FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Water Resource Management, Bureau of Watershed Management

NORTHWEST DISTRICT • OCHLOCKONEE–ST. MARKS BASIN

TMDL Report

Fecal Coliforms TMDL for Swamp Creek, WBID 427

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Websites

Florida Department of Environmental Protection, Bureau of Watershed Management

TMDL Program

http://www.dep.state.fl.us/water/tmdl/index.htm

Identification of Impaired Surface Waters Rule

http://www.dep.state.fl.us/legal/Rules/shared/62-303/62-303.pdf

STORET Program

http://www.dep.state.fl.us/water/storet/index.htm

2006 305(b) Report

http://www.dep.state.fl.us/water/tmdl/docs/2006_Integrated_Report.pdf

Criteria for Surface Water Quality Classifications

http://www.dep.state.fl.us/water/wqssp/classes.htm

Basin Status Report

http://www.dep.state.fl.us/water/basin411/stmarks/status.htm

Water Quality Assessment Report

http://www.dep.state.fl.us/water/basin411/stmarks/assessment.htm

HSPF and EFDC/EFDC_Explorer Training

www.dsllc.com

U.S. Environmental Protection Agency

National STORET Program

http://www.epa.gov/storet/

Region 4: Total Maximum Daily Loads in Florida

http://www.epa.gov/region4/water/tmdl/florida/

Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Load (TMDL) for fecal coliforms for Swamp Creek, located in the Ochlockonee–St. Marks Basin. The creek was verified as impaired for fecal coliforms, and was included on the Verified List of impaired waters for the Ochlockonee–St. Marks Basin that was adopted by Secretarial Order in June 2008. This TMDL establishes the allowable loadings to Swamp Creek that would restore this waterbody so that it meets its applicable water quality criteria for fecal coliforms.

1.2 Identification of Waterbody

The entire Swamp Creek watershed stretches from Grady County, Georgia, to the south, with a total length of about 6 miles and a total drainage area of 57.4 square miles (mi^2) (**Figure 1.1**). The Florida portion of the watershed is located in Gadsden County, Florida. Its 11.34 mi^2 drainage area extends from the Florida–Georgia state line to the south, where it converges with Attapulgus Creek to help form the Little River (**Figure 1.2**). Swamp Creek is a second-order stream that receives water from Mill Creek, as well as several other small tributaries. Both waterbodies are fed by the Floridan aquifer. Additional information about Swamp Creek's hydrology and geology are available in the Basin Status Report for the Ochlockonee–St. Marks Basin (Florida Department of Environmental Protection [Department], 2001).

For assessment purposes, the Department has divided the Ochlockonee–St. Marks Basin into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed or stream reach. The Ochlockonee–St. Marks Basin has been divided into numerous segments, as shown in **Figure 1.3**. This TMDL addresses primarily Swamp Creek (WBID 427).

Figure 1.1. Swamp Creek Watershed in Georgia and Florida

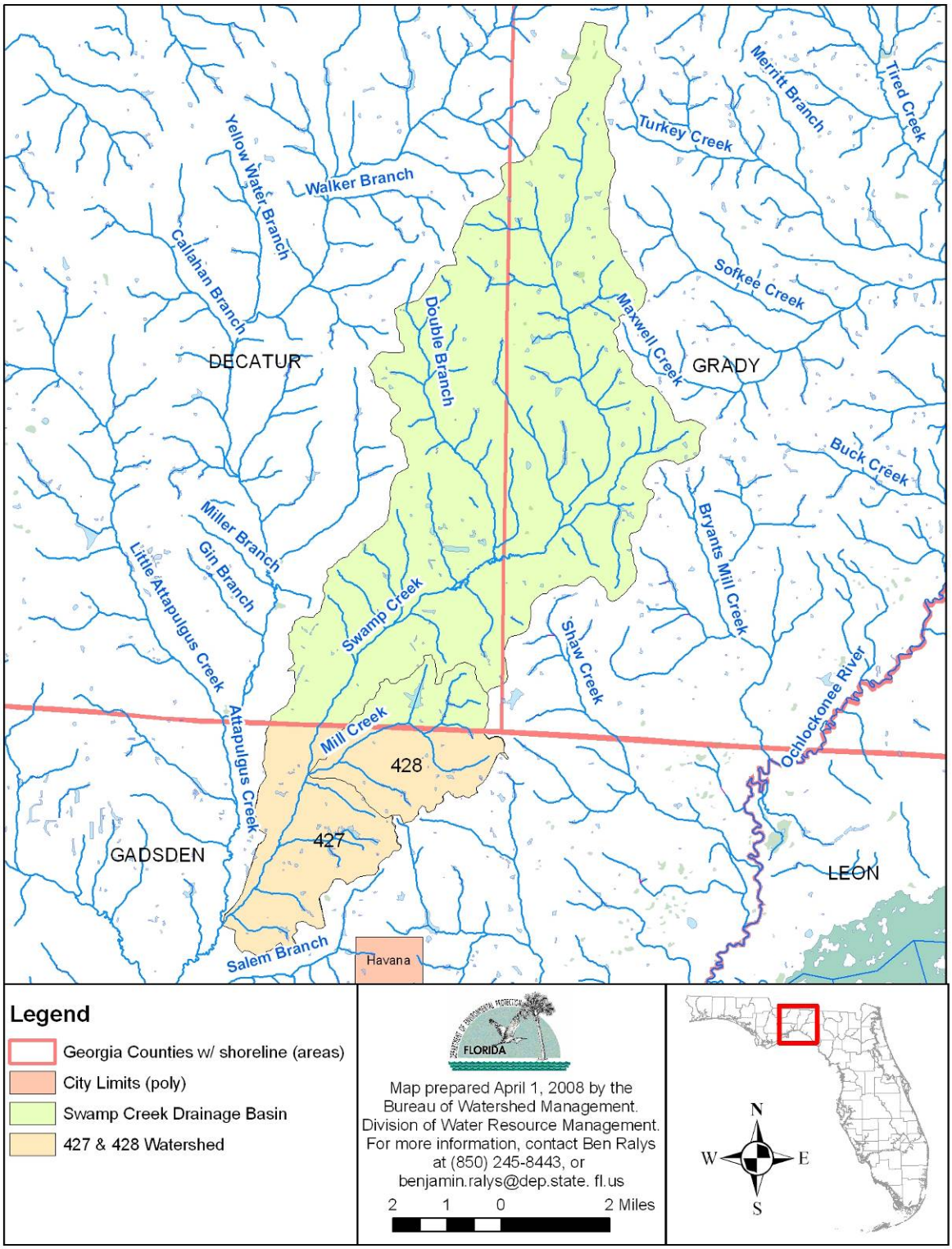


Figure 1.2. Swamp Creek Watershed in Florida, and Major Geopolitical Features

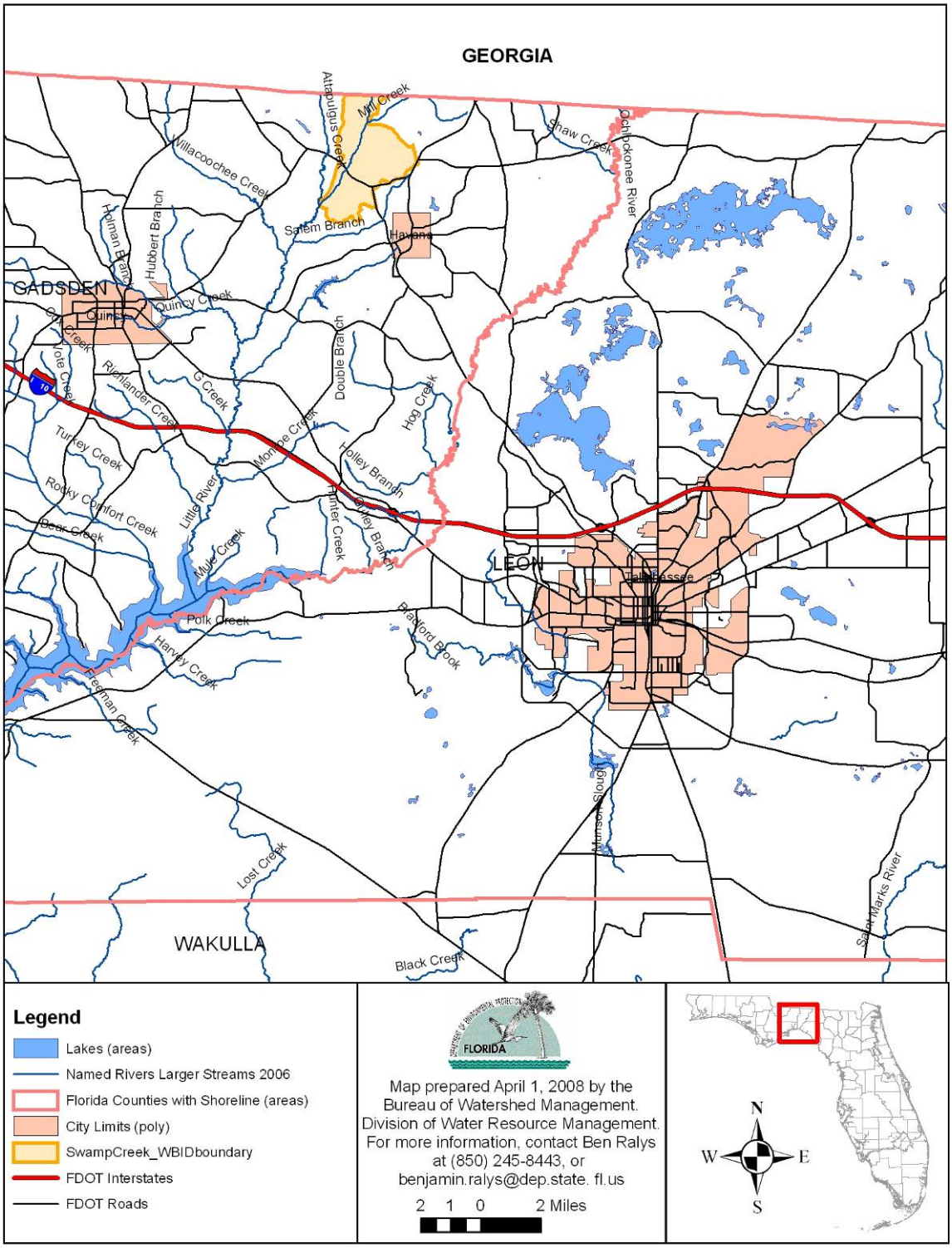
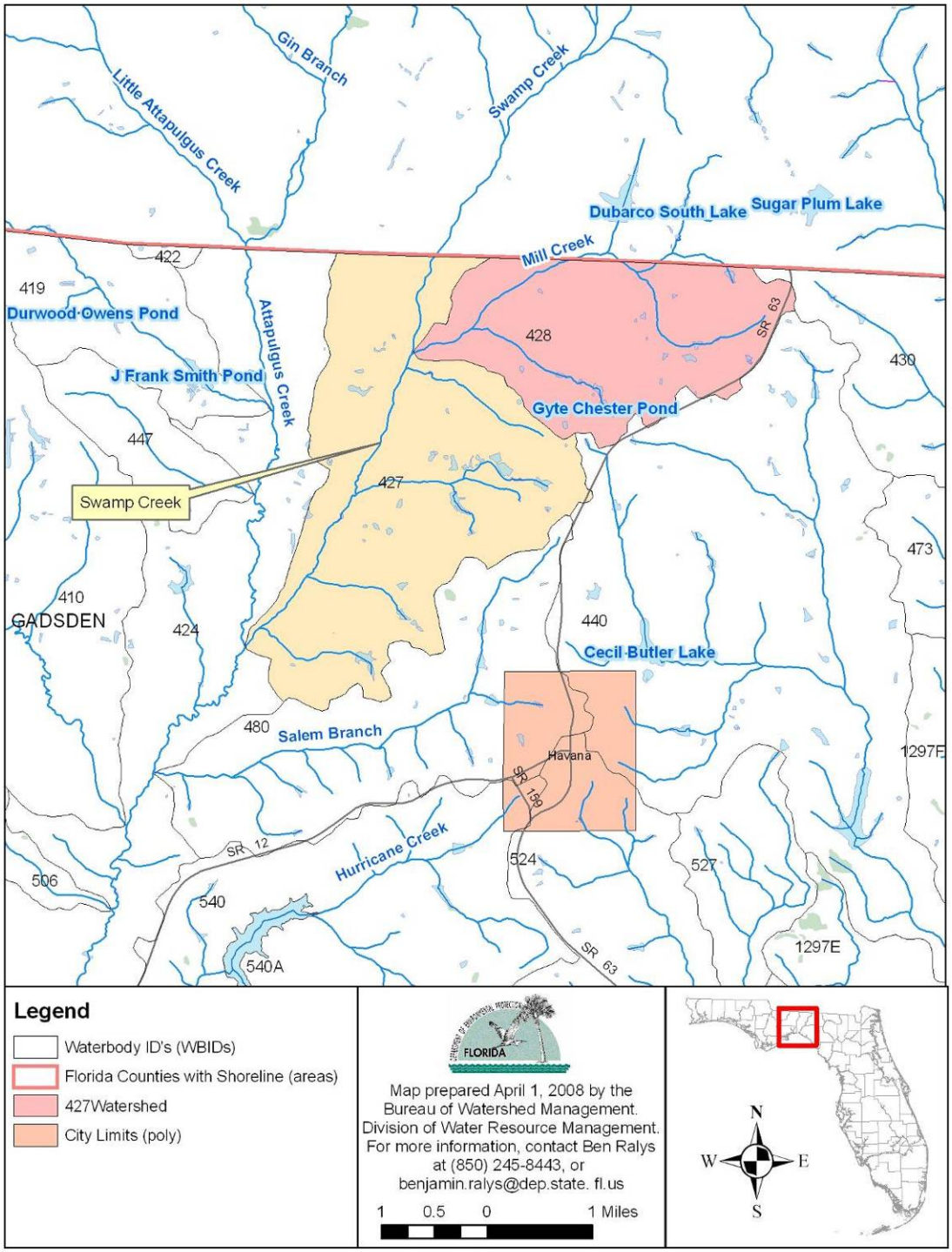


