FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Environmental Assessment and Restoration, Bureau of Watershed Restoration

NORTHEAST DISTRICT • LOWER ST. JOHNS BASIN

Final TMDL Report

Fecal Coliform TMDL for Little Black Creek (WBID 2368), Peters Creek (WBID 2444), and Greene Creek (WBID 2478)

Kyeongsik Rhew

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Acknowledgments

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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

2008 Integrated Report

http://www.dep.state.fl.us/water/docs/2008_Integrated_Report.pdf

Criteria for Surface Water Quality Classifications

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

Basin Status Report for the Lower St. Johns Basin

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

Water Quality Assessment Report for the Lower St. Johns Basin

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

U.S. Environmental Protection Agency

Region 4: Total Maximum Daily Loads in Florida

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

National STORET Program

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Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Loads (TMDLs) for fecal coliform bacteria for Little Black Creek, Peters Creek, and Greene Creek in the Lower St. Johns Basin. These waterbodies were verified as impaired for fecal coliform and therefore were included on the Verified List of impaired waters for the Lower St. Johns Basin that was adopted by Secretarial Order on May 19, 2009. The TMDLs establish the allowable fecal coliform loadings to Little Black Creek, Peters Creek, and Greene Creek that would restore these waterbodies so that they meet their applicable water quality criterion for fecal coliform.

1.2 Identification of Waterbody

Little Black Creek, Peters Creek, and Greene Creek, which are located in Clay County in northeast Florida, have drainage areas of approximately 13.7, 14.5, and 19.5 square miles (mi^2), respectively. Little Black Creek and Peters Creek flow directly into Black Creek, a tributary to the St. Johns River, and Greene Creek flows into Black Creek via South Fork Black Creek (**Figures 1.1** and **1.2**). Little Black Creek, Peters Creek, and Greene Creek are approximately 15.7, 11.4, and 11.5 miles long, respectively.

The Little Black Creek watershed is located in the northeastern part of Clay County, and the northern portion of the watershed is in Duval County. The Peters Creek watershed is located in the eastern portion of Clay County, approximately 7.5 miles south of the city of Jacksonville and approximately 1 mile west of the city of Green Cove Springs. The Greene Creek watershed is located in the southern portion of Clay County, approximately 1 mile south of the city of Penney Farms and 5.4 miles southwest of the city of Green Cove Springs. Additional information about the creeks' hydrology and geology is available in the Basin Status Report for the Lower St. Johns Basin (Florida Department of Environmental Protection [Department], 2002).

For assessment purposes, the Department has divided the Lower St. Johns Basin into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed or stream reach. This TMDL report addresses Little Black Creek (WBID 2368), Peters Creek (WBID 2444), and Greene Creek (WBID 2478) for fecal coliform.

Figure 1.1. Location of the Little Black Creek (WBID 2368), Peters Creek (WBID 2444), and Greene Creek (WBID 2478) Watersheds in the Lower St. Johns Basin, and Major Geopolitical Features in the Area

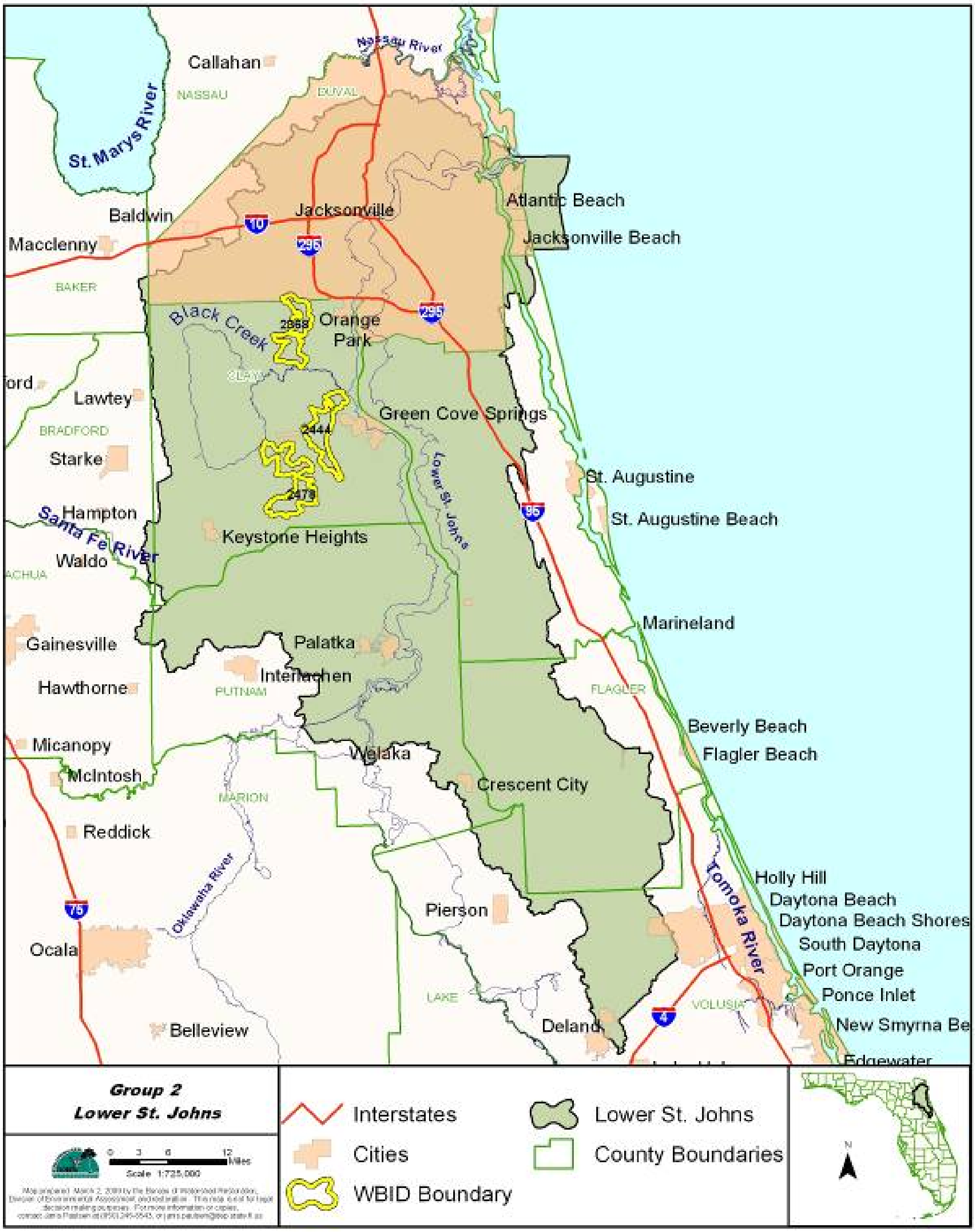
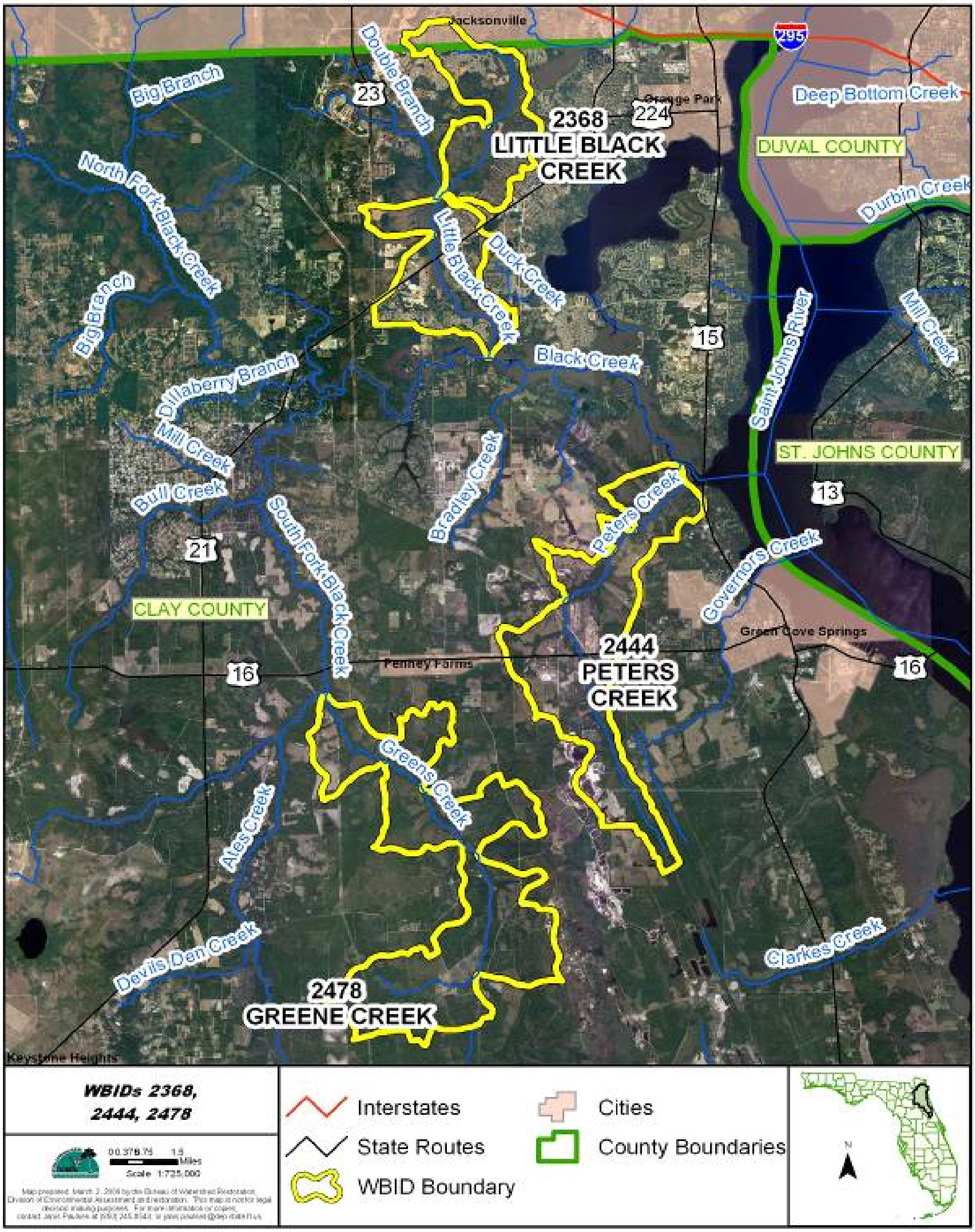


Figure 1.2. Location of the Little Black Creek (WBID 2368), Peters Creek (WBID 2444), and Greene Creek (WBID 2478) Watersheds in Clay County



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).

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 restoration plan, designed to reduce the amount of fecal coliform that caused the verified impairment of Little Black Creek, Peters Creek, and Greene Creek. These activities will depend heavily on the active participation of the St. Johns River Water Management District (SJRWMD), 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) lists 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.]); the state's 303(d) list is amended annually to include basin updates.

Florida's 1998 303(d) list included 55 waterbodies in the Lower St. Johns 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 modified in 2006 and 2007.

2.2 Information on Verified Impairment

The Department used the IWR to assess water quality impairments in Little Black Creek, Peters Creek, and Greene Creek, and has verified that these waterbody segments are impaired for fecal coliform bacteria. The verifications of impairment were based on the observations that a total of 7 out of 23 fecal coliform samples for Little Black Creek, 17 out of 28 for Peters Creek, and 8 out of 21 for Greene Creek collected during the verified period (January 1, 2001, through June 30, 2008) exceeded the applicable fecal water quality criterion (Rule 62-302, F.A.C.).

Table 2.1 summarizes the fecal coliform monitoring results for the verified period for Little Black Creek, Peters Creek, and Greene Creek. **Tables 2.2** through **2.4** also provide summary results for fecal coliform data for the verified period by month, season, and year in each waterbody, respectively.

