will be marked “**Blank**” or “**Duplicate**” respectively. This identifying information shall also be recorded in the bound field logbooks and on the Chain-Of-Custody Record.

7.9.2 Chain-of-Custody and Documentation - see Section 19

## **7.10 Cleaning and Maintenance**

To remove contaminants from sampling and other field equipment to levels that do not impact monitoring objectives, standard cleaning procedures are used. Generally cleaning is done in the lab. However, some field cleaning procedures are also used. Refer to Appendices B and C for cleaning procedures.

## **7.11 Initial Processing of Returned Equipment**

Field or sampling equipment that needs to be repaired will be identified with a "repair" tag. Any problems encountered with the equipment and specific required repairs shall be noted on this tag, as well as the date and the initials of the investigator. Field equipment or reusable sample containers needing cleaning or repairs will not be stored with clean equipment, sample tubing, or sample containers.

All aluminum foil wrapped equipment, containers, and tubing not used in the field may be placed back into stock after the following precautions are taken:

- Soap and hot water rinse plastic containers. Allow to air dry.
- If plastic wrapping leaks after soap/water rinse, remove the equipment and place it into the standard cleaning process.

## 7.12 References

1. U.S. Environmental Protection Agency, Office of Environmental and Compliance Assurance, NPDES Compliance Inspection Manual, September 1994.
2. South Carolina Department of Health and Environmental Control, Programming Guides for the ISCO Flow Meters and Samplers
3. ISCO, Inc., Instruction Manual for Model 2710, and 3710 Wastewater Samplers, Lincoln, Nebraska. Website: <http://www.isco.com/products>
4. U. S. Environmental Protection Agency, Center for Environmental Research Information, Retrofitting POTWs, EPA 625/6-89/020, Cincinnati, Ohio, 1989.
5. Water Pollution Control Federation, Operation Of Municipal Wastewater Treatment Plants, WEF Manual Of Practice No.11, Alexandria, Virginia, 1990.
6. Water Pollution Control Federation, Design Of Municipal Wastewater Treatment Plants, WEF Manual Of Practice No. 8, Book Press, Inc., Brattleboro, Vermont, 1991.
7. U.S. Environmental Protection Agency, Environmental Services Division, Water Compliance Unit, Activated Sludge Process Control Testing, Athens, GA, 1990.
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9. Metcalf and Eddy, Inc., Wastewater Engineering: Treatment, Disposal, Reuse, McGraw-Hill Book Co., New York, NY, 1991.
10. California State University - Sacramento, Operation of Wastewater Treatment Plants - Volume I, II, III, Sacramento, California.
11. South Carolina Department of Health and Environmental Control, Bureau of Water, State of South Carolina Monitoring Strategy, FYU2001.
12. U.S. Environmental Protection Agency, Handbook for the Sampling and Sample Preparation of Water and Wastewater, 600/4-82-029, September 1982.

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