Figure 1.3. WBIDs in the Swamp Creek Watershed in Florida, Including WBIDs 427 and 428



1.3 Background

This report was developed as part of the Department's watershed management approach for restoring and protecting state waters and addressing TMDL Program requirements. The watershed approach, which is implemented using a cyclical management process that rotates through the state's 52 river basins over a 5-year cycle, provides a framework for implementing the TMDL Program–related requirements of the 1972 federal Clean Water Act and the 1999 Florida Watershed Restoration Act (FWRA) (Chapter 99-223, Laws of Florida) (also see **Appendix A** for background information on the federal and state stormwater programs).

A TMDL represents the maximum amount of a given pollutant that a waterbody can assimilate and still meet water quality standards, including its applicable water quality criteria and its designated uses. TMDLs are developed for waterbodies that are verified as not meeting their water quality standards. They provide important water quality restoration goals that will guide restoration activities.

This TMDL report will be followed by the development and implementation of a Basin Management Action Plan, or BMAP, to reduce the amount of fecal coliforms that caused the verified impairment of Swamp Creek. These activities will depend heavily on the active participation of the Northwest Florida Water Management District (NWFWMD), local governments, businesses, and other stakeholders. The Department will work with these organizations and individuals to undertake or continue reductions in the discharge of pollutants and achieve the established TMDLs for impaired waterbodies.

Chapter 2: DESCRIPTION OF WATER QUALITY PROBLEM

2.1 Statutory Requirements and Rulemaking History

Section 303(d) of the federal Clean Water Act requires states to submit to the U.S. Environmental Protection Agency (EPA) a list of surface waters that do not meet applicable water quality standards (impaired waters) and establish a TMDL for each pollutant causing the impairment of listed waters on a schedule. The Department has developed such lists, commonly referred to as 303(d) lists, since 1992. The list of impaired waters in each basin, referred to as the Verified List, is also required by the FWRA (Subsection 403.067[4], Florida Statutes [F.S.]), and the state's 303(d) list is amended annually to include basin updates.

Florida's 1998 303(d) list included 24 waterbodies in the Ochlockonee–St. Marks Basin. However, the FWRA (Section 403.067, F.S.) stated that all previous Florida 303(d) lists were for planning purposes only and directed the Department to develop, and adopt by rule, a new science-based methodology to identify impaired waters. After a long rulemaking process, the Environmental Regulation Commission adopted the new methodology as Rule 62-303, Florida Administrative Code (F.A.C.) (Identification of Impaired Surface Waters Rule, or IWR), in April 2001; the rule was updated in 2006 and 2007.

2.2 Information on Verified Impairment

The Department used the IWR to assess water quality impairments in the Ochlockonee–St. Marks Basin and has verified the impairments listed in **Table 2.1**. **Table 2.2** provides selected assessment results for fecal coliforms within the verification period for Swamp Creek Watershed, which was January 1, 2000, through June 30, 2007.

This TMDL addresses the fecal coliforms impairment in Swamp Creek, WBID 427. There were a total of 35 fecal coliforms samples collected within the verified period. The samples used in the TMDL calculation range from 21 colony-forming units per 100 milliliters (cfu/100mL) to 5,100 cfu/100mL. **Table 2.3** briefly summarizes the fecal coliforms data for Swamp Creek.

Table 2.1. Verified Impaired Segments in the Ochlockonee–St. Marks Basin

WBID	Waterbody Segment	Parameters Assessed using the IWR	Priority for TMDL Development	Projected Year of TMDL Development
427	**Swamp Creek**	**Fecal Coliforms**	**Low**	**2008**
563	Unnamed Drain	Fecal Coliforms, Turbidity	Low	2018
582	Lake Jackson Outlet	Unionized Ammonia	Low	2014
628	Black Creek	Fecal Coliforms	Low	2018
647	Alford Arm	DO	Medium	2008
682	Juniper Creek	DO, Fecal Coliforms	Medium	2008
684	Mule Creek	Fecal Coliforms	Low	2018
689	Lake Overstreet Drain	Fecal Coliforms	Low	2018
716	Caney Branch	Fecal Coliforms	Low	2018
756	Lake Lafayette Drain	DO	Medium	2008
757	Bear Creek	Fecal Coliforms	Low	2018
807	Munson Slough (below Lake Munson)	DO, Unionized Ammonia	Medium	2013
808	Copeland Sink Drain	DO	Low	2014
809	Megginnis Arm Run	Fecal Coliforms	Low	2018
820	Godby Ditch	Fecal Coliforms	Low	2018
879	Hammock Creek	DO	Low	2014
896	Polk Creek	Fecal Coliforms	Low	2018
913	Big Creek	Fecal Coliforms	Low	2018
919	Unnamed Slough	Fecal Coliforms	Low	2018
921	Harvey Creek	Fecal Coliforms	Low	2018
965	Sweetwater Branch	Fecal Coliforms	Low	2018
971	Chicken Branch	Fecal Coliforms	Low	2018
977	Moore Branch	Fecal Coliforms	Low	2018
1006	Wakulla River	Biology	Medium	2008
1024	Black Creek	Fecal Coliforms	Low	2008
1028	McBride Slough	Fecal Coliforms	Low	2018
1049	Big Branch	Fecal Coliforms	Low	2018
1054	Black Creek	DO	Low	2014
1124	Big Boggy Branch	Fecal Coliforms	Low	2018
1300	Telogia Creek	Fecal Coliforms, Iron	Medium	2008
1303	Quincy Creek	Fecal Coliforms, Iron	Low	2018
8026	Coastapalach Gulf West	Shellfish	Medium	2008
8999	Gulf Coast	Mercury (in Fish Tissue)	Low	2011
1248B	Ochlockonee Bay	Fecal Coliforms	Low	2018
1248C	Ochlockonee Bay	Fecal Coliforms	Low	2018
1297B	Ochlockonee River	Iron	Medium	2013

WBID	Waterbody Segment	Parameters Assessed using the IWR	Priority for TMDL Development	Projected Year of TMDL Development
1297C	Lake Talquin	DO, TSI	Medium	2013
1297D	Lake Talquin	TSI	Medium	2013
1297E	Ochlockonee River	Iron	Medium	2013
1297F	Ochlockonee River	Iron	Medium	2013
540A	Tallavanna Lake	TSI	Medium	2008
756A	Upper Lake Lafayette	Fecal Coliforms, DO	Low	2018
756B	Lake Piney Z	DO, TSI	Medium	2008
756C	Lower Lake Lafayette	DO, TSI	Medium	2008
791N	Lake Miccosukee	TSI	Low	2014
8025B	Mashes Island	Bacteria	High	2008
8026B	Shell Point	Bacteria	Low	2018
807C	Lake Munson	DO, TSI, Turbidity	Medium	2008
807D	Munson Slough (above Lake Munson)	DO, Fecal Coliforms, Turbidity	Low	2008
971B	Lake Weeks	DO	Medium	2008

Note: The parameters listed in **Table 2.1** provide a complete picture of the impairment in the Ochlockonee–St. Marks Basin, but this TMDL only addresses the fecal Coliforms impairment in the Swamp Creek watershed.

Table 2.2. Fecal Coliforms Data within the Verified Period for Swamp Creek, WBID 427

WBID	Station	Date	Time	Result
427	21FLDEP 303919608427079	1/16/2002	1225	340
427	21FLWQA	11/15/2005	1058	410
427	21FLWQA 303919608427079	2/15/2006	905	136
427	21FLPNS 303919608427079	2/15/2006	1410	210
427	21FLPNS 303919608427079	3/1/2006	1205	260
427	21FLPNS 303919608427079	3/21/2006	1250	1700
427	21FLPNS 303919608427079	3/29/2006	1015	610
427	21FLPNS 303919608427079	4/26/2006	1015	280
427	21FLPNS 303919608427079	5/18/2006	945	250
427	21FLPNS 303919608427079	5/31/2006	915	170
427	21FLPNS 303919608427079	6/8/2006	1035	70
427	21FLPNS 303919608427079	6/19/2006	1200	340
427	21FLPNS 303919608427079	7/11/2006	940	96
427	21FLPNS 303919608427079	7/26/2006	1015	580
427	21FLPNS 303919608427079	8/16/2006	1321	5100
427	21FLPNS 303919608427079	8/31/2006	1225	470
427	21FLPNS 303919608427079	9/26/2006	1300	1315
427	21FLPNS 303919608427079	10/5/2006	1040	310
427	21FLPNS 303919608427079	10/26/2006	1300	360
427	21FLPNS 303919608427079	11/14/2006	1245	410
427	21FLPNS 303919608427079	11/28/2006	1320	200
427	21FLPNS 303919608427079	12/7/2006	1015	200
427	21FLPNS 303919608427079	12/20/2006	1132	210

Note: Data for the entire period of record can be found in Chapter 5.
"Result" column is in cfu/100mL.