Table 2.1. Summary of Fecal Coliform Monitoring Data for Little Black Creek (WBID 2368), Peters Creek (WBID 2444), and Greene Creek (WBID 2478) During the Verified Period (January 1, 2001, through June 30, 2008)

- = Empty cell
* Most probable number per 100 milliliters

Waterbody (WBID)	Parameter	Fecal Coliform[1]
Little Black Creek (2368)	Total number of samples	23
Little Black Creek (2368)	IWR-required number of exceedances for the Verified List	5
Little Black Creek (2368)	Number of observed exceedances	7
Little Black Creek (2368)	Number of observed nonexceedances	16
Little Black Creek (2368)	Number of seasons during which samples were collected	4
Little Black Creek (2368)	Highest observation (MPN/100mL)[1]	1,325
Little Black Creek (2368)	Lowest observation (MPN/100mL)[1]	10
Little Black Creek (2368)	Median observation (MPN/100mL)[1]	196
Little Black Creek (2368)	Mean observation (MPN/100mL)[1]	298
-	**FINAL ASSESSMENT:**	**Impaired**
Peters Creek (2444)	Total number of samples	28
Peters Creek (2444)	IWR-required number of exceedances for the Verified List	6
Peters Creek (2444)	Number of observed exceedances	17
Peters Creek (2444)	Number of observed nonexceedances	11
Peters Creek (2444)	Number of seasons during which samples were collected	4
Peters Creek (2444)	Highest observation (MPN/100mL)[1]	2,400
Peters Creek (2444)	Lowest observation (MPN/100mL)[1]	24
Peters Creek (2444)	Median observation (MPN/100mL)[1]	505
Peters Creek (2444)	Mean observation (MPN/100mL)[1]	597
-	**FINAL ASSESSMENT:**	**Impaired**
Greene Creek (2478)	Total number of samples	21
Greene Creek (2478)	IWR-required number of exceedances for the Verified List	5
Greene Creek (2478)	Number of observed exceedances	8
Greene Creek (2478)	Number of observed nonexceedances	13
Greene Creek (2478)	Number of seasons during which samples were collected	4
Greene Creek (2478)	Highest observation (MPN/100mL)[1]	1,352
Greene Creek (2478)	Lowest observation (MPN/100mL)[1]	30
Greene Creek (2478)	Median observation (MPN/100mL)[1]	200
Greene Creek (2478)	Mean observation (MPN/100mL)[1]	389
-	**FINAL ASSESSMENT:**	**Impaired**

Table 2.2. Summary of Fecal Coliform Data by Month for Little Black Creek (WBID 2368), Peters Creek (WBID 2444), and Greene Creek (WBID 2478) During the Verified Period (January 1, 2001, through June 30, 2008)

- = Empty cell/no data
[1] Coliform counts are #/100mL.
[2] Exceedances represent values above 400 counts/100 mL.

WBID	Month	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedance
2368	January	5	20	307	57	120	0	0%
2368	February	-	-	-	-	-	-	-
2368	March	-	-	-	-	-	-	-
2368	April	-	-	-	-	-	-	-
2368	May	-	-	-	-	-	-	-
2368	June	2	440	1,027	734	734	2	100%
2368	July	4	50	480	195	230	1	25%
2368	August	2	520	568	544	544	2	100%
2368	September	4	93	1,325	196	452	1	25%
2368	October	2	10	550	280	280	1	50%
2368	November	2	100	233	167	167	0	0%
2368	December	2	10	61	36	36	0	0%
2444	January	4	68	800	230	332	1	25%
2444	February	2	560	2,100	1,330	1,330	2	100%
2444	March	2	520	900	710	710	2	100%
2444	April	2	580	708	644	644	2	100%
2444	May	2	24	384	204	204	0	0%
2444	June	2	320	686	503	503	1	50%
2444	July	4	73	782	395	411	2	50%
2444	August	4	320	673	480	488	2	50%
2444	September	-	-	-	-	-	-	-
2444	October	4	250	2,400	567	946	3	75%
2444	November	2	450	775	613	613	2	100%
2444	December	-	-	-	-	-	-	-
2478	January	3	136	667	576	460	2	67%
2478	February	3	67	1050	620	579	2	67%
2478	March	2	380	480	430	430	1	50%
2478	April	1	30	30	30	30	0	0%
2478	May	-	-	-	-	-	-	-
2478	June	1	1,352	1,352	1,352	1,352	1	100%
2478	July	2	53	809	431	431	1	50%
2478	August	3	40	220	100	120	0	0%
2478	September	-	-	-	-	-	-	-
2478	October	3	100	200	100	133	0	0%
2478	November	2	50	940	495	495	1	50%
2478	December	1	193	193	193	193	0	0%

Table 2.3. Summary of Fecal Coliform Data by Season for Little Black Creek (WBID 2368), Peters Creek (WBID 2444), and Greene Creek (WBID 2478) During the Verified Period (January 1, 2001, through June 30, 2008)

[1] Coliform counts are #/100mL.
[2] Exceedances represent values above 400 counts/100 mL.

WBID	Season	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedance
2368	Winter	5	20	307	57	120	0	0%
2368	Spring	2	440	1,027	734	734	2	100%
2368	Summer	10	50	1,325	223	382	4	40%
2368	Fall	6	10	550	81	161	1	17%
2444	Winter	8	68	2,100	540	676	5	63%
2444	Spring	6	24	708	482	450	3	50%
2444	Summer	8	73	782	425	418	4	50%
2444	Fall	6	250	2,400	567	835	5	83%
2478	Winter	8	67	1,050	528	497	5	63%
2478	Spring	2	30	1,352	691	691	1	50%
2478	Summer	5	40	809	100	244	1	20%
2478	Fall	6	50	940	147	264	1	17%

Table 2.4. Summary of Fecal Coliform Data by Year for Little Black Creek (2368), Peters Creek (2444), and Greene Creek (2478) During the Verified Period (January 1, 2001, through June 30, 2008)

[1] Coliform counts are #/100mL.
[2] Exceedances represent values above 400 counts/100 mL.

WBID	Year	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedance
2368	2001	1	20	20	20	20	0	0
2368	2003	2	10	61	36	36	0	0
2368	2004	10	10	568	206	245	3	30
2368	2007	10	57	1,325	270	430	4	40
2444	2004	6	68	360	242	218	0	0
2444	2007	22	24	2,400	590	701	17	77
2478	2002	4	100	940	287	403	1	25
2478	2004	6	40	576	84	162	1	17
2478	2007	10	30	1,352	350	453	5	50
2478	2008	1	1,050	1,050	1,050	1,050	1	100

Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criterion Applicable to the TMDLs

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)**

Little Black Creek, Peters Creek, and Greene Creek are Class III waterbodies, with a designated use of recreation, propagation, and the maintenance of a healthy, well-balanced population of fish and wildlife. The criterion applicable to these TMDLs is the Class III criterion for fecal coliform.

3.2 Applicable Water Quality Standards and Numeric Water Quality Target

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

Fecal Coliform Bacteria:

The most probable number (MPN) or membrane filter (MF) counts per 100 mL of fecal coliform 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. There were insufficient data (fewer than 10 samples in a given month) available to evaluate the geometric mean criterion for fecal coliform bacteria. Therefore, the criterion selected for the TMDLs was not to exceed 400 MPN/100 mL in any sampling event for fecal coliform. The 10 percent exceedance allowed by the water quality criterion for fecal coliform bacteria was not used directly in estimating the target load, but was included in the TMDLs' margin of safety (as described in subsequent chapters).

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 pollutants in the impaired waterbody and the amount of pollutant loadings 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, such as 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 Fecal Coliform in the Little Black Creek, Peters Creek, and Greene Creek Watersheds

4.2.1 Point Sources

Wastewater Point Sources

No NPDES-permitted wastewater facilities were identified in the Peters Creek and Greene Creek watersheds. However, two outfalls (D-007 and D-006) were identified going to Greene Creek from Iluka Resources, Inc. (FL0002119), which is located in the Clarks Creek watershed (WBID 2503). This is a mineral sands mining and processing facility, and therefore does not contribute fecal coliform bacteria to surface water.

One NPDES-permitted wastewater facility (Ridaught Landing WWTF; FL0039721) was identified in the Little Black Creek watershed. This facility, which is located in the southern part of the watershed, has a 1.875 mgd annual average daily flow (AADF) permitted discharge to Little Black Creek.

Municipal Separate Storm Sewer System Permittees

In the Little Black Creek, Peters Creek, and Greene Creek watersheds, Clay County has a Phase II municipal separate storm sewer system (MS4) permit (FLR04E045).

4.2.2 Land Uses and Nonpoint Sources

Land Uses

The spatial distribution and acreage of different land use categories were identified using the SJRWMD's year 2004 land use coverage contained in the Department's geographic information system (GIS) library. Land use categories in the watershed were aggregated using the simplified Level 1 codes and tabulated in **Tables 4. 1a–c**. **Figure 4.1** shows the acreage of the principal land uses in each watershed.

As shown in the tables, the Little Black Creek, Peters Creek, and Greene Creek watersheds cover about 8,760, 9,303, and 12,518 acres, respectively. Natural land uses dominate, including water/wetlands, upland forest, and barren land; these occupy about 4,558, 6,877, and 12,255 acres and account for about 52.0, 73.9, and 97.9 percent of the total areas of the Little Black Creek, Peters Creek, and Greene Creek watersheds, respectively.

Because no conventional point sources were identified in the watersheds, the primary loadings of fecal coliform into the creeks are generated by nonpoint sources or MS4-permitted areas in the watersheds. Nonpoint sources of coliform bacteria generally, but not always, come from the coliform bacteria that accumulate on land surfaces and wash off as a result of storm events, the contribution from ground water from sources such as failed septic tanks, and/or sewer line leakage. In addition, feces from pets in residential areas can be another important source of fecal coliform through the surface runoff.

Table 4.1a. Classification of Land Use Categories in the Little Black Creek Watershed (WBID 2368) in 2004

- = Empty cell

Level 1 Code	Land Use	Acreage	% Acreage
1000	Urban and built-up	291	3.3%
	Low-density residential	752	8.6%
	Medium-density residential	1,962	22.4%
	High-density residential	288	3.3%
2000	Agriculture	372	4.2%
3000	Rangeland	410	4.7%
4000	Upland forest	1,525	17.4%
5000	Water	149	1.7%
6000	Wetland	2,759	31.5%
7000	Barren land	125	1.4%
8000	Transportation, communication, and utilities	127	1.4%
-	**TOTAL:**	**8,760**	**100.0%**

Table 4.1b. Classification of Land Use Categories in the Peters Creek Watershed (WBID 2444) in 2004

- = Empty cell

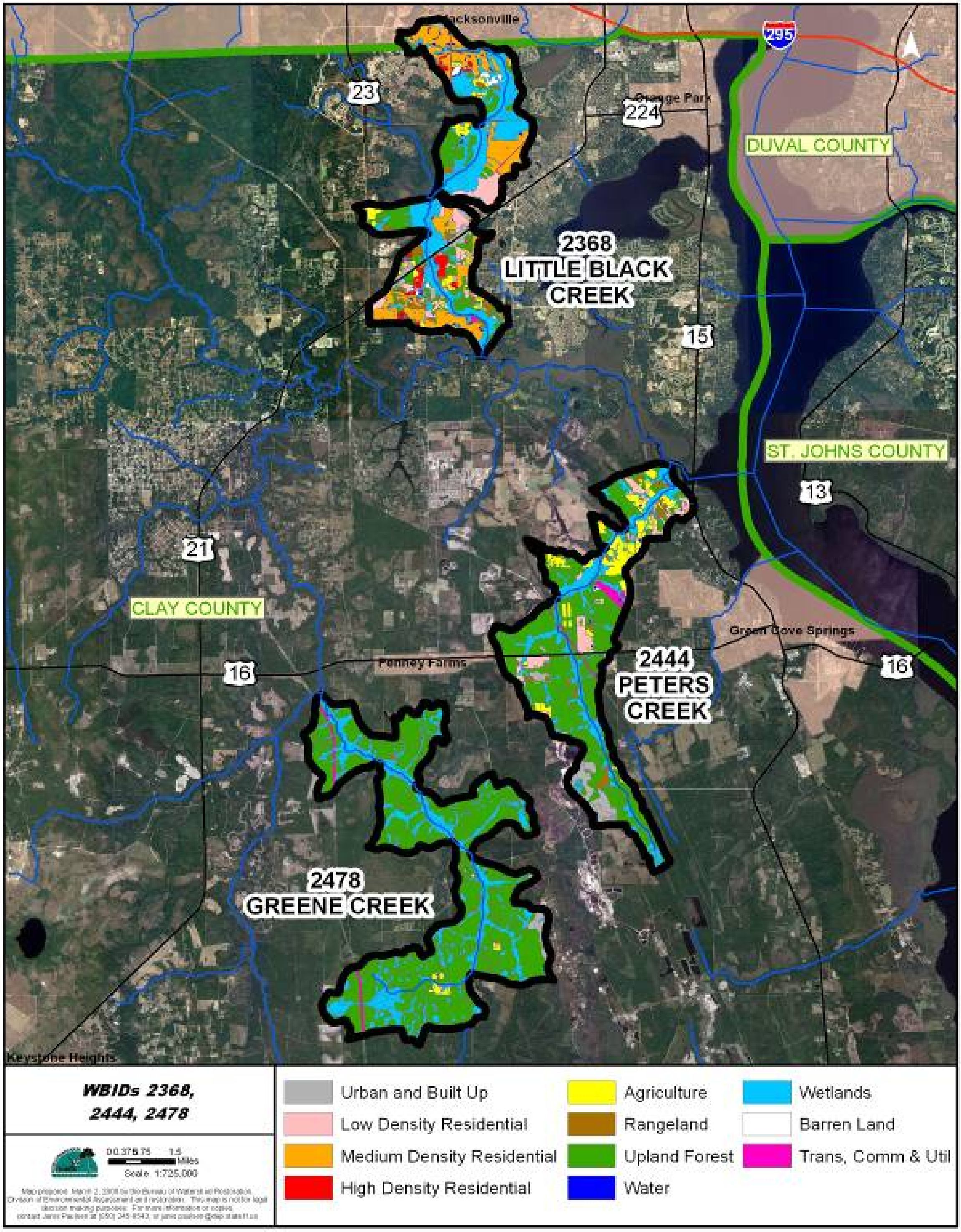
Level 1 Code	Land Use	Acreage	% Acreage
1000	Urban and built-up	438	4.7%
	Low-density residential	442	4.8%
	Medium-density residential	13	0.1%
	High-density residential	0	0.0%
2000	Agriculture	1,074	11.5%
3000	Rangeland	268	2.9%
4000	Upland forest	4,997	53.7%
5000	Water	57	0.6%
6000	Wetland	1,763	19.0%
7000	Barren land	60	0.6%
8000	Transportation, communication, and utilities	191	2.1%
-	**TOTAL:**	**9,303**	**100.0%**

Table 4.1c. Classification of Land Use Categories in the Greene Creek Watershed (WBID 2478) in 2004

- = Empty cell

Level 1 Code	Land Use	Acreage	% Acreage
1000	Urban and built-up	0	0.0%
	Low-density residential	16	0.1%
	Medium-density residential	0	0.0%
	High-density residential	0	0.0%
2000	Agriculture	82	0.7%
3000	Rangeland	38	0.3%
4000	Upland forest	9,173	73.3%
5000	Water	4	0.0%
6000	Wetland	3,075	24.6%
7000	Barren land	3	0.0%
8000	Transportation, communication, and utilities	127	1.0%
-	**TOTAL:**	**12,518**	**100.0%**

Figure 4.1. Principal Land Uses in the Little Black Creek (WBID 2368), Peters Creek (WBID 2444), and Greene Creek (WBID 2478) Watersheds in 2004



Pets

Pets (especially dogs) could be a significant source of coliform pollution through surface runoff in the Little Black Creek, Peters Creek, and Greene Creek watersheds. Studies report that up to 95 percent of the fecal coliform found in urban stormwater can have nonhuman origins (Alderiso et al., 1996; Trial et al., 1993).

The most important nonhuman fecal coliform contributors appear to be dogs and cats. In a highly urbanized Baltimore catchment, Lim and Olivieri (1982) found that dog feces were the single greatest source for fecal coliform and fecal strep bacteria. Trial et al. (1993) also reported that cats and dogs were the primary source of fecal coliform in urban watersheds. Using bacteria source tracking techniques, it was found in Stevenson Creek in Clearwater, Florida, that the amount of fecal coliform bacteria contributed by dogs was as important as those from septic tanks (Watson, 2002).

According to the American Pet Products Manufacturers Association (APPMA), about 4 out of 10 U.S. households include at least one dog. A single gram of dog feces contains about 23 million fecal coliform bacteria (van der Wel, 1995). Unfortunately, statistics show that about 40 percent of American dog owners do not pick up their dogs' feces. **Table 4.2** shows the fecal coliform concentrations of the surface runoff measured in two urban areas (Bannerman et al., 1993; Steuer et al., 1997). While the bacteria levels differed widely in the two studies, both indicated that residential lawns, driveways, and streets were the major source areas for bacteria.

The number of dogs in the three watersheds is not known. Therefore, the statistics produced by APPMA were used in this analysis to estimate the possible fecal coliform loads contributed by dogs. The human population in the Little Black Creek, Peters Creek, and Greene Creek watersheds calculated based on the Tiger Track 2000 data (Department's GIS library) was 12,464, 1,778, and 46, respectively. According to the U.S. Census Bureau, there was an average of 2.77 people per household in Clay County. This gives about 4,500, 642, and 17 households in the Little Black Creek, Peters Creek, and Greene Creek watersheds, respectively. Assuming that 40 percent of the households in this area have one dog, the total numbers of dogs are about 1,800, 257, and 7 in the Little Black Creek, Peters Creek, and Greene Creek watersheds, respectively.

Table 4.3 shows the waste production rate for a dog (450 grams/day) and the fecal coliform counts per gram of dog wastes (2,200,000 counts/gram). Assuming that 40 percent of dog owners do not pick up dog feces, the total waste produced by dogs and left on the land surface in residential areas is 323,974, 46,215, and 1,196 grams/day in the Little Black Creek, Peters Creek, and Greene Creek watersheds, respectively. The total produced by dogs is 7.13×10^{11}, 1.02×10^{11}, and 2.63×10^{9} counts/day of fecal coliform in the Little Black Creek, Peters Creek, and Greene Creek watersheds, respectively. It should be noted that this load only represents the fecal coliform load created in the watershed and is not intended to be used to represent a part of the existing load that reaches the receiving waterbody. The fecal coliform load that eventually reaches the receiving waterbody could be significantly less than this value due to attenuation in overland transport.

Table 4.2. Concentrations (Geometric Mean Colonies/100mL) of Fecal Coliform from Urban Source Areas (Steuer et al., 1997; Bannerman et al., 1993)

Geographic Location	Marquette, Michigan	Madison, Wisconsin
Number of storms sampled	12	9
Commercial parking lot	4,200	1,758
High-traffic street	1,900	9,627
Medium-traffic street	2,400	56,554
Low-traffic street	280	92,061
Commercial rooftop	30	1,117
Residential rooftop	2,200	294
Residential driveway	1,900	34,294
Residential lawns	4,700	42,093
Basin outlet	10,200	175,106

Table 4.3. Dog Population Density, Wasteload, and Fecal Coliform Density (Weiskel et al., 1996)

* Number from APPMA

Type	Population density (#/household)	Wasteload (grams/day)	Fecal coliform density (fecal coliform/gram)
Dog	0.4*	450	2,200,000

Septic Tanks

Septic tanks are another potentially important source of coliform pollution in urban watersheds. When properly installed, most of the coliform from septic tanks should be removed within 50 meters of the drainage field (Minnesota Pollution Control Agency, 1999). However, in areas with a relatively high ground water table, the drain field can be flooded during the rainy season, and coliform bacteria can pollute the surface water through stormwater runoff.

Septic tanks may also cause coliform pollution when they are built too close to irrigation wells. Any well that is installed in the surficial aquifer system will cause a drawdown. If the septic tank system is built too close to the well (e.g., less than 75 feet), the septic tank discharge will be within the cone of influence of the well. As a result, septic tank effluent may enter the well, and once the polluted water is used to irrigate lawns, coliform bacteria may reach the land surface and wash into surface waters during the rainy season.

A rough estimate of fecal coliform loads from failed septic tanks in each watershed can be made using **Equation 4.1**:

$$L = 37.85 * N * Q * C * F \qquad \textbf{(Equation 4.1)}$$

Where:

L is the fecal coliform daily load (counts/day);
N is the total number of septic tanks in the area (septic tanks);
Q is the discharge rate for each septic tank;
C is the fecal coliform concentration for the septic tank discharge; and
F is the septic tank failure rate.

Based on 2008 Florida Department of Health (FDOH) onsite sewage GIS coverage (available: http://www.doh.state.fl.us/environment/programs/EhGis/EhGisDownload.htm), about 308, 118, and 12 housing units *(N)* were identified as being on septic tanks in the Little Black Creek, Peters Creek, and Greene Creek watersheds, respectively (**Figure 4.2**). 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 Census Bureau, the average household size is about 2.77 people/household for Clay County. The same population densities were assumed for the Little Black Creek, Peters Creek, and Greene Creek watersheds. A commonly cited value for per capita wastewater production rate is 70 gallons/day/person (EPA, 2001). The commonly cited concentration (*C*) for septic tank discharge is $1x10^6$ counts/100mL for fecal coliform (EPA, 2001).

No measured septic tank failure rate data were available for the watersheds when these TMDLs were developed. Therefore, the failure rate was derived from the number of septic tank and septic tank repair permits for Clay County published by FDOH (available: http://www.doh.state.fl.us/environment/OSTDS/statistics/ostdsstatistics.htm). The number of septic tanks in the county was calculated assuming that none of the installed septic tanks will be removed after being installed (**Table 4.4**). The reported number of septic tank repair permits was also obtained from the FDOH Website. Based on this information, the discovery rates of failed septic tanks for each year between 2002 and 2007 were calculated and listed in **Table 4.4**.