Table 2.3. Summary of Fecal Coliforms Data within the Verified Period for Swamp Creek, WBID 427

Waterbody (WBID)	Parameter	Fecal Coliforms
Swamp Creek (427)	Total number of samples	23
	IWR-required number of exceedances for the Verified List	5
	Number of observed exceedances	8
	Number of observed nonexceedances	15
	Number of seasons during which samples were collected	4
	Highest observation (cfu/100mL)	5,100
	Lowest observation (cfu/100mL)	70
	Median observation (cfu/100mL)	310
	Mean observation (cfu/100mL)	343
	Final Assessment	**Impaired**

Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criteria Applicable to the TMDL

Florida's surface waters are protected for five designated use classifications, as follows:

Class I	**Potable water supplies**
Class II	**Shellfish propagation or harvesting**
Class III	**Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife**
Class IV	**Agricultural water supplies**
Class V	**Navigation, utility, and industrial use (there are no state waters currently in this class)**

The Swamp Creek Watershed contains a number of Class III fresh waterbodies—i.e., Swamp Creek, Mill Creek, and several other small tributaries. Class III waterbodies have a designated use of recreation, propagation, and the maintenance of a healthy, well-balanced population of fish and wildlife. The water quality criterion applicable to the impairment addressed by this TMDL is the Class III criterion for fecal coliforms.

3.2 Applicable Water Quality Standards and Numeric Water Quality Target

Numeric criteria for bacterial quality are expressed in terms of fecal coliforms bacteria concentrations. The water quality criterion for the protection of Class III waters, as established by Rule 62-302, F.A.C., states the following:

> ***Fecal Coliforms Bacteria:***
> *The most probable number (MPN) or membrane filter (MF) counts per 100 mL of fecal coliforms bacteria shall not exceed a monthly average of 200, nor exceed 400 in 10 percent of the samples, nor exceed 800 on any one day.*

The criterion states that monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period. However, during the development of load curves for the impaired waterbody (as described in subsequent sections); there were insufficient data (fewer than 10 samples in a given month) available to evaluate the geometric mean criterion for fecal coliforms bacteria. Therefore, the criterion selected for the TMDL was not to exceed 400 in 10 percent of the samples.

Chapter 4: ASSESSMENT OF SOURCES

4.1 Types of Sources

An important part of the TMDL analysis is the identification of pollutant source categories, source subcategories, or individual sources of nutrients in the watershed and the amount of pollutant loading contributed by each of these sources. Sources are broadly classified as either "point sources" or "nonpoint sources." Historically, the term "point sources" has meant discharges to surface waters that typically have a continuous flow via a discernable, confined, and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) are examples of traditional point sources. In contrast, the term "nonpoint sources" was used to describe intermittent, rainfall-driven, diffuse sources of pollution associated with everyday human activities, including runoff from urban land uses, agriculture, silviculture, and mining; discharges from failing septic systems; and atmospheric deposition.

However, the 1987 amendments to the Clean Water Act redefined certain nonpoint sources of pollution as point sources subject to regulation under the EPA's National Pollutant Discharge Elimination System (NPDES) Program. These nonpoint sources included certain urban stormwater discharges, including those from local government master drainage systems, construction sites over five acres, and a wide variety of industries (see **Appendix A** for background information on the federal and state stormwater programs).

To be consistent with Clean Water Act definitions, the term "point source" will be used to describe traditional point sources (such as domestic and industrial wastewater discharges) **and** stormwater systems requiring an NPDES stormwater permit when allocating pollutant load reductions required by a TMDL (see **Section 6.1**). However, the methodologies used to estimate nonpoint source loads do not distinguish between NPDES stormwater discharges and non-NPDES stormwater discharges, and as such, this source assessment section does not make any distinction between the two types of stormwater.

4.2 Potential Sources of Coliforms in the Swamp Creek Watershed

4.2.1 Point Sources

There is currently one permitted wastewater treatment facility in the Florida portion of the Swamp Creek watershed that discharges a load either directly or indirectly into the watershed (**Figure 4.1**). Coastal Forest Resources Company – Havana Plywood has two permits (FLA010091 and FLR05A004), which allow the facility to discharge into the watershed (**Table 4.1**). **Appendix C** summarizes the facility's discharge. One permitted facility in Georgia also discharges into the watershed (**Table 4.1**).

Municipal Separate Storm Sewer System Permittees

There are currently no NPDES municipal separate storm sewer system (MS4) permittees in the watershed.

Figure 4.1. Wastewater Facilities in the Swamp Creek Watershed, WBID 427

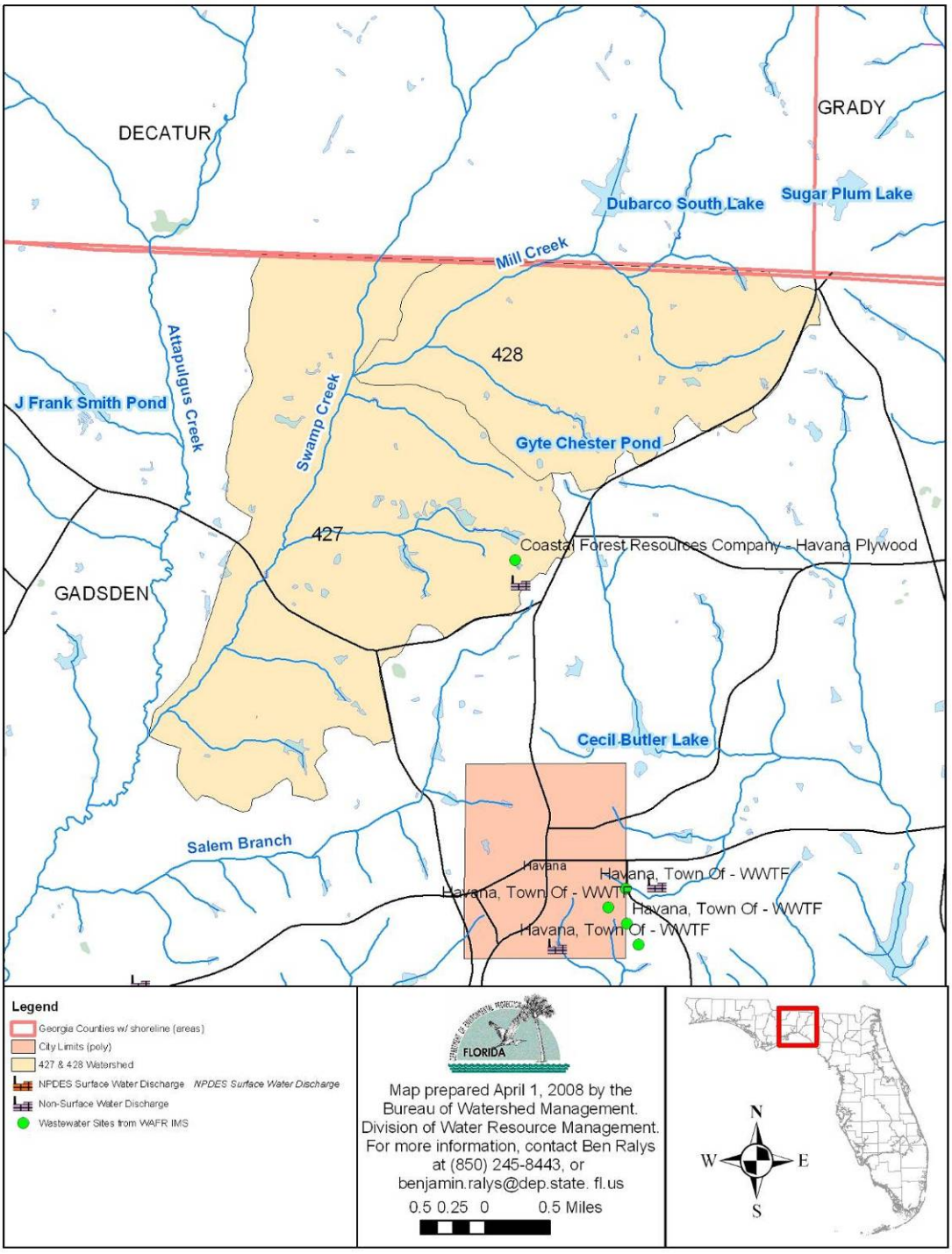


Table 4.1. Point Sources in the Swamp Creek Watershed in Georgia and Florida

Permit Number	Facility Name	City	Type of Facility	Facility Status	Design Capacity (mgd)	Watershed	WBID
GA0046744	Englehard Specialty Chemicals	Decatur, Georgia	Industrial	Active		Swamp Creek	N/A
FLA010091	Coastal Plywood	Havana	Industrial	Active		Swamp Creek	427
FLR05A004	Coastal Plywood Company	Havana	Industrial	Active		Swamp Creek	427

N/A – Not applicable.

4.2.2 Land Uses and Nonpoint Sources

Potentially all of the fecal Coliforms loadings to the Swamp Creek Watershed are generated from nonpoint sources in the watershed. Potential nonpoint sources of Coliformss include loadings from surface runoff, wildlife, livestock, pets, and leaking septic tanks.

Land Uses

The spatial distribution and acreage of different land use categories were identified using the 1995 NWFWMD land use coverage (scale 1:40,000) contained in the Department's geographic information system (GIS) library. The land use tables below only cover the Florida portion of the Swamp Creek watershed. Land use categories in the Florida portion of the watershed were aggregated using the simplified Level 1 codes tabulated in **Tables 4.2a** and **4.2b. Figure 4.2** shows the acreage of the principal land uses in the watershed. As shown in **Table 4.2a**, land use in the Swamp Creek Watershed (WBIDs 427 and 428) is heavily dominated by upland forests, which comprise 62.74 percent of the entire watershed. Other measurable land uses in the watershed include agriculture (14.69 percent), urban and built-up (9.64 percent), and wetlands (8.56 percent).

Table 4.2a. Classification of Land Use Categories in the Swamp Creek Watershed

Level 1 Code	Land Use	Acreage	Mi^2	% of WBID Watershed
Swamp Creek, WBID 427				
1000	Urban and Built-up	423.21	0.66	9.15
2000	Agriculture	539.96	0.84	11.67
3000	Rangeland	0.00	0.00	0.00
4000	Upland Forests	2,985.85	4.67	64.55
5000	Water	83.38	0.13	1.80
6000	Wetlands	591.40	0.92	12.78
7000	Barren Lands	0.00	0.00	0.00
8000	Transportation, Communication, and Utilities	2.03	0.00	0.04
	Total	**4,625.83**	**7.23**	**100.00**