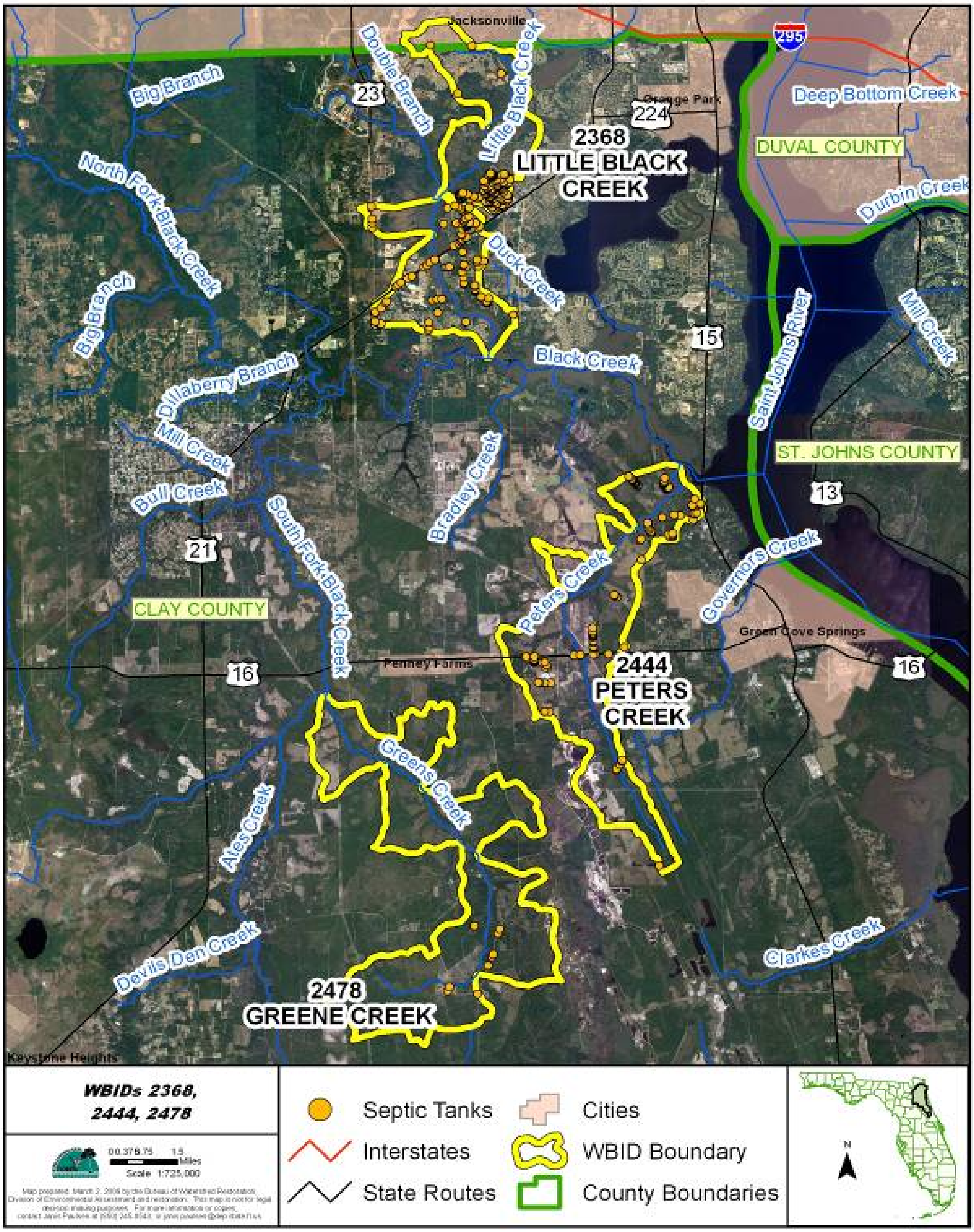
Based on **Table 4.4**, the average annual septic tank failure discovery rate is about 0.63 percent for Clay County. Assuming that failed septic tanks are not discovered for about 5 years, the estimated annual septic tank failure rate is about 5 times the discovery rate, or 3.2 percent. Based on **Equation 4.1**, the estimated fecal coliform loadings from failed septic tanks in the Little Black Creek, Peters Creek, and Greene Creek watersheds are about 7.23×10^{10}, 2.77×10^{10}, and 2.82×10^9 counts/day, respectively.

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.

When this TMDL was developed, no information on sewer line coverage was available to the Department, and so it was difficult to determine with certainty whether the entire area was sewered. Typically, high- and medium-density residential areas are sewered to avoid too-high septic tank density. Fecal coliform loading from sewer line leakage can be calculated based on

Figure 4.2. Distribution of Onsite Sewage Disposal Systems (Septic Tanks) in the Little Black Creek (WBID 2368), Peters Creek (WBID 2444), and Greene Creek (WBID 2478) Watersheds



the number of people in the watershed, typical per household generation rates, and typical fecal coliform concentrations in domestic sewage, assuming a leakage rate of 0.5 percent (Culver et al., 2002). Based on this assumption, a rough estimate of fecal coliform loads from leaks and SSOs in the Little Black Creek, Peters Creek, and Greene Creek watersheds can be made using **Equation 4.2**.

$$L = 37.85 * N * Q * C * F \qquad \textbf{(Equation 4.2)}$$

Where:

L is the fecal coliform daily load (counts/day);
N is the number of households using sanitary sewer in the watershed;
Q is the discharge rate for each household;
C is the fecal coliform concentration for domestic wastewater discharge; and
F is the sewer line leakage rate.

The number of households (*N*) in the Little Black Creek, Peters Creek, and Greene Creek watersheds connected to the sewer lines are 4,192, 524, and 5 (total households minus septic tank households), respectively. The discharge rate through sewers from each household (*Q*) was calculated by multiplying the average household size (2.77 for Clay County) by the per capita wastewater production rate per day (70 gallons). The commonly cited concentration (*C*) for domestic wastewater is 1×10^6 counts/100mL for fecal coliform (EPA, 2001). The contribution of fecal coliform through sewer line leakage was assumed to be 0.5 percent of the total sewage loading created from the population not on septic tanks (Culver et al., 2002). Based on **Equation 4.2**, the estimated fecal coliform loadings from sewer line leakage in the Little Black Creek, Peters Creek, and Greene Creek watersheds are about 1.54×10^{11}, 1.92×10^{10}, and 1.69×10^8 counts/day, respectively.

Table 4.4. Estimated Septic Tank Numbers and Septic Tank Failure Rates for Clay County, 2002–07

- = Empty cell
* Failure rate is 5 times the failure discovery rate.

-	2002	2003	2004	2005	2006	2007	Average
New installation (septic tanks)	580	467	429	438	522	286	454
Accumulated installation (septic tanks)	22,445	29,025	29,492	29,921	30,359	30,881	29,687
Repair permit (septic tanks)	236	185	241	183	145	128	186
Failure discovery rate (%)	0.83	0.64	0.82	0.61	0.48	0.41	0.63
Failure rate (%)*	4.1	3.2	4.1	3.1	2.4	2.1	3.2

Wildlife

Wildlife deposit coliform bacteria with their feces onto land surfaces, where they can be transported during storm events to nearby streams. Some wildlife (such as otters, beavers, raccoons, and birds) deposit their feces directly into the water. The bacterial load from naturally occurring wildlife is assumed to be background. In addition, any strategy employed to control this source would probably have a negligible impact on attaining water quality standards.

Summary of Nonpoint Sources

Table 4.5 summarizes the loadings from dogs, septic tanks, and SSOs for the Little Black Creek, Peters Creek, and Greene Creek watersheds. It is important to note that this is not a complete list and represents estimates of potential loadings. Proximity to each waterbody, rainfall frequency and magnitude, soil types, drainage features, and temperature are just a few of the factors that could influence and determine the actual loadings from these sources that reach Little Black Creek, Peters Creek, and Greene Creek.

Table 4.5. Estimated Fecal Coliform Loadings from Dogs, Septic Tanks, and SSOs in the Little Black Creek, Peters Creek, and Greene Creek Watersheds

Waterbody	Dogs (counts/day)	Septic Tanks (counts/day)	SSOs (counts/day)
Little Black Creek	7.13×10^{11}	7.23×10^{10}	1.54×10^{11}
Peters Creek	1.02×10^{11}	2.77×10^{10}	1.92×10^{10}
Greene Creek	2.63×10^{9}	2.82×10^{9}	1.69×10^{8}

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

No long-term stream flow information was available for Little Black Creek, Peters Creek, and Greene Creek; therefore, the load duration curve method could not be applied. To determine the required reduction for these TMDLs, the required percent reduction that would be required for each of the exceedances was determined using all available data, and the percent reduction required to meet the state fecal coliform standard of 400 counts/100mL was determined. The median value of all of these reductions determined the overall required reduction, and therefore the TMDLs.

5.1.1 Data Used in the Determination of the TMDLs

All data used for this TMDL report were provided by the Department's Northeast District office and the city of Jacksonville. **Figure 5.1** shows the locations of the water quality sites where fecal coliform data were collected. These analyses used fecal coliform data collected from 2001 to 2008 in Little Black Creek, from 2004 to 2007 in Peters Creek, and from 2002 to 2008 in Greene Creek. During the sampling period, a total of 23 fecal coliform samples was collected from 2 sampling stations in Little Black Creek, 28 fecal coliform samples from 3 sampling stations in Peters Creek, and 21 fecal coliform samples from 2 sampling stations in Greene Creek.

Figures 5.2a–c show the fecal coliform concentrations observed in each waterbody, respectively. In Little Black Creek, the concentration of fecal coliform ranged from 10 to 1,325 counts/100mL (**Figure 5.2a**) and averaged 298 counts/100mL during the verified period. Seasonally, the highest fecal coliform concentration and exceedance rate (100%; n=2) were observed during the second quarter, and the lowest were during the first quarter (**Figure 5.3a**). Spatially, the fecal coliform concentrations and exceedance rates were similar between the stations (**Figure 5.4a**). On each of the spatial distribution graphs, the X-axis is arranged from upstream (left) toward downstream (right) (**Figures 5.4a–c**).

In Peters Creek, the concentration of fecal coliform ranged from 24 to 2,400 counts/100mL (**Figure 5.2b**) and averaged 597 counts/100mL during the verified period. Seasonally, the higher fecal coliform concentrations and exceedance rates were observed during the first and fourth quarters compared with the second and third quarters (**Figure 5.3b**). Spatially, the fecal coliform concentration and exceedance rate were highest at the upstream station (21FLA 20030388) and lowest at the downstream station (21FLA 20030387) (**Figure 5.4b**).

In Greene Creek, the fecal coliform concentration ranged from 30 to 1,352 counts/100mL (**Figure 5.2c**) and averaged 386 counts/100mL during the verified period. Seasonally, the higher fecal coliform concentrations and exceedance rates were observed during the first and second quarters (**Figure 5.3c**). Spatially, the fecal coliform concentrations were higher at the downstream station than at the upstream station, but the exceedance rate was higher at the upstream station (**Figure 5.4c**).

Figure 5.1. Locations of Water Quality Stations in Little Black Creek (WBID 2368), Peters Creek (WBID 2444), and Greene Creek (WBID 2478)

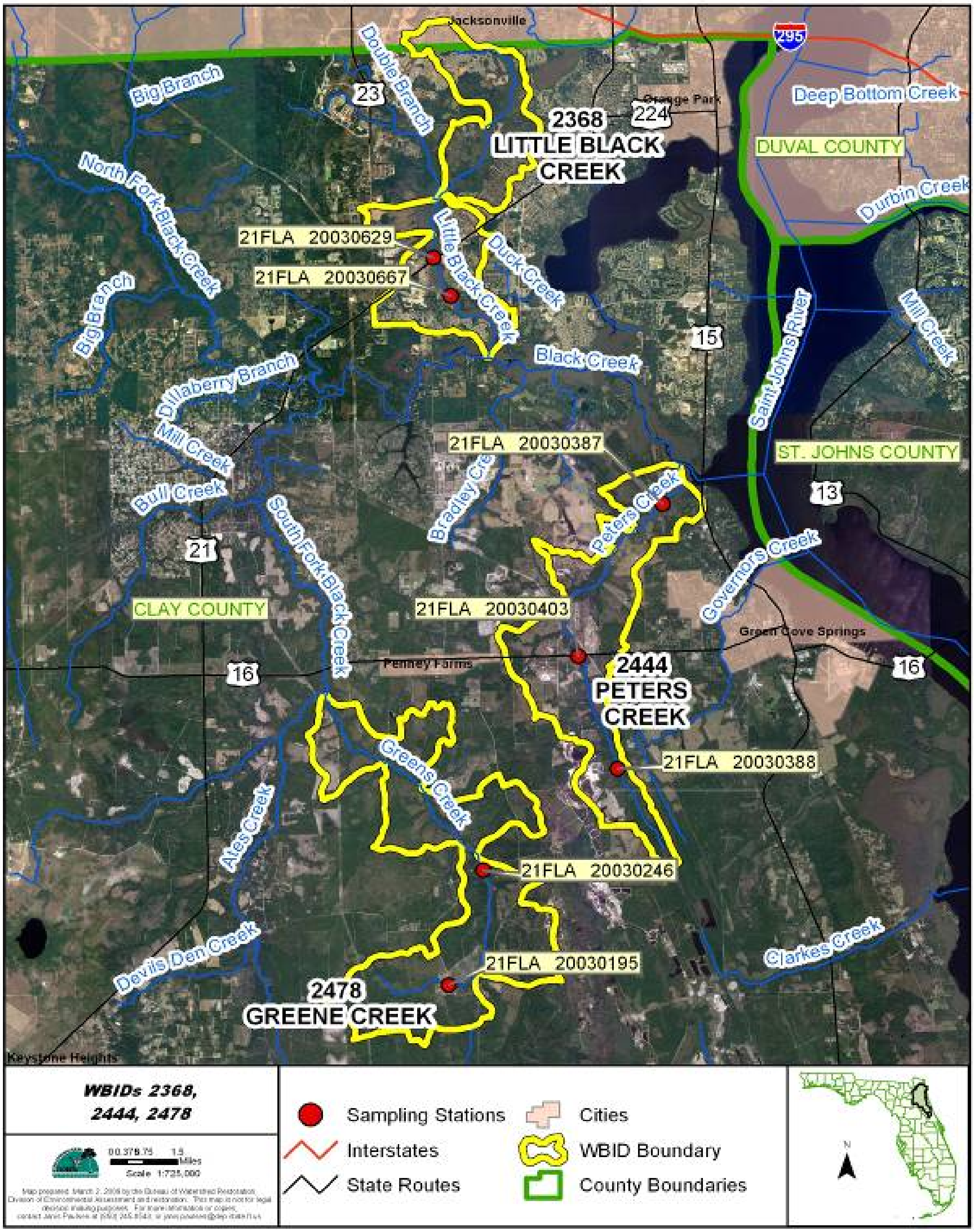


Figure 5.2a. Trend of Fecal Coliform Concentrations in Little Black Creek (WBID 2368) During the Verified Period