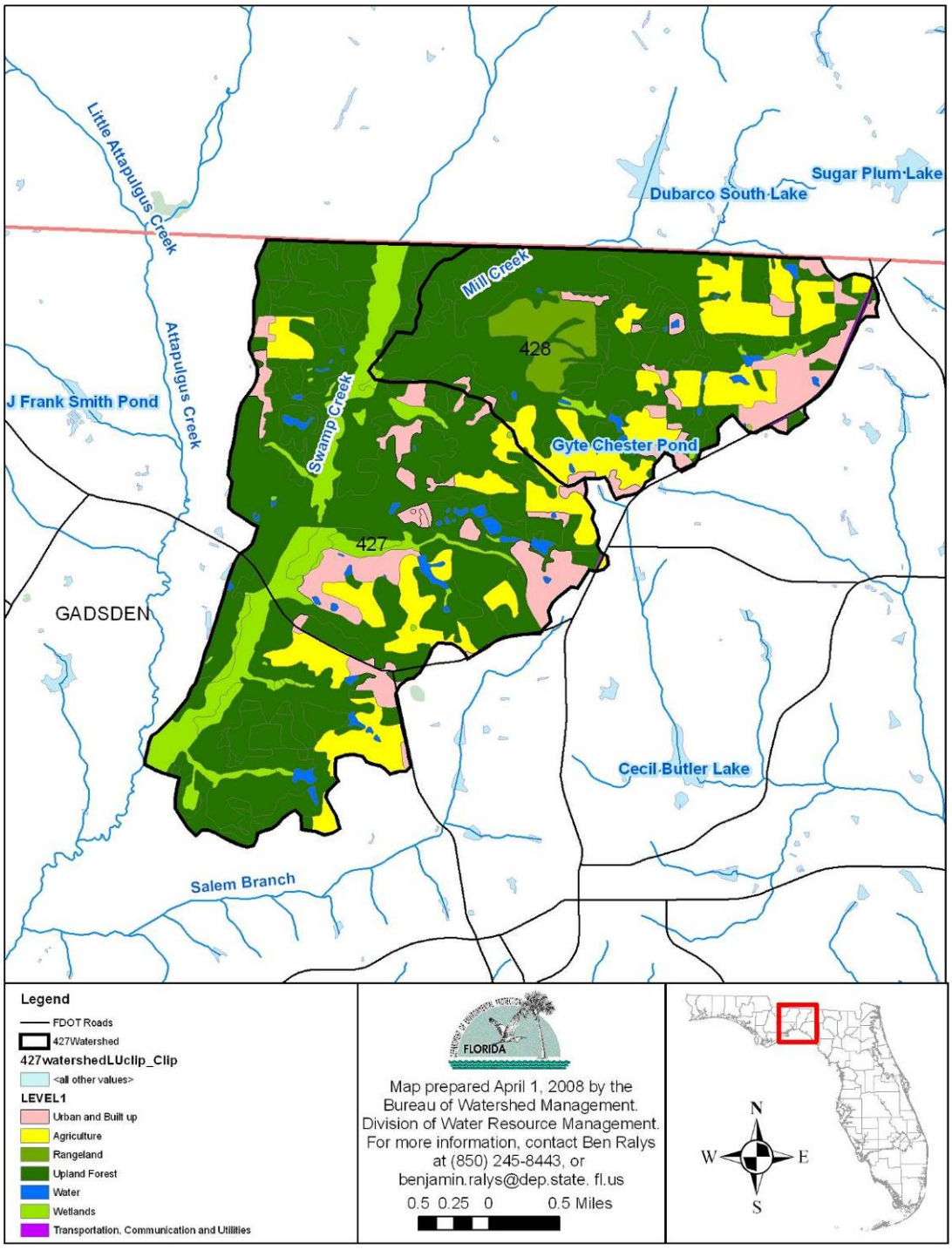
Level 1 Code	Land Use	Acreage	Mi^2	% of WBID Watershed
Mill Creek, WBID 428				
1000	Urban and Built-up	276.70	0.43	10.51
2000	Agriculture	526.28	0.82	19.98
3000	Rangeland	181.25	0.28	6.88
4000	Upland Forests	1,568.79	2.45	59.57
5000	Water	31.62	0.05	1.20
6000	Wetlands	29.74	0.05	1.13
7000	Barren Lands	0.00	0.00	0.00
8000	Transportation, Communication, and Utilities	19.18	0.03	0.73
	Total	**2,633.56**	**4.12**	**100.00**

Level 1 Code	Land Use	Acreage	Mi^2	% of WBID Watershed
Swamp Creek, WBIDs 427 and 428				
1000	Urban and Built-up	699.91	1.09	9.64
2000	Agriculture	1,066.24	1.67	14.69
3000	Rangeland	181.25	0.28	2.50
4000	Upland Forests	4,554.64	7.12	62.74
5000	Water	114.99	0.18	1.58
6000	Wetlands	621.14	0.97	8.56
7000	Barren Lands	0.00	0.00	0.00
8000	Transportation, Communication, and Utilities	21.21	0.03	0.29
	Total	**7,259.38**	**11.34**	**100.00**

Table 4.2b. Classification of Land Use Categories in Gadsden County

Level 1 Code	Land Use	Acreage	Mi^2	% of County
Gadsden County				
1000	Urban and Built-up	21,691.60	33.89	6.42
2000	Agriculture	43,886.81	68.57	12.98
3000	Rangeland	8,764.68	13.69	2.59
4000	Upland Forests	233,163.80	364.32	68.98
5000	Water	9,152.93	14.30	2.71
6000	Wetlands	18,175.10	28.40	5.38
7000	Barren Land	52.56	0.08	0.02
8000	Transportation, Communication, and Utilities	3,115.13	4.87	0.92
	Total	**338,002.61**	**528.13**	**100.00**

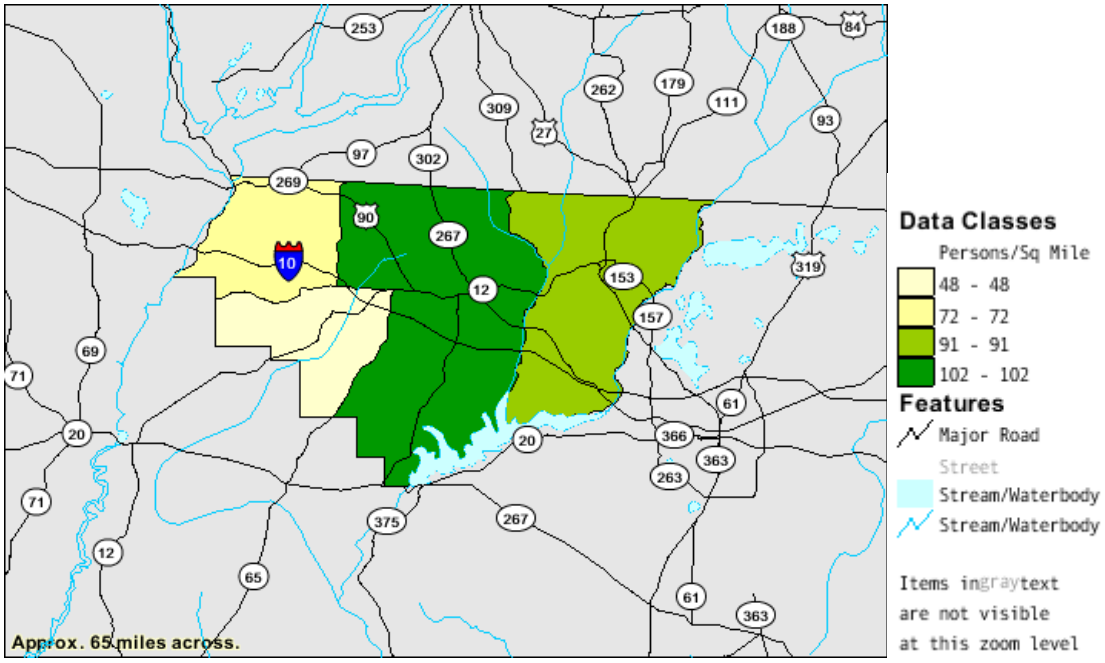
Figure 4.2. Principal Land Uses in the Swamp Creek Watershed, WBIDs 427 and 428



Population

According to the U.S. Census Bureau (2008), the population density in and around the Swamp Creek Watershed in the year 2000 was at or less than 87.4 people/mi^2 (10 persons/mi^2 is the minimum used by the Census Bureau) (**Figure 4.3**). The Bureau reports that for Gadsden County, which includes WBIDs 427 and 428, the total population for 2000 was 45,087, and the county has 15,867 occupied housing units and 17,703 total housing units. For all of Gadsden County, the Census Bureau reported a housing density of 34.3 housing units/mi^2, placing Gadsden County among the lowest in housing densities in Florida (U.S. Census Bureau Website, 2008). This is also supported by land use coverage, which shows that only 9.64 percent of land use in the Swamp Creek Watershed is delineated as urban and built-up.

Figure 4.3. Population Density in Gadsden County, Florida



Septic Tanks

On-site sewage treatment and disposal systems (OSTDS's), including septic tanks, are commonly used where providing central sewer is not cost-effective or practical. When properly sited, designed, constructed, maintained, and operated, OSTDS's are a safe means of disposing of domestic waste. The effluent from a well-functioning OSTDS is comparable to secondarily treated wastewater from a sewage treatment plant. When not functioning properly, OSTDS's can be a source of coliforms, pathogens, and other pollutants to both ground water and surface water.

No measured septic tank failure rate data were available for the watershed at the time this TMDL analysis was conducted. Therefore the failure rate was derived from the number of septic tanks and septic tank repair permits for the county published by the Florida Department of

Health (FDOH) (http://www.doh.state.fl.us/environment/OSTDS/statistics/ostdsstatistics.htm) (**Table 4.3a**). As of 2007, Gadsden County had roughly 16,381 septic systems (FDOH Website, 2008). Data for septic tanks are based on 1970 to 2007 Census results, with year-by-year additions based on new septic tank construction permits. The data do not reflect septic tanks that have been removed going back to 1970. From fiscal years 1991 to 2007, 1,761 permits for repairs were issued (FDOH Website, 2008).

Based on the number of permitted septic tanks and housing units located in the county, approximately 8 percent of the housing units are connected to a wastewater treatment facility, with the remaining 92 percent using septic tank systems. Using the FDOH information, a discovery rate of failed septic tanks for each year between 2000 and 2005 was calculated and listed in **Table 4.3a**. Using the table, the average annual septic tank failure discovery rate for Gadsden County is about 0.60 percent. Assuming that failed septic tanks are not discovered for about 5 years, the estimated annual septic tank failure rate is about 5 times the discovery rate, or 3 percent.

Table 4.3a. Estimated Septic Numbers and Septic Failure Rates for Gadsden County, 2000–05

	2000	2001	2002	2003	2004	2005	Average
New installation (septic tanks)	242	204	206	242	270	303	245
Accumulated installation (septic tanks)	14,500	14,742	14,946	15,152	15,394	15,664	15,066
Repair permit (septic tanks)	79	89	102	110	89	76	91
Failure discovery rate (%)	0.54	0.60	0.68	0.73	0.58	0.49	0.60
Failure rate (%)*	2.7	3.0	3.4	3.7	2.9	2.5	3.0

* The failure rate is 5 times the failure discovery rate.

The Swamp Creek Watershed comprises 11.34 mi^2, or approximately 2.15 percent of the total land area of Gadsden County (528.13 mi^2). The number of septic tanks in the watershed is not known, but using the ratio of Level 1 urban and built-up land use in the watershed to that in Gadsden County (1.9511E-02), the number of septic tanks in the watershed (N) is estimated to be about 32. Using this number, and 70 gallons/day/person (EPA, 2001), the discharge rate from each septic tank (*Q*) was calculated by multiplying the average household size by the per capita wastewater production rate per day.

Based on the information published by the U.S. Census Bureau, the average household size for Gadsden County is about 2.6 people/household. The same population density was assumed for the Swamp Creek watershed. Assuming the above, a loading of 1.325 X 10^{10} colonies/day to the watershed is derived. These estimations, as shown in **Table 4.3b,** constitute 1.11 percent of the estimated total load to the Swamp Creek Watershed. **Appendix B** contains a table showing the full septic loading to the watershed.