Note: The red line indicates the target concentration (400 counts/100mL).

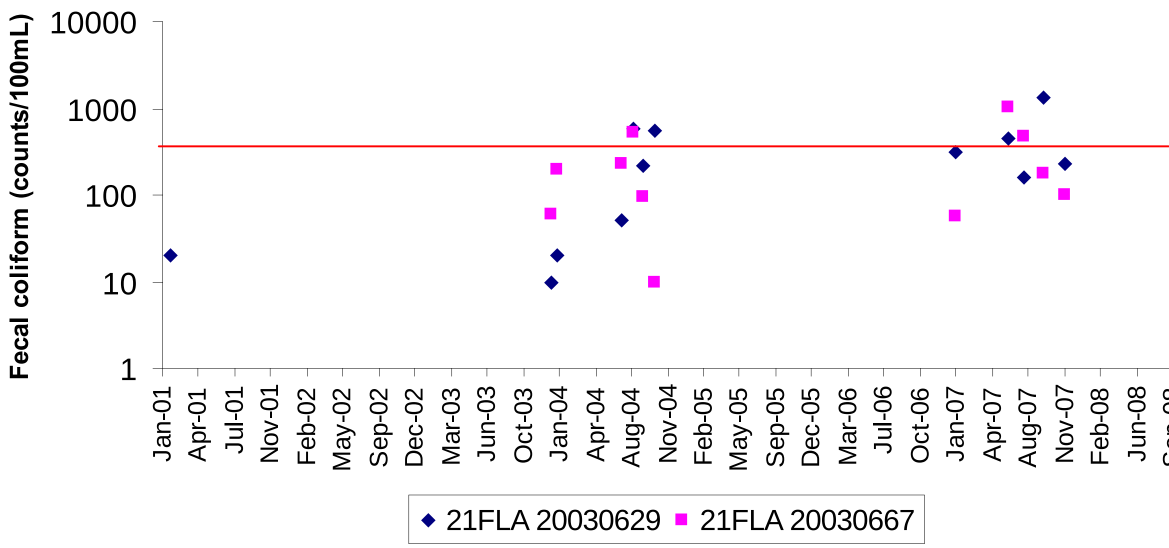


Figure 5.2b. Trend of Fecal Coliform Concentrations in Peters Creek (WBID 2444) During the Verified Period

Note: The red line indicates the target concentration (400 counts/100mL).

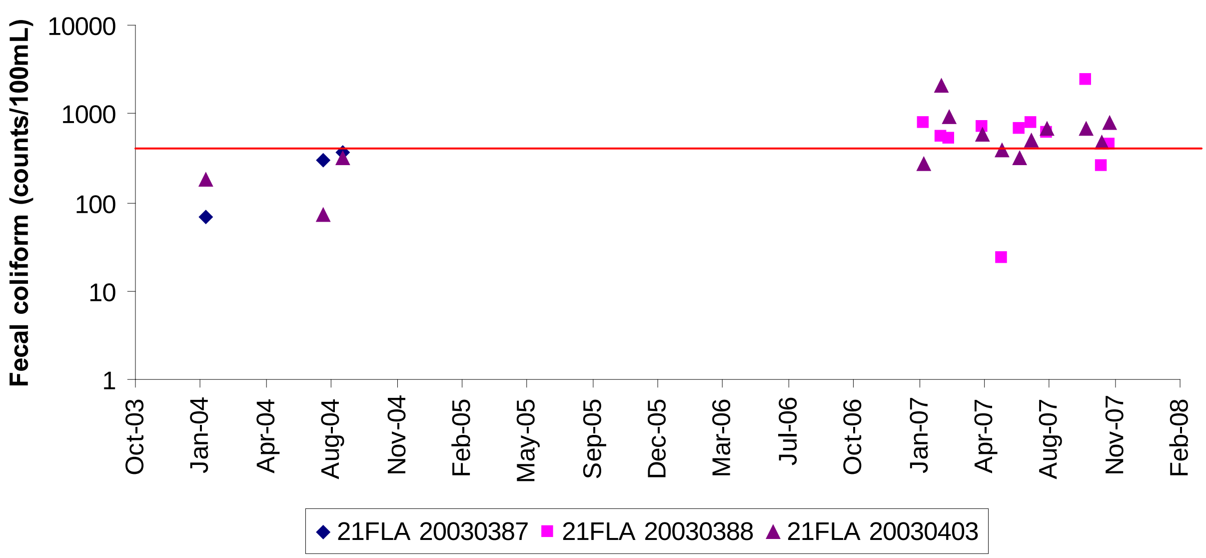


Figure 5.2c. Trend of Fecal Coliform Concentrations in Greene Creek (WBID 2478) During the Verified Period

Note: The red line indicates the target concentration (400 counts/100mL).

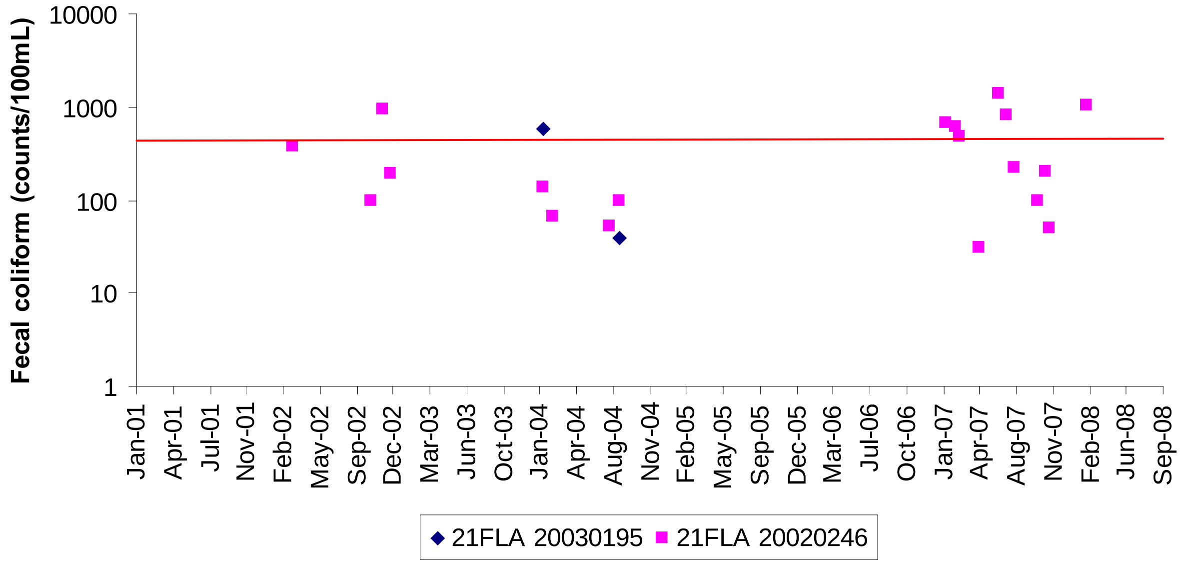


Figure 5.3a. Seasonal Trend of Fecal Coliform Concentration and Exceedance Rate in Little Black Creek (WBID 2368) During the Verified Period

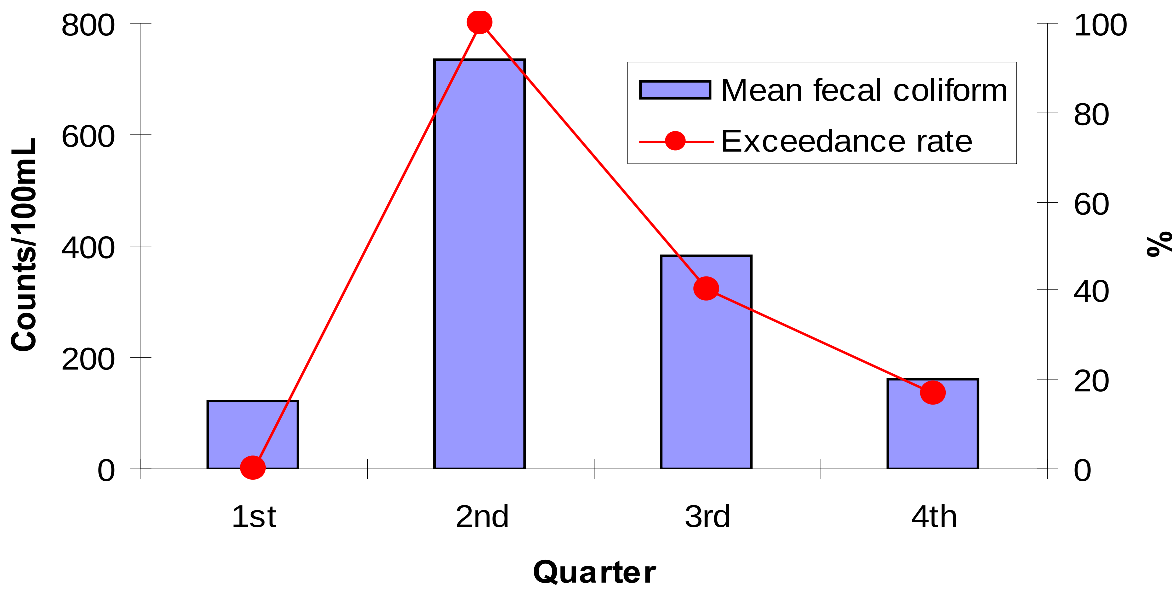


Figure 5.3b. Seasonal Trend of Fecal Coliform Concentration and Exceedance Rate in Peters Creek (WBID 2444) During the Verified Period

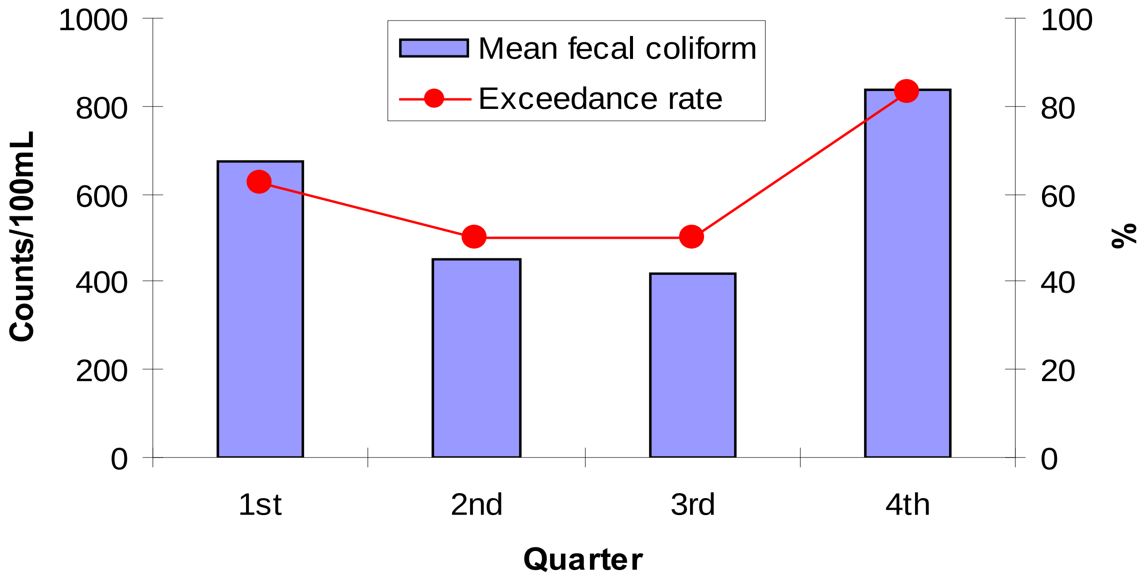


Figure 5.3c. Seasonal Trend of Fecal Coliform Concentration and Exceedance Rate in Greene Creek (WBID 2478) During the Verified Period

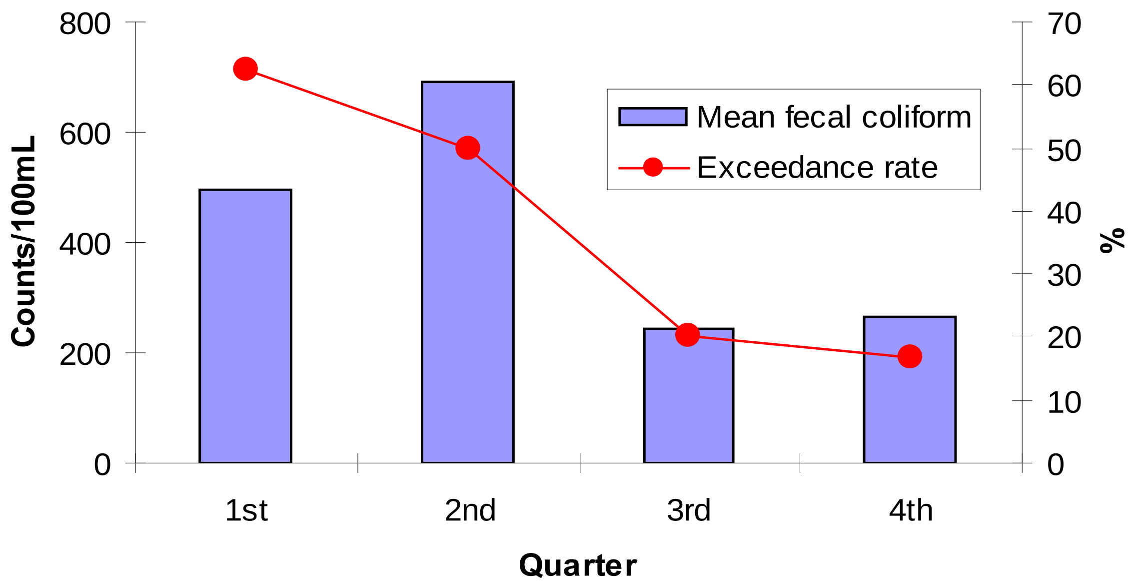


Figure 5.4a. Spatial Trend of Fecal Coliform Concentration and Exceedance Rate in Little Black Creek (WBID 2368) During the Verified Period

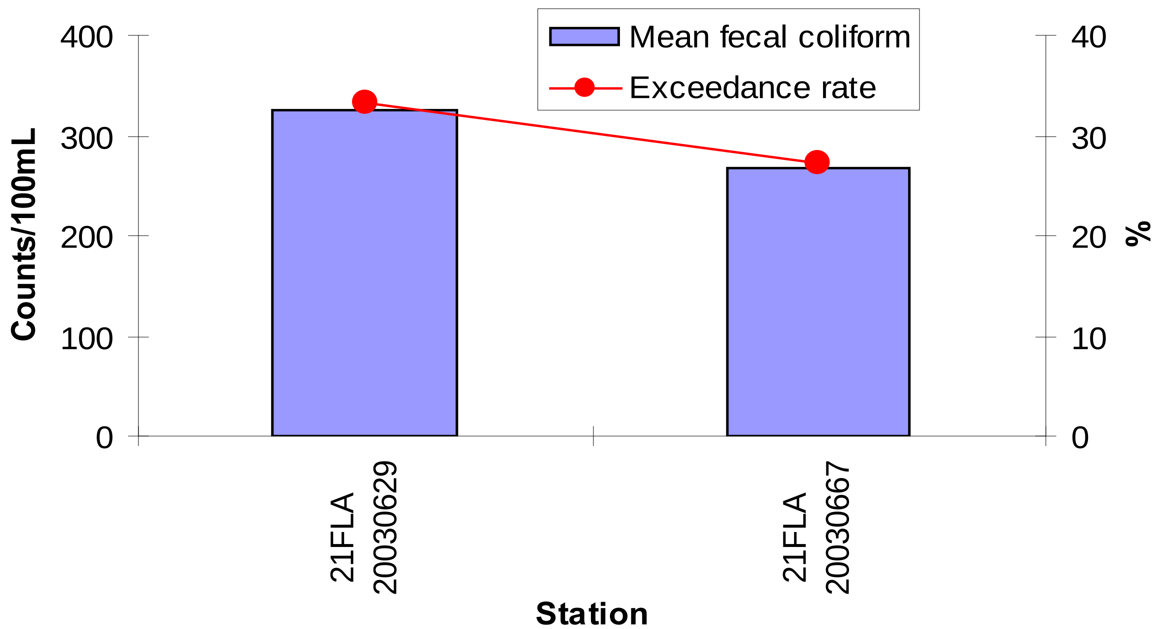


Figure 5.4b. Spatial Trend of Fecal Coliform Concentration and Exceedance Rate in Peters Creek (WBID 2444) During the Verified Period

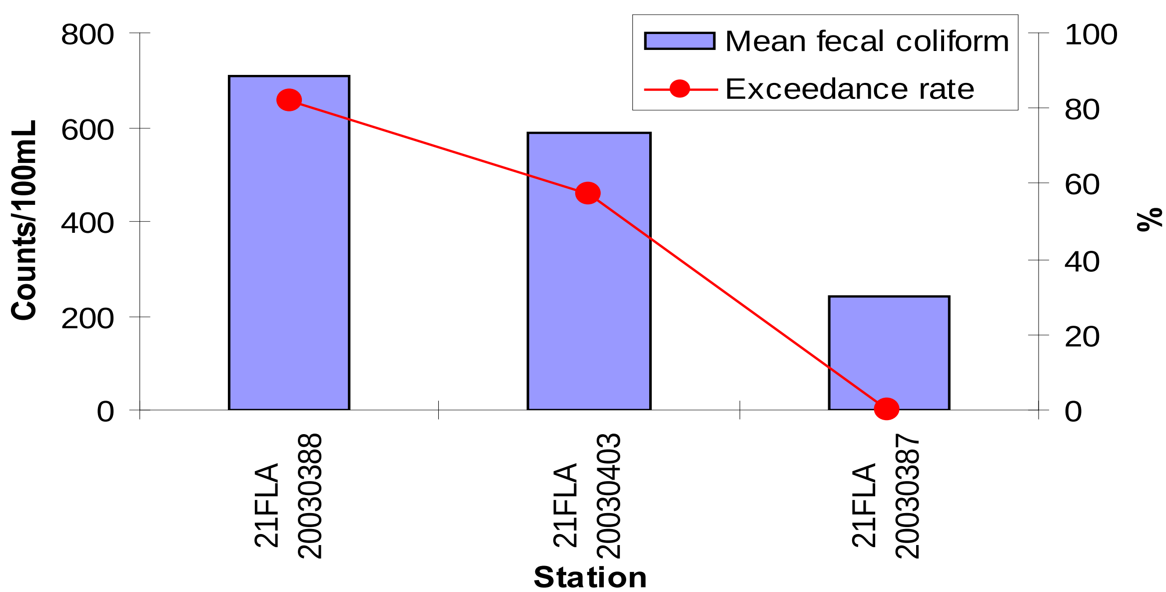
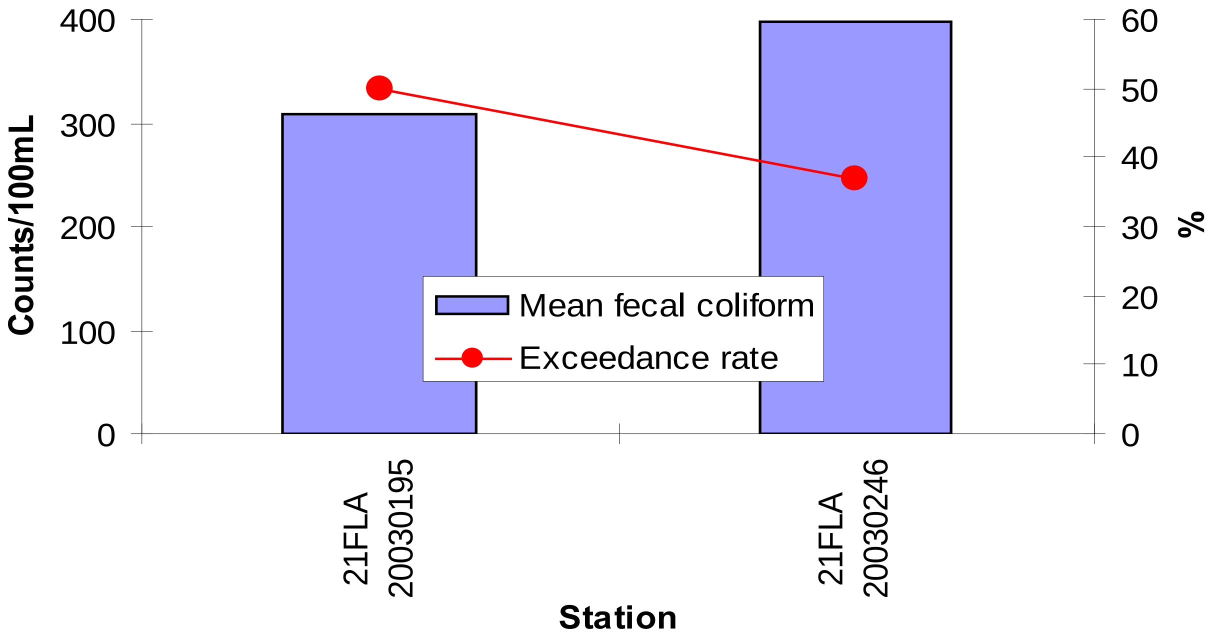


Figure 5.4c. Spatial Trend of Fecal Coliform Concentration and Exceedance Rate in Greene Creek (WBID 2478) During the Verified Period



5.1.2 TMDL Development Process

Due to the lack of supporting information, mainly flow data, a simple reduction calculation was performed to determine the needed reduction. Exceedances of the state criterion were compared with the criterion of 400 counts/100 mL. For each individual exceedance, an individual required reduction was calculated using the following:

$$\textbf{Load reduction} = \frac{\textbf{Existing loading} - \textbf{Allowable loading}}{\textbf{Existing loading}} \times \textbf{100\%}$$

After the individual results were calculated, the median of the individual values was calculated. **Tables 5.1a–c** show the individual reduction calculations for fecal coliform. The median reductions were 27.3, 40.6, and 45.3 percent for Little Black Creek, Peters Creek, and Greene Creek, respectively.