Table 4.3b. Estimation of Fecal Coliforms Loading from Failed Septic Tanks in the Swamp Creek Watershed

Estimated Population Density and Area	Estimated Number of Septic Tanks in Area	Estimated Number of Tank Failures	Estimated Concentration from Failed Tanks (cfu/100mL)	Gallons/ Person/ Day	Estimated Number of People per Household	Estimated Load from Failing Tanks (cfu/day)
Standard Loading	1.0	1.0	1.000E+06	70	2.6	6.624E+09
Swamp Creek Watershed	32.00	2.0	1.000E+06	70	2.6	1.325E+10
Gadsden County	16381.00	819.00	1.000E+06	70	2.6	5.643E+12

Sanitary Sewer Overflows

Sanitary sewer overflows (SSOs) can also be a potential source of fecal bacteria pollution. Human sewage can be introduced into surface waters even when storm and sanitary sewers are separated. Leaks and overflows are common in many older sanitary sewers where capacity is exceeded, high rates of infiltration and inflow occur (i.e., outside water gets into pipes, reducing capacity), frequent blockages occur, or sewers are simply falling apart due to poor joints or pipe materials. Power failures at pumping stations are also a common cause of SSOs. The greatest risk of an SSO occurs during storm events; however, few comprehensive data are available to quantify SSO frequency and bacteria loads in most watersheds.

Fecal coliform loading from sewer line leakage can be calculated, based on the number of people in the watershed, typical per household generation rates, and the typical fecal coliform concentration in domestic sewage and assuming a leakage rate of 5 percent (Culver et al., 2002). Based on these assumptions, a rough estimate of fecal coliform loads from leaks and overflows of sanitary sewer lines in the Swamp Creek watershed is equal to 4.339E+10 (see **Appendix B** for the full septic loading table).

Livestock

Another potential nonpoint source of coliforms includes livestock and other agricultural animals. **Table 4.4a** summarizes cattle populations (U.S. Department of Agriculture [USDA], 2002) in Gadsden County in 2002, and **Table 4.4b** summarizes populations of other agricultural animals in the county in 2002. Gadsden County is ranked as one of the lowest in the state in terms of the total number of cattle and calves and beef cows. Approximately 14.69 percent of the Swamp Creek Watershed is specifically categorized as agriculture under the Level 1 land use system.

Table 4.4a. Summary of the Cattle Population in Gadsden County, 2002

Livestock	Year 2002	
	Inventory	Sold
Cattle and Calves	4,564	2,518
Dairy Cattle	46	
Beef Cattle	2,710	

Source: USDA, 2002.

Table 4.4b. Summary of Agricultural Animal Populations (Excluding Cattle)

Livestock	Year 2002	
	Inventory	Sold
Hogs and Pigs	551	
Poultry		
Layers and pullets 20 weeks and older	70	
Broilers		
Sheep and Lambs	66	
Horses	500	5
Milk Goats		
Goats, except Angora and Milk		
Ducks	22	
Geese	25	
Pheasants	6	
Other Poultry		
Mules, Burros, and Donkeys	14	
Rabbits		

Source: USDA, 2002.

Pets–Domestic Animals

Another possible source of fecal coliform bacteria in the Swamp Creek Watershed could be pets or domestic animals. The Department has been unable to obtain data on the number of dogs in the area; however, estimates can be made using literature-based values of dog ownership rates. Using dog to household ratio estimates from the American Veterinary Medical Association (AVMA) (2007), the approximate loading to the watershed from dogs is 8.98E+11 counts per day. Similarly, the number of horses and ponies can be estimated for a load of 6.50E+09 counts per day. The estimated total domestic animal load (excluding cats) is 9.04E+11 counts per day, which is 12.9 percent of the total internal load.

Boats

There are currently no houseboats in the Swamp Creek Watershed.

Wildlife

The most recent TMDL work (Benham, 2007) quantifying wildlife contributions to fecal coliform divides the load among eight categories of wildlife: deer, raccoons, muskrats, beavers, geese, ducks, wild turkeys, and other. Wildlife are assigned to a habitat they would normally frequent. For example, beaver, geese, and ducks are assigned to a buffer 91 meters wide along the perimeter of main streams and impoundments, while deer are assigned to the entire watershed. The Florida Department of Agriculture and Consumer Services (FDACS) (Knight, 2003) notes that there are 5 major wildlife areas along several tributaries used for shellfish harvesting in Escambia County. The white-tailed deer population has been estimated (Department, 1998) at various densities (12.8/mi^2), as shown in **Appendix B**. Migratory waterfowl and other bird populations have been estimated annually from 1998 through 2006 (BirdSource Website, 2007). The value used for bird density (0.44/mi^2) is a composite of the largest species by size for the county. The total load from wildlife is estimated as 1.4176E+13 counts per day, or 9.08 percent of the total.

Spills

The Florida Department of Community Affairs (FDCA) (2007) maintains a Website (www.eoconline.org) that lists pollutant spills by date, time, county, reported amount, and description. Pollutants may be wastewater, petroleum, or other types of waste. Using the annual estimate of gallons spilled and a fecal concentration corresponding to raw sewage, an estimate of annual loading can be made. However, at this time, basin-specific data are not available to make this calculation.

4.3 Source Summary

Table 4.5 summarizes the daily average fecal coliform loadings (from 1997 to 2006) from runoff, septic tank leakage, wildlife, and livestock in the Swamp Creek watershed, and **Table 4.6.b** summarizes external loads to the watershed (see **Appendix D** for additional details).

Table 4.5. Estimated Average Daily Quantity of Internal Fecal Coliform Loads to the Swamp Creek Watershed, 1997–2006

Nonpoint Source Category	Internal Loads to Swamp Creek Watershed	% of Total Load
Total Livestock	1.28E+13	9.19E+01
Total Wildlife	6.54E+10	4.71E-01
Total Domestic Animals (Excluding Cats)	9.04E+11	6.52E+00
Total Septic	1.53E+11	1.11E+00
Total	**1.39E+13**	**1.00E+02**

Tables 4.6a and **4.6b** display the estimated external load entering the Swamp Creek watershed from Georgia. **Table 4.6a** summarizes the fecal coliform data used in calculating the TMDL for Swamp Creek above the state line, and **Table 4.6b** displays the estimated load as well as the percent reduction needed to restore the Georgia portion of Swamp Creek to meet the Georgia criteria.

Table 4.6a. Summary of Fecal Coliform Data to Calculate the Estimated External Load to the Swamp Creek Watershed

Date	Observed Fecal Coliform (counts/100 mL)	Estimated Instantaneous Flow On Sample Day (cfs)	Geometric Mean (counts/100 mL)	Mean Flow (cfs)	Geometric Mean Fecal Coliform Loading (counts/30 days)	Geometric Mean TMDL Fecal Coliform Loading (counts/30 days)
26-Feb-03	20	21.0				
4-Mar-03	460	100.0				
11-Mar-03	330	100.0				
19-Mar-03	270	100.0	169	80.3	9.97E+12	5.89E+13
19-Mar-03	270	100.0				
3-Apr-03	20	24.0				
8-Apr-03	3,500	100.0				
17-Apr-03	40	17.0	166	60.3	7.33E+12	4.42E+13
24-Jul-03	1,300	100.0				
7-Aug-03	110	72.0				
14-Aug-03	490	93.0				
20-Aug-03	50	23.0	243	72.0	1.29E+13	1.06E+13
11-Sep-03	80	11.0				
17-Sep-03	170	9.8				
24-Sep-03	293	18.0				
9-Oct-03	270	17.0	181	14.0	1.85E+12	2.05E+12

Note: This table was taken from *Total Maximum Daily Load evaluation for seventeen stream segments in the Ochlockonee River Basin for fecal coliform,* Table A-16 (Georgia Environmental Protection Division, 2006).

Table 4.6b. Summary of Estimated External Load to the Swamp Creek Watershed

Stream Segment	Current Load (counts/30 days)	TMDL Components					Percent Reduction
		WLA (counts/30 days)[1]	WLAsw (counts/30 days)	LA (counts/30 days)	MOS (counts/30 days)	TMDL (counts/30 days)	
Attapulgus Creek	1.00E+15			2.58E+14	2.87E+13	2.87E+14	71
Aucilla River	2.68E+13	3.62E+10		9.88E+12	1.10E+12	1.10E+13	59
Big Creek - Woodhaven Rd. E. of Coolidge to Ochlockonee River	7.93E+14			5.28E+14	5.87E+13	5.87E+14	72
Big Creek - Headwaters to Little Creek near Meigs	4.71E+13			1.48E+13	1.65E+12	1.65E+13	65
Bridge Creek	3.71E+13	2.89E+10		1.03E+13	1.15E+12	1.15E+13	69
Little Attapulgus Creek	5.26E+14			1.72E+14	1.91E+13	1.91E+14	64
Little Ochlockonee River - Slocumb Branch to downstream SR 111 near Moultrie	1.98E+14			1.32E+14	1.47E+13	1.47E+14	51
Liitle Ochlockonee River - Big Creek to Ochlockonee River near Ochlockonee	7.21E+13	4.46E+10		6.95E+13	7.73E+12	7.73E+13	0
Little Tired Creek	1.63E+13			5.05E+12	5.62E+11	5.62E+12	65
Lost Creek	6.32E+12			1.72E+12	1.91E+11	1.91E+12	70
Ochlockonee River - Headwaters, upstream Ga. Hwy. 112 near Sylvester to Bay Branch	7.55E+12			2.24E+12	2.49E+11	2.49E+12	67
Ochlockonee River - SR 37 downstream Moultrie to Bridge Creek	3.44E+13	1.03E+12		2.66E+13	3.07E+12	3.07E+13	11
Olive Creek	1.94E+12			9.10E+11	1.01E+11	1.01E+12	48
Oquina Creek	1.15E+14	1.21E+12		7.54E+13	8.51E+12	8.51E+13	89
Parkers Mill Creek	2.90E+14			1.14E+14	1.26E+13	1.26E+14	85
Swamp Creek	1.29E+13			9.51E+12	1.06E+12	1.06E+13	18
Tired Creek	1.25E+13			8.41E+12	9.35E+11	9.35E+12	25

The information provided in this chapter consists of estimates and is presented for reference purposes to help guide the BMAP process. It was not used in the percent reduction calculation of this TMDL.

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

The methodology used for this TMDL was the "percent reduction" methodology. The Department generally prefers to use the load duration curve or "Kansas" method for coliform TMDLs, but this method could not be used because there are no stream gauging stations on Swamp Creek. To determine the TMDL, the percent reduction that would be required for each of the exceedances to meet applicable criteria was determined, and the median value of all of these reductions for both fecal determined the overall required reduction, and therefore the TMDL.

5.1.1 Data Used in the Determination of the TMDL

Seven sampling stations in the Florida portion of the Swamp Creek Watershed have coliform observations. The primary data collector of data was the Department. The seven sampling stations were sampled between January 14, 1992, through and September 11, 2007. The EPA, Biological Research Associates, and the NWFWMD conducted additional sampling. **Figure 5.1** shows the locations of these sites, and **Tables 5.1a** and **5.1b** provide a brief statistical overview of the observed data at these sites.

In addition, **Figure 5.2** shows a graphical display of the recent data points that were collected between January 14, 1992, and the present. Of the 35 recent samples collected, 12 samples exceeded the 400 cfu/100mL fecal coliform criterion. The Department conducted special sampling of Swamp Creek and its tributaries and wells (Wieckowicz, 2005).