Table 5.1a. Calculation of Fecal Coliform Reductions for the TMDL for Little Black Creek (WBID 2368)

- = Empty cell
[1] Coliform counts are #/100mL.
[2] Exceedances represent values above 400 counts/100mL.

Date	Station	Fecal Coliform Exceedances[1, 2]	Fecal Coliform Target[1]	% Reduction
8/5/2004	21FLA 20030667	520	400	23.1%
8/5/2004	21FLA 20030629	568	400	29.6%
10/6/2004	21FLA 20030629	550	400	27.3%
6/14/2007	21FLA 20030629	440	400	9.1%
6/14/2007	21FLA 20030667	1,027	400	61.1%
7/26/2007	21FLA 20030667	480	400	16.7%
9/20/2007	21FLA 20030629	1,325	400	69.8%
-	-	-	**Median % Reduction:**	**27.3%**

Table 5.1b. Calculation of Fecal Coliform Reductions for the TMDL for Peters Creek (WBID 2444)

- = Empty cell
[1] Coliform counts are #/100mL.
[2] Exceedances represent values above 400 counts/100mL.

Date	Station	Fecal Coliform Exceedances[1, 2]	Fecal Coliform Target[1]	% Reduction
1/25/2007	21FLA 20030388	800	400	50.0%
2/22/2007	21FLA 20030388	560	400	28.6%
2/22/2007	21FLA 20030403	2,100	400	81.0%
3/6/2007	21FLA 20030388	520	400	23.1%
3/6/2007	21FLA 20030403	900	400	55.6%
4/26/2007	21FLA 20030403	580	400	31.0%
4/26/2007	21FLA 20030388	708	400	43.5%
6/21/2007	21FLA 20030388	686	400	41.7%
7/10/2007	21FLA 20030403	490	400	18.4%
7/10/2007	21FLA 20030388	782	400	48.8%
8/2/2007	21FLA 20030388	600	400	33.3%
8/2/2007	21FLA 20030403	673	400	40.6%
10/1/2007	21FLA 20030403	664	400	39.8%
10/1/2007	21FLA 20030388	2,400	400	83.3%
10/25/2007	21FLA 20030403	470	400	14.9%
11/6/2007	21FLA 20030388	450	400	11.1%
11/6/2007	21FLA 20030403	775	400	48.4%
-	-	-	**Median % Reduction:**	**40.6%**

Table 5.1c. Calculation of Fecal Coliform Reductions for the TMDL for Greene Creek (WBID 2478)

- = Empty cell
[1] Coliform counts are #/100mL
[2] Exceedances represent values above 400 counts/100 mL.

Date	Station	Fecal Coliform Exceedances[1, 2]	Fecal Coliform Target[1]	% Reduction
11/14/2002	21FLA 20030246	940	400	57.4%
1/22/2004	21FLA 20030195	576	400	30.6%
1/25/2007	21FLA 20030246	667	400	40.0%
2/22/2007	21FLA 20030246	620	400	35.5%
3/6/2007	21FLA 20030246	480	400	16.7%
6/21/2007	21FLA 20030246	1,352	400	70.4%
7/10/2007	21FLA 20030246	809	400	50.6%
2/14/2008	21FLA 20030246	1,050	400	61.9%
-	**-**	**-**	**Median % Reduction:**	**45.3%**

5.1.3 Critical Conditions

The critical conditions for coliform loadings in a given watershed depend 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, wildlife with direct access to the receiving water can 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.

As no current flow data were available for all three waterbodies, hydrologic conditions were analyzed using rainfall. A loading curve–type chart that would normally be applied to flow events was created using precipitation data from Jacksonville International Airport for the period from 1990 to 2008. The chart was divided in the same manner as if flow were being analyzed, where extreme precipitation events represent the upper percentiles (0–5th percentile), followed by large precipitation events (5th–10th percentile), medium precipitation events (10th–40th percentile), small precipitation events (40th–60th percentile), and no recordable precipitation events (60th–100th percentile). Three-day (the day of and two days prior to sampling) precipitation accumulations were used in the analysis (**Tables 5. 2a–c** and **Figures 5.5a–c** show the results for Little Black Creek, Peters Creek, and Greene Creek, respectively).

Historical data show that fecal coliform exceedances occurred significantly in high precipitation events (extreme, large, and medium) in all three waterbodies, indicating that nonpoint sources are probably a major contributing factor. The exceedance rates for little or no precipitation events, while generally low, are not insignificant, except for Little Black Creek. These exceedances at baseflow can be attributed to ground water contributions from failed septic tanks and/or leaking collection systems. Although Little Black Creek showed no exceedances for little or no precipitation events, it is difficult to draw conclusions with so few samples (n=4) (**Table 5.2a** and **Figure 5.5a**); thus the Department did not focus on a particular set of critical conditions for any of the three waterbodies. **Tables 5.2a–c** and **Figures 5.5a–c** show fecal coliform data by hydrologic condition for Little Black Creek, Peters Creek, and Greene Creek, respectively.

Table 5.2a. Summary of Fecal Coliform Data by Hydrologic Condition for Little Black Creek (WBID 2368)

[1] Exceedances represent values above 400 counts/100 mL.

Precipitation Event	Event Range (inches)	Total Samples	Number of Exceedances[1]	% Exceedances	Number of Nonexceedances[1]	% Nonexceedances
Extreme	>2.1"	2	1	50.00%	1	50.00%
Large	1.33" - 2.1"	4	3	75.00%	1	25.00%
Medium	0.18" - 1.33"	8	2	25.00%	6	75.00%
Small	0.01" - 0.18"	7	1	14.29%	6	85.71%
None/Not Measurable	<0.01"	4	0	0.00%	4	100.00%

Table 5.2b. Summary of Fecal Coliform Data by Hydrologic Condition for Peters Creek (WBID 2444)

[1] Exceedances represent values above 400 counts/100 mL.
[2] N/A – Not applicable

Precipitation Event	Event Range (inches)	Total Samples	Number of Exceedances[1]	% Exceedances	Number of Nonexceedances[1]	% Nonexceedances
Extreme	>2.1"	0	0	N/A[2]	0	N/A[2]
Large	1.33" - 2.1"	3	2	66.67%	1	33.33%
Medium	0.18" - 1.33"	14	8	57.14%	6	42.86%
Small	0.01" - 0.18"	9	4	44.44%	5	55.56%
None/Not Measurable	<0.01"	16	8	50.00%	8	50.00%

Table 5.2c. Summary of Fecal Coliform Data by Hydrologic Condition for Greene Creek (WBID 2478)

[1] Exceedances represent values above 400 counts/100 mL.
[2] N/A – Not applicable

Precipitation Event	Event Range (inches)	Total Samples	Number of Exceedances[1]	% Exceedances	Number of Nonexceedances[1]	% Nonexceedances
Extreme	>2.1"	0	0	N/A[2]	0	N/A[2]
Large	1.33" - 2.1"	1	0	0.00%	1	100.00%
Medium	0.18" - 1.33"	9	5	55.56%	4	44.44%
Small	0.01" - 0.18"	3	1	33.33%	2	66.67%
None/Not Measurable	<0.01"	9	3	33.33%	6	66.67%

Figure 5.5a. Fecal Coliform Data by Hydrologic Condition Based on Rainfall for Little Black Creek (WBID 2368)

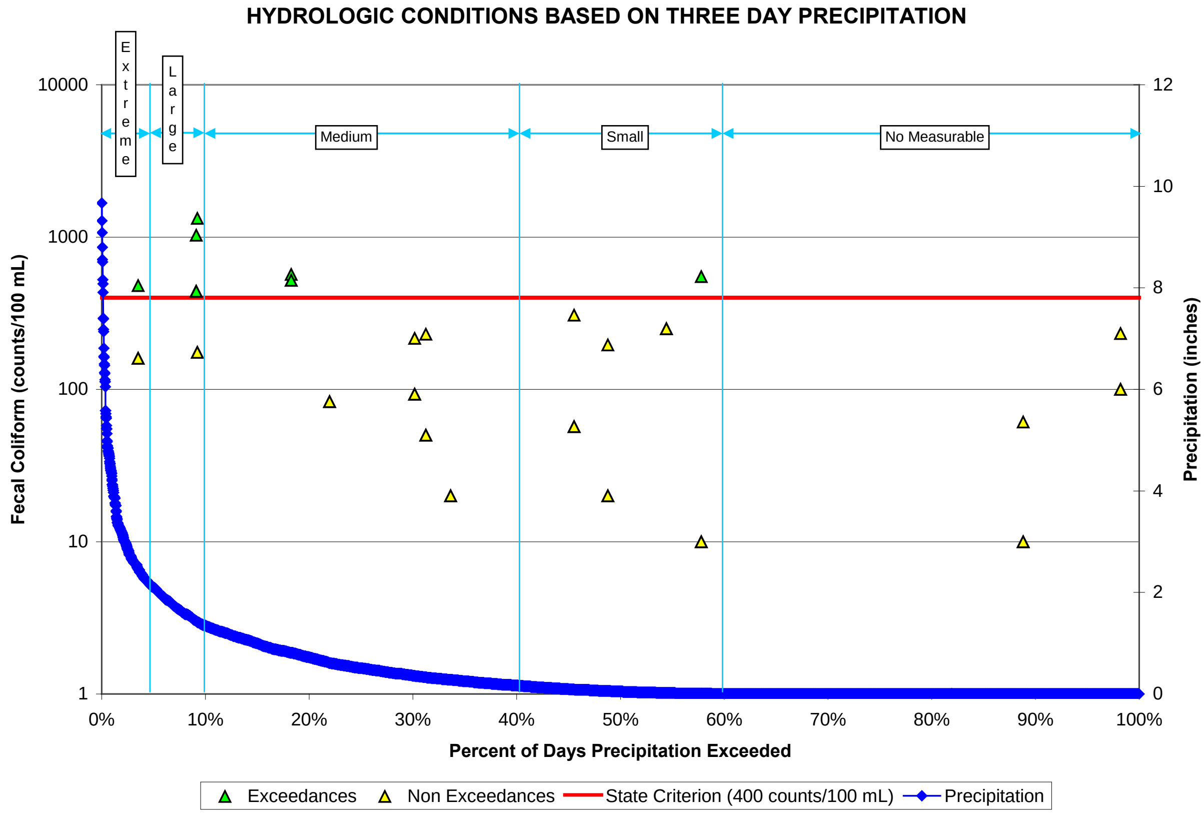


Figure 5.5b. Fecal Coliform Data by Hydrologic Condition Based on Rainfall for Peters Creek (WBID 2444)