Figure 5.1. Monitoring Sites in Swamp Creek, WBIDs 427 and 428

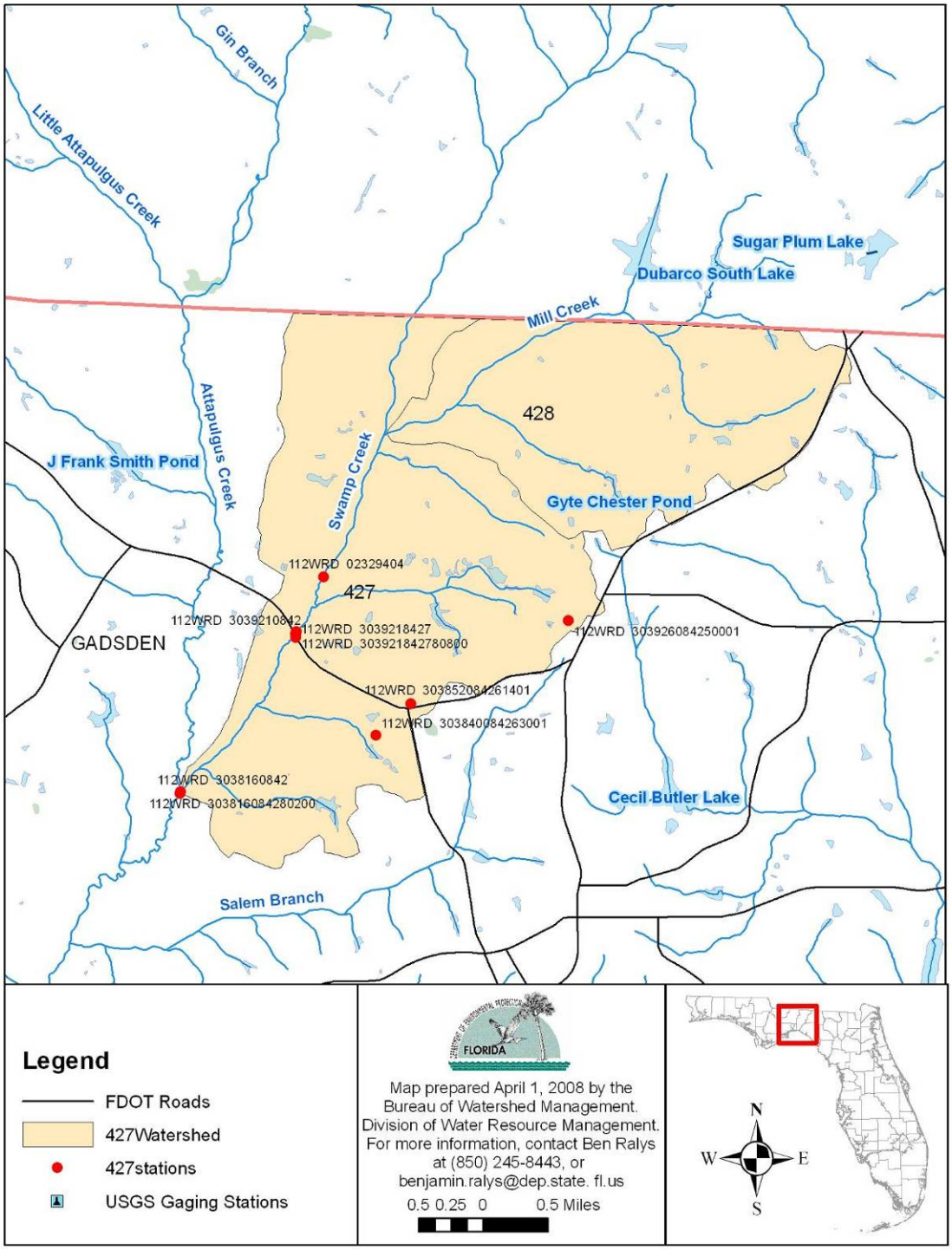


Table 5.1a. Rank Ordered Table of Observed Data for Swamp Creek, WBID 427

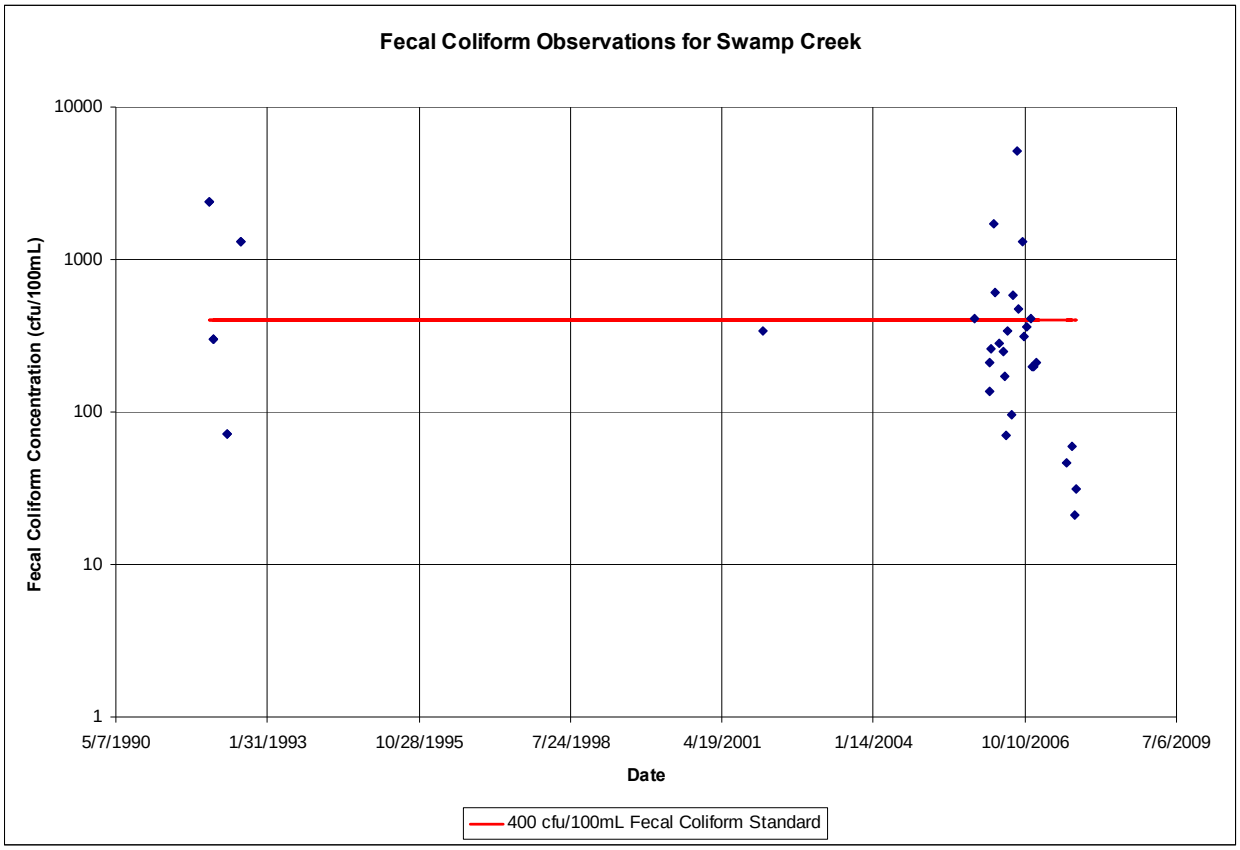
WBID	Station	Date	Time	Result (cfu/100 mL)
427	21FLBRA 427-A	9/4/2007	1357	21
427	21FLBRA 427-A	9/11/2007	930	31
427	21FLBRA 427-A	7/11/2007	1443	46
427	**21FLBRA 427-A**	**8/14/2007**	**1502**	**59***
427	21FLPNS 303919608427079	6/8/2006	1035	70
427	21FLNWFDS232	5/13/1992	1230	72
427	21FLNWFD303919084270901	5/13/1992	1230	72
427	21FLPNS 303919608427079	7/11/2006	940	96
427	21FLWQA 303919608427079	2/15/2006	905	136
427	21FLPNS 303919608427079	5/31/2006	915	170
427	21FLPNS 303919608427079	11/28/2006	1320	200
427	21FLPNS 303919608427079	12/7/2006	1015	200
427	21FLPNS 303919608427079	2/15/2006	1410	210
427	21FLPNS 303919608427079	12/20/2006	1132	210
427	21FLPNS 303919608427079	5/18/2006	945	250
427	21FLPNS 303919608427079	3/1/2006	1205	260
427	21FLPNS 303919608427079	4/26/2006	1015	280
427	21FLNWFDS232	2/10/1992	1200	300
427	21FLNWFD303919084270901	2/10/1992	1130	300
427	21FLPNS 303919608427079	10/5/2006	1040	310
427	21FLDEP 303919608427079	1/16/2002	1225	340
427	21FLPNS 303919608427079	6/19/2006	1200	340
427	21FLPNS 303919608427079	10/26/2006	1300	360
427	21FLPNS 303919608427079	11/14/2006	1245	410
427	21FLWQA	11/15/2005	1058	410
427	21FLPNS 303919608427079	8/31/2006	1225	470
427	21FLPNS 303919608427079	7/26/2006	1015	580
427	21FLPNS 303919608427079	3/29/2006	1015	610
427	21FLNWFDS232	8/10/1992	1315	1,300
427	21FLNWFD303919084270901	8/10/1992	1300	1,300
427	21FLPNS 303919608427079	9/26/2006	1300	1,315
427	21FLPNS 303919608427079	3/21/2006	1250	1,700
427	21FLNWFD303919084270901	1/14/1992	1000	2,400
427	21FLNWFDS232	1/14/1992	1000	2,400
427	21FLPNS 303919608427079	8/16/2006	1321	5,100

* Bold rows indicate that values have been averaged.

Table 5.1b. Summary of Statistical Table of Observed Data for Swamp Creek, WBID 427

WBID	Total Number of Samples	Geometric Mean (N/100mL)	Number of Samples above Standard Concentration (FC>400(N/100mL))	Minimum Concentration (N/100mL)	Maximum Concentration (N/100mL)
427	35	290.62	12	21	5,100

Figure 5.2. Chart of Recent Observations for Fecal Coliform in Swamp Creek



5.1.2 TMDL Development Process

Exceedances of the state criterion were compared with the criterion of 400 counts/100mL. For each individual exceedance, an individual required reduction was calculated using the following:

$$\textbf{(1)}\ \frac{\textbf{[(observed value) – (state criterion)] x 100}}{\textbf{(observed value)}}$$

After the individual results were calculated, the median of the individual values was calculated, which is 69.23 percent. This means that in order to meet the state criterion of 400 counts/100mL, a 69.23 percent reduction in current loading is necessary, and this would therefore be the TMDL for Swamp Creek. **Table 5.2** shows the individual reduction calculations for Swamp Creek, including all exceedances, and **Table 5.1.b** summarizes the data used in the calculation of the TMDL.

Table 5.2. Calculation of Reductions for the Fecal Coliform TMDL for Swamp Creek, WBID 427

WBID	Station Number	Date	Time	Result	Reduction Required
427	21FLPNS 303919608427079	11/14/2006	1245	410	2.439
427	21FLWQA	11/15/2005	1058	410	2.439
427	21FLPNS 303919608427079	8/31/2006	1225	470	14.894
427	21FLPNS 303919608427079	7/26/2006	1015	580	31.034
427	21FLPNS 303919608427079	3/29/2006	1015	610	34.426
427	21FLNWFDS232	8/10/1992	1315	1300	69.231
427	21FLNWFD303919084270901	8/10/1992	1300	1300	69.231
427	21FLPNS 303919608427079	9/26/2006	1300	1315	69.582
427	21FLPNS 303919608427079	3/21/2006	1250	1700	76.471
427	21FLNWFD303919084270901	1/14/1992	1000	2400	83.333
427	21FLNWFDS232	1/14/1992	1000	2400	83.333
427	21FLPNS 303919608427079	8/16/2006	1321	5100	92.157
	Median			**1300**	**69.231**

5.1.3 Critical Conditions/Seasonality

The critical condition for coliform loadings in a given watershed depends on many factors, including the presence of point sources and the land use pattern in the watershed. Typically, the critical condition for nonpoint sources is an extended dry period followed by a rainfall runoff event. During the wet weather period, rainfall washes off coliform bacteria that have built up on the land surface under dry conditions, resulting in the wet weather exceedances. However, significant nonpoint source contributions can also appear under dry conditions without any major surface runoff event. This usually happens when nonpoint sources contaminate the surficial aquifer, and fecal coliform bacteria are brought into the receiving waters through baseflow. In addition, as described above, livestock that have direct access to the receiving water can also contribute to the exceedance during dry weather. The critical condition for point source loading typically occurs during periods of low stream flow, when dilution is minimized.