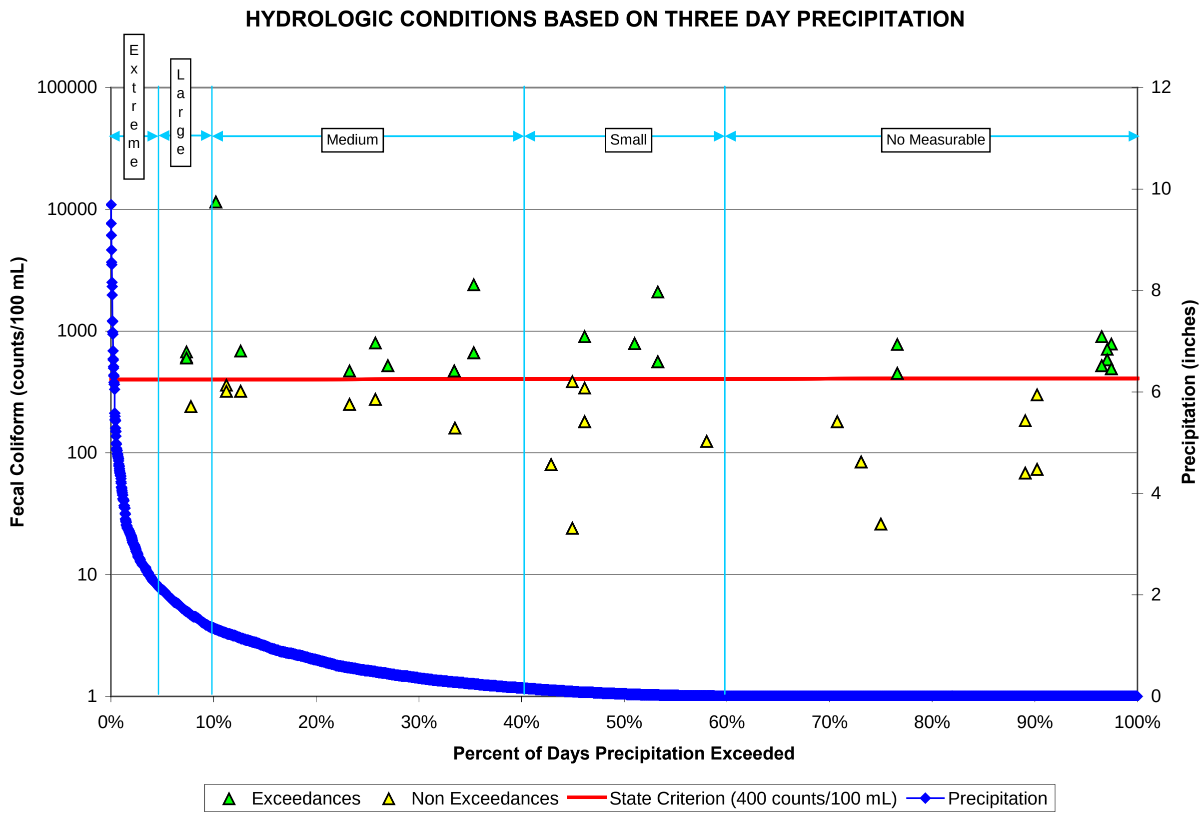
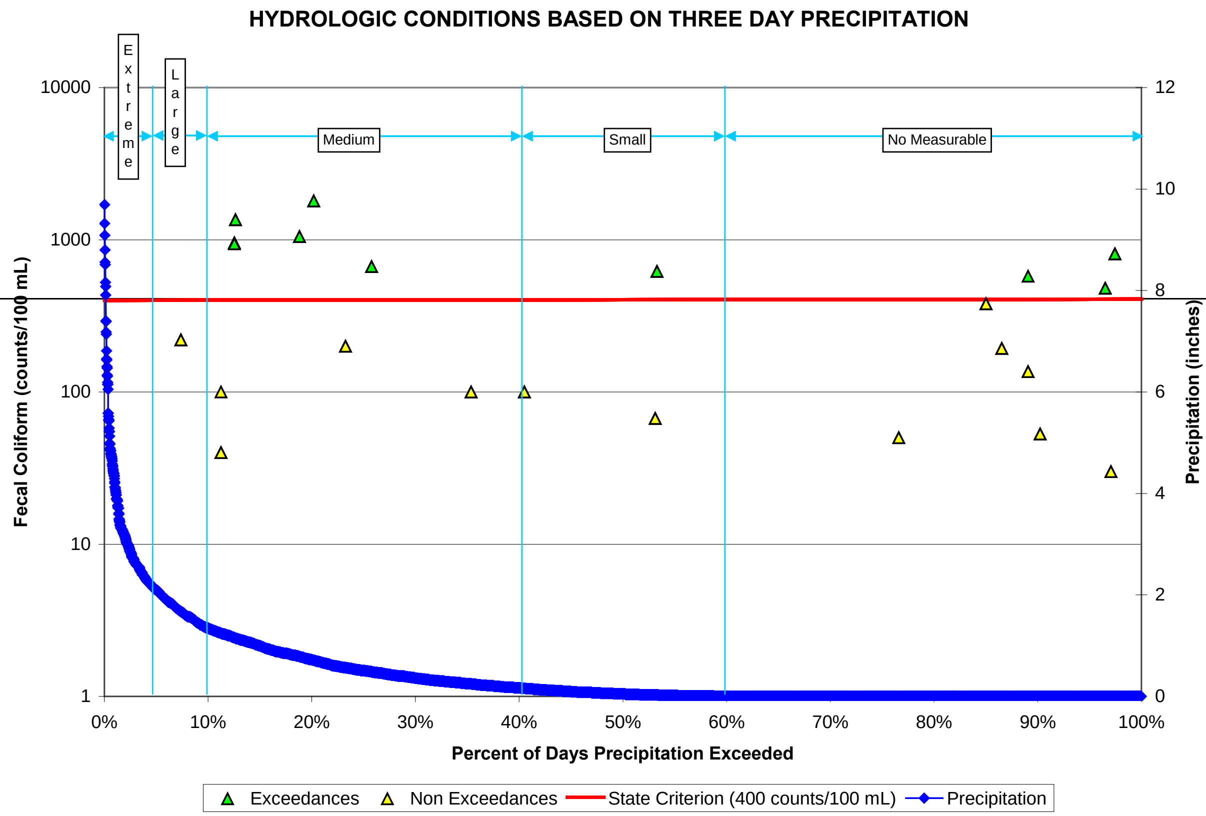


Figure 5.5c. Fecal Coliform Data by Hydrologic Condition Based on Rainfall for Greene Creek (WBID 2478)



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 TMDLs for Little Black Creek, Peters Creek, and Greene Creek are expressed in terms of MPN/day and percent reduction, and represent the maximum daily fecal coliform load the streams can assimilate without exceeding the fecal coliform criterion (**Table 6.1**).

Table 6.1. TMDL Components for Fecal Coliform in Little Black Creek (WBID 2368), Peters Creek (WBID 2444), and Greene Creek (WBID 2478)

N/A = Not applicable

WBID	Parameter	TMDL (counts/100mL)	Wasteload Allocation for Wastewater (counts/100mL)	Wasteload Allocation for NPDES Stormwater (% reduction)	LA (% reduction)	MOS
2368	Fecal coliform	400	Must Meet Permit Limits	27%	27%	Implicit
2444	Fecal coliform	400	N/A	41%	41%	Implicit
2478	Fecal coliform	400	N/A	45%	45%	Implicit

6.2 Load Allocation

A fecal coliform reduction of 27, 41, and 45 percent is needed from nonpoint sources in the Little Black Creek, Peters Creek, and Greene Creek watersheds, respectively. 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**).

6.3 Wasteload Allocation

6.3.1 NPDES Wastewater Discharges

No NPDES-permitted wastewater facilities with fecal coliform limits were identified in the Peters Creek and Greene Creek watersheds. One NPDES-permitted wastewater facility (Ridaught Landing WWTF; FL0039721) was identified in the Little Black Creek watershed. This facility, located in the southern part of the waterbody, has a 1.875 mgd AADF permitted discharge to Little Black Creek. The permit includes effluent discharge limits for fecal coliform bacteria. This facility must meet the permit limits for fecal coliform as stated in its permit specifications.

Section I.A.6 of the permit (FL0039721) reads as follows:

> *The arithmetic mean of the monthly fecal coliform values collected during an annual period shall not exceed 14 per 100 mL of effluent sample. The median value of the fecal coliform values for a minimum number of 10 samples of effluent each collected on a separate day during a period of 30 consecutive days (monthly), shall not exceed 14 per 100 mL of sample. No more than 10 percent of the samples collected (the 90th percentile value) during a period of 30 consecutive days shall exceed 43 fecal coliform values per 100 mL of sample. Any one sample shall not exceed 86 fecal coliform values per 100 mL of sample.*

6.3.2 NPDES Stormwater Discharges

The WLA for stormwater discharges with an MS4 permit is a 27, 41, and 45 percent reduction in current fecal coliform for Little Black Creek, Peters Creek, and Greene Creek, respectively. It should be noted that any MS4 permittee is only responsible for reducing the anthropogenic loads associated with stormwater outfalls that it owns or otherwise has responsible control over, and it is not responsible for reducing other nonpoint source loads in its jurisdiction.

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 these TMDLs. An MOS was included in the TMDLs by not allowing any exceedances of the state criterion, even though intermittent natural exceedances would be expected and would be taken into account when determining impairment. Additionally, the TMDLs calculated for fecal coliform were based on meeting the water quality criterion of 400 counts/100mL without any exceedances, while the actual criterion allows for 10 percent exceedances over the fecal coliform criterion.

Chapter 7: TMDL IMPLEMENTATION

TMDL Implementation

Following the adoption of this TMDL by rule, the Department will determine the best course of action regarding its implementation. Depending upon the pollutant(s) causing the waterbody impairment and the significance of the waterbody, the Department will select the best course of action leading to the development of a plan to restore the waterbody. Often this will be accomplished cooperatively with stakeholders by creating a Basin Management Action Plan, referred to as the BMAP. Basin Management Action Plans are the primary mechanism through which TMDLs are implemented in Florida [see Subsection 403.067(7) F.S.]. A single BMAP may provide the conceptual plan for the restoration of one or many impaired waterbodies.

If the Department determines a BMAP is needed to support the implementation of this TMDL, a BMAP will be developed through a transparent stakeholder-driven process intended to result in a plan that is cost-effective, technically feasible, and meets the restoration needs of the applicable waterbodies. Once adopted by order of the Department Secretary, BMAPs are enforceable through wastewater and municipal stormwater permits for point sources and through BMP implementation for nonpoint sources. Among other components, BMAPs typically include:

- Water quality goals (based directly on the TMDL);
- Refined source identification;
- Load reduction requirements for stakeholders (quantitative detailed allocations, if technically feasible);
- A description of the load reduction activities to be undertaken, including structural projects, nonstructural BMPs, and public education and outreach;
- A description of further research, data collection, or source identification needed in order to achieve the TMDL;
- Timetables for implementation;
- Implementation funding mechanisms;
- An evaluation of future increases in pollutant loading due to population growth;
- Implementation milestones, project tracking, water quality monitoring, and adaptive management procedures; and
- Stakeholder statements of commitment (typically a local government resolution).

BMAPs are updated through annual meetings and may be officially revised every five years. Completed BMAPs in the state have improved communication and cooperation among local stakeholders and state agencies, improved internal communication within local governments, applied high-quality science and local information in managing water resources, clarified obligations of wastewater point source, MS4 and non-MS4 stakeholders in TMDL implementation, enhanced transparency in DEP decision-making, and built strong relationships between DEP and local stakeholders that have benefited other program areas.

However, in some basins, and for some parameters, particularly those with fecal coliform impairments, the development of a BMAP using the process described above will not be the most efficient way to restore a waterbody, such that it meets its' designated uses. Why? Because fecal coliform impairments result from the cumulative effects of a multitude of potential sources, both natural and anthropogenic. Addressing these problems requires good old fashioned detective work that is best done by those in the area. There are a multitude of assessment tools that are available to assist local governments and interested stakeholders in this detective work. The tools range from the simple – such as Walk the WBIDs and GIS mapping - to the complex such as Bacteria Source Tracking. Department staff will provide technical assistance, guidance, and oversight of local efforts to identify and minimize fecal coliform sources of pollution. Based on work in the Lower St Johns River tributaries and the Hillsborough River basin, the Department and local stakeholders have developed a logical process and tools to serve as a foundation for this detective work. In the near future, the Department will be releasing these tools to assist local stakeholders with the development of local implementation plans to address fecal coliform impairments. In such cases, the Department will rely on these local initiatives as a more cost-effective and simplified approach to identify the actions needed to put in place a roadmap for restoration activities, while still meeting the requirements of Chapter 403.067(7), F.S.

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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 water management districts, along with wetland protection requirements, into the Environmental Resource Permit regulations.

Rule 62-40, F.A.C., also requires the state's 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.

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 the 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 (FDOT) 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 focus 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.

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