Chapter 6: DETERMINATION OF THE TMDL

6.1 Expression and Allocation of the TMDL

The objective of a TMDL is to provide a basis for allocating acceptable loads among all of the known pollutant sources in a watershed so that appropriate control measures can be implemented and water quality standards achieved. A TMDL is expressed as the sum of all point source loads (wasteload allocations, or WLAs), nonpoint source loads (load allocations, or LAs), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$\mathbf{TMDL = \sum WLAs + \sum LAs + MOS}$$

As discussed earlier, the WLA is broken out into separate subcategories for wastewater discharges and stormwater discharges regulated under the NPDES Program:

$$\mathbf{TMDL \cong \sum WLAs_{wastewater} + \sum WLAs_{NPDES\ Stormwater} + \sum LAs + MOS}$$

It should be noted that the various components of the revised TMDL equation may not sum up to the value of the TMDL because (a) the WLA for NPDES stormwater is typically based on the percent reduction needed for nonpoint sources and is also accounted for within the LA, and (b) TMDL components can be expressed in different terms (for example, the WLA for stormwater is typically expressed as a percent reduction, and the WLA for wastewater is typically expressed as mass per day).

WLAs for stormwater discharges are typically expressed as "percent reduction" because it is very difficult to quantify the loads from MS4s (given the numerous discharge points) and to distinguish loads from MS4s from other nonpoint sources (given the nature of stormwater transport). The permitting of stormwater discharges also differs from the permitting of most wastewater point sources. Because stormwater discharges cannot be centrally collected, monitored, and treated, they are not subject to the same types of effluent limitations as wastewater facilities, and instead are required to meet a performance standard of providing treatment to the "maximum extent practical" through the implementation of best management practices (BMPs).

This approach is consistent with federal regulations (40 CFR § 130.2[I]), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or **other appropriate measure**. The TMDL for the Swamp Creek Watershed is expressed in terms of percent reduction, and represents the maximum annual fecal coliform load the watershed can assimilate and maintain the fecal coliform criterion (**Table 6.1**).

Table 6.1. TMDL Components for the Swamp Creek Watershed

WBID	Parameter	TMDL (% Reduction)	WLA		LA (% Reduction)	MOS
			Wastewater (cfu/100mL)	NPDES Stormwater		
Swamp Creek, WBID 427	Fecal Coliform	69.23%	Point sources must meet permit limits*	N/A*	69.23%	Implicit

† The percent reduction is based on the 10th to 90th percentile of recurrence intervals minus the WLA; see **Table 5.4**
* Any newly permitted discharges are subject to achieving the Class III water quality criterion for fecal coliform under permit limits or to the maximum extent practicable.
N/A – Not applicable.

6.2 Load Allocation

Based on a load duration curve approach similar to that developed by Kansas (Stiles, 2002), a fecal coliform reduction of 69.23 percent is needed from nonpoint sources in the Swamp Creek Watershed. It should be noted that the LA includes loading from stormwater discharges regulated by the Department and the water management districts that are not part of the NPDES Stormwater Program (see **Appendix A**). The daily LA for the Swamp Creek watershed is also a reduction of 69.23 percent.

6.3 Wasteload Allocation

Currently, there are two point source permitted NPDES wastewater discharges in the watershed. Any new potential discharger is expected to comply with the Class III criterion for coliform bacteria.

6.3.1 NPDES Wastewater Discharges

As mentioned previously, there are currently two permitted wastewater facilities with a discharge permit in the Swamp Creek Watershed. These facilities are not known to be sources of fecal coliform bacteria. Any new potential discharger is expected to comply with the Class III criterion for coliform bacteria.

6.3.2 NPDES Stormwater Discharges

There are currently no NPDES MS4 permits in the Swamp Creek watershed.

6.4 Margin of Safety

Consistent with the recommendations of the Allocation Technical Advisory Committee (Department, 2001), an implicit MOS was used in the development of this TMDL. An implicit MOS was provided by the conservative decisions associated with a number of modeling assumptions and the development of assimilative capacity.

For fecal coliform, an implicit MOS was inherently incorporated by using 400 MPN/100mL of fecal coliform as the water quality target for each and every sampling event, instead of no more than 10 percent of the samples exceeding 400 MPN/100mL. For fecal coliform TMDLs, using the correlation lines fitting through only the existing loadings that exceeded the allowable loadings could overestimate the actual existing loading, which makes the estimation more conservative and therefore adds to the MOS. An additional MOS was included in the TMDL by not allowing any exceedances of the state criterion, even though intermittent natural exceedances of the criterion would be expected and would be taken into account when determining impairment.

Chapter 7: NEXT STEPS: IMPLEMENTATION PLAN DEVELOPMENT AND BEYOND

7.1 Basin Management Action Plan

Following the adoption of this TMDL by rule, the next step in the TMDL process is to develop an implementation plan for the TMDL, which will be a component of the BMAP for the Swamp Creek watershed. This document will be developed over the next year in cooperation with local stakeholders and will attempt to reach consensus on more detailed allocations and on how load reductions will be accomplished. The BMAP will include the following:

- *Appropriate allocations among the affected parties;*
- *A description of the load reduction activities to be undertaken;*
- *Timetables for project implementation and completion;*
- *Funding mechanisms that may be utilized;*
- *Any applicable signed agreement;*
- *Local ordinances defining actions to be taken or prohibited;*
- *Local water quality standards, permits, or load limitation agreements; and*
- *Monitoring and follow-up measures.*

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Appendices

Appendix A: Background Information on Federal and State Stormwater Programs

In 1982, Florida became the first state in the country to implement statewide regulations to address the issue of nonpoint source pollution by requiring new development and redevelopment to treat stormwater before it is discharged. The Stormwater Rule, as authorized in Chapter 403, F.S., was established as a technology-based program that relies on the implementation of BMPs that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Rule 62-40, F.A.C. In 1994, the Department's stormwater treatment requirements were integrated with the stormwater flood control requirements of the state's water management districts, along with wetland protection requirements, into the Environmental Resource Permit regulations.

Rule 62-40, F.A.C., also requires the water management districts to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a Surface Water Improvement and Management (SWIM) plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL. To date, stormwater PLRGs have been established for Tampa Bay, Lake Thonotosassa, the Winter Haven Chain of Lakes, the Everglades, Lake Okeechobee, and Lake Apopka. No PLRG had been developed for Newnans Lake when this report was published.

In 1987, the U.S. Congress established Section 402(p) as part of the federal Clean Water Act Reauthorization. This section of the law amended the scope of the federal NPDES permitting program to designate certain stormwater discharges as "point sources" of pollution. The EPA promulgated regulations and began implementing the Phase I NPDES Stormwater Program in 1990. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific standard industrial classification (SIC) codes, construction sites disturbing 5 or more acres of land, and master drainage systems of local governments with a population above 100,000, which are better known as MS4s. However, because the master drainage systems of most local governments in Florida are interconnected, the EPA implemented Phase I of the MS4 permitting program on a countywide basis, which brought in all cities (incorporated areas), Chapter 298 urban water control districts, and the Florida Department of Transportation throughout the 15 counties meeting the population criteria. The Department received authorization to implement the NPDES Stormwater Program in 2000.

An important difference between the federal NPDES and the state's stormwater/environmental resource permitting programs is that the NPDES Program covers both new and existing discharges, while the state's program focuses on new discharges only. Additionally, Phase II of the NPDES Program, implemented in 2003, expands the need for these permits to construction sites between 1 and 5 acres, and to local governments with as few as 1,000 people. While these urban stormwater discharges are now technically referred to as "point sources" for the purpose of regulation, they are still diffuse sources of pollution that cannot be easily collected and treated by a central treatment facility, as are other point sources of pollution such as domestic and industrial wastewater discharges. It should be noted that all MS4 permits issued in Florida include a reopener clause that allows permit revisions to implement TMDLs when the implementation plan is formally adopted.

Appendix B: Summary of Land Use Loads by Category

Land Use Information for the Swamp Creek Watershed

LAND USE LEVEL 1		GADSDEN COUNTY FL		SWAMP CREEK	
		TOTAL		TOTAL	
		SQMI	%	SQMI	%
1000	URBAN AND BUILT UP	33.8933	6.4175909	0.6613	9.149142
2000	AGRICULTURE	68.5734	12.98416	0.8437	11.67266
3000	RANGELAND	13.6949	2.5930867	0	0
4000	UPLAND FORESTS	364.3199	68.98284	4.6654	64.54621
5000	WATER	14.3015	2.7079445	0.1303	1.802712
6000	WETLANDS	28.3987	5.3772055	0.9241	12.785
7000	BARREN LAND	0.0821	0.0155454	0	0
8000	TRANSPORTATION AND UTILITIES	4.8674	0.9216271	0.0032	0.044272
	TOTAL LAND	513.8297	97.292055	7.0977	98.19729
	TOTAL LAND+WATER	528.1312	100	7.228	100
	TOTAL CENSUS 2003	528.49		10.3114904	
	URBAN RATIO WBID/COUNTY	1		0.01951123	
	AGRICULTURE RATIO WBID/COUNTY	1		0.0123036	
	NATURAL RATIO WBID/COUNTY	1		0.01354395	
	TOTAL SEPTIC TANKS THRU 2005	16381		319.613472	
	TOTAL REPAIRS 1991 THRU 2005	1761		34.3592775	
	TOTAL FAILURES	819.05		15.9806736	
	TOTAL 2000 HOUSEHOLDS	15867		309.5847	
	TOTAL HOUSEBOATS				
	TOTAL 1990 PUBLIC SEWER	6046		117.964902	
	TOTAL 1990 SEPTIC	8455		164.967457	
	TOTAL 1990 OTHER	358		6.98502064	
	TOTAL 2000 POPULATION	45087		879.702865	

Fecal Coliform Loading From Animals in the Swamp Creek Watershed

Animal Type	Fecal Coliform Load Produced by Animals (cts/ animal/ day)	Number of Animals in Leon County	County Area (mi^2)	Animal Density in Gadsden County (#/mi^2)	References	Swamp Creek Watershed Drainage Area (mi^2)	Number of Animals in Swamp Creek Watershed	Load Produced by Animals in Swamp Creek Watershed (cts/day)
LIVESTOCK								
Cattle and Calves Inventory	1.04E+11	4564	528.1312			7.228	56.15365	5.84E+12
Cattle and Calves Sold	1.04E+11	2518	528.1312			7.228	30.98048	3.222E+12
Dairy Cattle Inventory	1.01E+11	46	528.1312		C	7.228	0.565966	5.705E+10
Beef Cattle Inventory	1.04E+11	2710	528.1312		C	7.228	33.34277	3.468E+12
Sheep and Lambs Inventory	1.20E+10	66	528.1312		C	7.228	0.812038	9.744E+09
Sheep and Lambs Sold	1.20E+10	0	528.1312			7.228	0	0
Horses and Ponies Inventory	4.20E+08	500	528.1312		C	7.228	6.151802	2.584E+09
Horses and Ponies Sold	4.20E+08	5	528.1312			7.228	0.061518	25837570
Mules, Burros, and Donkeys Inventory	4.20E+08	14	528.1312		C,E	7.228	0.17225	72345195
Mules, Burros, and Donkeys Sold	4.20E+08		528.1312			7.228	0	0
Llamas (~Sheep)	1.20E+10		528.1312		C,E	7.228	0	0
Bison (~Beef Cattle)	1.04E+11		528.1312		C,E	7.228	0	0
Deer	5.00E+08		528.1312		C,E	7.228	0	0
Elk	5.00E+08		528.1312		C,E	7.228	0	0
Goats, All (~Sheep) Inventory	1.20E+10	365	528.1312		C,E	7.228	4.490816	5.389E+10
Goats, All (~Sheep) Sold	1.20E+10	46	528.1312			7.228	0.565966	6.792E+09
Hogs and Pigs Inventory	1.08E+10	551	528.1312		C	7.228	6.779286	7.322E+10
Hogs and Pigs Sold	1.08E+10		528.1312			7.228	0	0
Layer Chickens Inventory	1.40E+08	70	528.1312		C	7.228	0.861252	120575325
Layer Chickens Sold	1.40E+08		528.1312			7.228	0	0
Broilers Inventory	1.40E+08		528.1312		C	7.228	0	0
Broilers Sold	1.40E+08		528.1312			7.228	0	0
Turkeys Inventory	9.50E+07	18	528.1312		C	7.228	0.221465	21039164
Turkeys Sold	9.50E+07		528.1312			7.228	0	0
Ducks Inventory	2.50E+09	22	528.1312		C	7.228	0.270679	676698253
Ducks Sold	2.50E+09		528.1312			7.228	0	0
Geese Inventory	4.90E+10	25	528.1312		C	7.228	0.30759	1.507E+10

Animal Type	Fecal Coliform Load Produced by Animals (cts/ animal/ day)	Number of Animals in Leon County	County Area (mi^2)	Animal Density in Gadsden County (#/mi^2)	References	Swamp Creek Watershed Drainage Area (mi^2)	Number of Animals in Swamp Creek Watershed	Load Produced by Animals in Swamp Creek Watershed (cts/day)
Geese Sold	4.90E+10		528.1312			7.228	0	0
Emus (~Geese)	4.90E+10		528.1312		C,E	7.228	0	0
Ostriches (~Geese)	4.90E+10		528.1312		C,E	7.228	0	0
Pheasants (~Geese) Inventory	4.90E+10	6	528.1312		C,E	7.228	0.073822	3.617E+09
Pheasants (~Geese) Sold	4.90E+10		528.1312			7.228	0	0
Pigeons or Squab Inventory	1.60E+08		528.1312		C	7.228	0	0
Pigeons or Squab Sold	1.60E+08		528.1312			7.228	0	0
Quail (~Pigeon)	1.60E+08		528.1312		C	7.228	0	0
Other			528.1312		C	7.228	0	0
Rabbits Inventory	2.53E+09		528.1312		J,K	7.228	0	0
Rabbits Sold	2.53E+09		528.1312		J,K	7.228	0	0
TOTAL LIVESTOCK			528.1312		C	7.228	0	**1.275E+13**
WILDLIFE			528.1312		C	7.228		
Alligators			528.1312		C	7.228	0	0
Black Bears			528.1312		C	7.228	0	0
Raccoons	1.25E+08		528.1312		C	7.228	0	0
Beavers	2.50E+08		528.1312		C	7.228	0	0
Deer	5.00E+08	8702	528.1312		CI	7.228	117.8595	5.893E+10
Dolphin, Porpoise, Manatee			528.1312		C	7.228	0	0
Waterfowl	4.90E+10	9.7513	528.1312		CI	7.228	0.132071	6.471E+09
Wild Pigs	1.08E+10		528.1312		CI	7.228	0	0
TOTAL WILDLIFE			528.1312		C	7.228		**6.54E+10**
DOMESTIC ANIMALS			528.1312		C	7.228		
Dogs	5.00E+09	4638.84	528.1312	0.58*HH	F	7.228	179.5591	8.978E+11
Cats	5.00E+09	5278.68	528.1312	0.66*HH	F	7.228	204.3259	1.022E+12
Horses and Ponies–Pets	4.20E+08	399.9	528.1312	0.05*HH	F	7.228	15.47923	6.501E+09
TOTAL DOMESTIC			528.1312			7.228		**9.043E+11**
SEPTIC–HUMAN IMPACTS			528.1312			7.228		
Human	2.00E+09		528.1312			7.228		
Sewer Line Leaks	6.89E+09		528.1312			7.228		4.34E+10

Animal Type	Fecal Coliform Load Produced by Animals (cts/ animal/ day)	Number of Animals in Leon County	County Area (mi^2)	Animal Density in Gadsden County (#/mi^2)	References	Swamp Creek Watershed Drainage Area (mi^2)	Number of Animals in Swamp Creek Watershed	Load Produced by Animals in Swamp Creek Watershed (cts/day)
Houseboats–Nonmarina	2.00E+09		528.1312		C	7.228		
Boats–Marina Slips	2.00E+09		528.1312			7.228		0
Septic Tanks Failed	6.89E+09		528.1312			7.228	15.98067	1.101E+11
Septic Tanks Normal			528.1312			7.228		
Septic Tanks–ATU	2.76E+08		528.1312		H	7.228		
TOTAL SEPTIC			528.1312			7.228		**1.535E+11**
AQUACULTURE								
Fish Farms			528.1312			7.228	0	
Fish Farms Sold			528.1312			7.228	0	
Oyster Houses			528.1312			7.228	0	
TOTAL AQUACULTURE			528.1312			7.228	0	
TOTAL			528.1312			7.228	0	**1.388E+13**

REFERENCES

A USDA Census, 2002; Note A–D indicates confidential data not available at

B Assume 1 animal per household* 7,180 housing units=7,180.

C EPA, 2001. Available: http://www.epa.gov/owow/tmdl/pathogen_all.pdf.

D American Society of Agricultural and Biological Engineers, 1998. Available: http://www.asae.org.

E Estimated from similar animals.

F American Veterinary Medical Association, 2002. Available: http://www.avma.org. Dogs=0.58*Households, Cats=0.66*HH, Horses=0.05*HH.

G Speas, 2004. Range of 500 to 1,900 cfu/100mL or 96 percent removal, use one ATU=0.04*6.89E09 cfu/day.

H EPA, 2008. Available: http://www.epa.gov/region1/assistance/ceitts/wastewater/techs/delta.html.

I Knight, 2003.

J Available: http://www.bae.ncsu/edu/programs/extension/manure.

K Rhode Island Department of Environmental Management, 2003. Table 8.

Appendix C: Summary of Permitted Point Source Loads

NPDES Permit Number	Facility Name	Units	Max/Min	Annual Average	Monthly Average	Weekly Average	Single Sample	Monitoring Frequency	Sample Type	Monitoring Location Site Number	Dischages to the Swamp Creek Watershed
GA0046744	Englehard Specialty Chemicals			See Permit							Yes
FLA010091	Coastal Plywood			See Permit							Yes
FLR05A004	Coastal Plywood			See Permit							Yes

Appendix D: Summary of Measured External Loads

Calculation of External Load to the Swamp Creek Watershed

Date	Observed Fecal Coliform (counts/100 mL)	Estimated Instantaneous Flow On Sample Day (cfs)	Geometric Mean (counts/100 mL)	Mean Flow (cfs)	Geometric Mean Fecal Coliform Loading (counts/30 days)	Geometric Mean TMDL Fecal Coliform Loading (counts/30 days)
26-Feb-03	20	21.0				
4-Mar-03	460	100.0				
11-Mar-03	330	100.0				
19-Mar-03	270	100.0	169	80.3	9.97E+12	5.89E+13
19-Mar-03	270	100.0				
3-Apr-03	20	24.0				
8-Apr-03	3,500	100.0				
17-Apr-03	40	17.0	166	60.3	7.33E+12	4.42E+13
24-Jul-03	1,300	100.0				
7-Aug-03	110	72.0				
14-Aug-03	490	93.0				
20-Aug-03	50	23.0	243	72.0	1.29E+13	1.06E+13
11-Sep-03	80	11.0				
17-Sep-03	170	9.8				
24-Sep-03	293	18.0				
9-Oct-03	270	17.0	181	14.0	1.85E+12	2.05E+12

Note: This table was taken from *Total Maximum Daily Load evaluation for seventeen stream segments in the Ochlockonee River Basin for fecal coliform,* Table A-16 (Georgia Environmental Protection Division, 2006).

Stream Segment	Current Load (counts/30 days)	TMDL Components					Percent Reduction
		WLA (counts/30 days)[1]	WLAsw (counts/30 days)	LA (counts/30 days)	MOS (counts/30 days)	TMDL (counts/30 days)	
Attapulgus Creek	1.00E+15			2.58E+14	2.87E+13	2.87E+14	71
Aucilla River	2.68E+13	3.62E+10		9.88E+12	1.10E+12	1.10E+13	59
Big Creek - Woodhaven Rd. E. of Coolidge to Ochlockonee River	7.93E+14			5.28E+14	5.87E+13	5.87E+14	72
Big Creek - Headwaters to Little Creek near Meigs	4.71E+13			1.48E+13	1.65E+12	1.65E+13	65
Bridge Creek	3.71E+13	2.89E+10		1.03E+13	1.15E+12	1.15E+13	69
Little Attapulgus Creek	5.26E+14			1.72E+14	1.91E+13	1.91E+14	64
Little Ochlockonee River - Slocumb Branch to downstream SR 111 near Moultrie	1.98E+14			1.32E+14	1.47E+13	1.47E+14	51
Liitle Ochlockonee River - Big Creek to Ochlockonee River near Ochlockonee	7.21E+13	4.46E+10		6.95E+13	7.73E+12	7.73E+13	0
Little Tired Creek	1.63E+13			5.05E+12	5.62E+11	5.62E+12	65
Lost Creek	6.32E+12			1.72E+12	1.91E+11	1.91E+12	70
Ochlockonee River - Headwaters, upstream Ga. Hwy. 112 near Sylvester to Bay Branch	7.55E+12			2.24E+12	2.49E+11	2.49E+12	67
Ochlockonee River - SR 37 downstream Moultrie to Bridge Creek	3.44E+13	1.03E+12		2.66E+13	3.07E+12	3.07E+13	11
Olive Creek	1.94E+12			9.10E+11	1.01E+11	1.01E+12	48
Oquina Creek	1.15E+14	1.21E+12		7.54E+13	8.51E+12	8.51E+13	89
Parkers Mill Creek	2.90E+14			1.14E+14	1.26E+13	1.26E+14	85
Swamp Creek	1.29E+13			9.51E+12	1.06E+12	1.06E+13	18
Tired Creek	1.25E+13			8.41E+12	9.35E+11	9.35E+12	25

Appendix E: Summary of Effluent Data

Refer to the CD to obtain the entire dataset.

Appendix F: Summary of Photos and News Articles

Swamp Creek downstream of highway

Swamp Creek downstream of railroad crossing

Conservation easement around a portion of Swamp Creek

Land use surrounding a portion of Swamp Creek

Wild game farm located on the Florida–Georgia state line in the Swamp Creek watershed

Wild game farm

Swamp Creek upstream of Highway

Swamp Creek upstream of railroad crossing

Appendix G: Swamp Creek Watershed Data

Florida Department of Environmental Protection
Division of Water Resource Management
Bureau of Watershed Management
2600 Blair Stone Road, Mail Station 3565
Tallahassee, Florida 32399-2400
www.dep.state.fl.us/water/