FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Water Resource Management, Bureau of Watershed Management

SOUTHWEST DISTRICT • SPRINGS COAST BASIN •
ANCLOTE RIVER/COASTAL PINELLAS COUNTY PLANNING UNIT

TMDL Report

Fecal Coliform TMDL for Saint Joes Creek, WBID 1668A

Paul C. Kurisko

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Editorial assistance was provided by Jan Mandrup-Poulsen and Kevin Petrus.

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For additional information on the watershed management approach and impaired waters in the Springs Coast Basin, contact
Fred Calder
Florida Department of Environmental Protection
Bureau of Watershed Management
Watershed Planning and Coordination Section
2600 Blair Stone Road, Mail Station 3565
Tallahassee, FL 32399-2400
Email: fred.calder@dep.state.fl.us
Phone: (850) 245–8555; SunCom: 205–8555
Fax: (850) 245–8434

Access to all data used in the development of this report can be obtained by contacting
Kevin Petrus
Florida Department of Environmental Protection
Bureau of Watershed Management
Watershed Assessment Section
2600 Blair Stone Road, Mail Station 3555
Tallahassee, FL 32399-2400
Email: kevin.petrus@dep.state.fl.us
Phone: (850) 245–8459; SunCom: 205–8459
Fax: (850) 245–8444

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https://www.flrules.org/gateway/chapterhome.asp?chapter=62-303

Florida 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

Water Quality Status and Assessment Reports for the Springs Coast Basin

http://www.dep.state.fl.us/water/basin411/springscoast/index.htm

U.S. Environmental Protection Agency, National STORET Program

Region 4: Total Maximum Daily Loads in Florida

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National STORET Program

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Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Load (TMDL) for fecal coliform bacteria for the freshwater segment of Saint Joes Creek, located in the Anclote River/Coastal Pinellas County Planning Unit, which is part of the larger Springs Coast Basin. The stream was verified as impaired for fecal coliform bacteria and was included on the Verified List of impaired waters for the Coastal Pinellas County portion of the Springs Coast Basin that was adopted by Secretarial Order in December 2007 (Florida Department of Environmental Protection [FDEP], 2007). The TMDL establishes the allowable loadings to Saint Joes Creek that would restore the waterbody so that it meets the applicable water quality criterion for fecal coliform bacteria.

1.2 Identification of Waterbody

Saint Joes Creek is located within the Long Bayou watershed, in the west-central portion of Pinellas County, Florida (Figure 1.1). For assessment purposes, FDEP divided the Saint Joes Creek watershed into four water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each waterbody segment (Figure 1.2). The main stem of Saint Joes Creek is divided into a tidal and a freshwater segment, identified as WBIDs 1668E and 1668A, respectively. Two tributaries, which flow into the tidal segment of the creek, are Bonn Creek (WBID 1668D) and Pinellas Park Ditch Number 5 (WBID 1668B). This TMDL report focuses on the freshwater segment of Saint Joes Creek (WBID 1668A) and on Miles Creek, a tributary of the freshwater segment of the creek. Figure 1.2 shows the stream channels within WBID 1668A. Separate TMDL reductions were determined for the main channel of Saint Joes Creek and the Miles Creek tributary.

Saint Joes Creek discharges to the Cross Bayou, Long Bayou, and Boca Ciega Bay estuary system. It is free flowing until it reaches the uppermost portion of its tidal area. The tidal portion, or the upper reaches of WBID 1668E, begins where the creek crosses under 46th Avenue in the city of St. Petersburg.

The Saint Joes Creek watershed (WBID 1668A) has a total surface area of about 9 square miles (Figure 1.1). All of the watershed lies within Pinellas County. Land use is predominantly residential, with 73 percent of the area designated as such. Major urban areas include portions of the city of St. Petersburg, Kenneth City, and West and East Lealman (a U.S. Census Designated Place [CDP]) (U.S. Census Bureau American FactFinder Website). The population of St. Petersburg, as of the 2003 U.S. Census estimate, was 247,610, making it the fourth largest city in the state. Based on the population density in St. Petersburg (4,163 persons/square mile) the estimated existing population in the Saint Joes Creek area (WBID 1668A) is 37,467 (U.S. Census Bureau State & County QuickFacts Website).

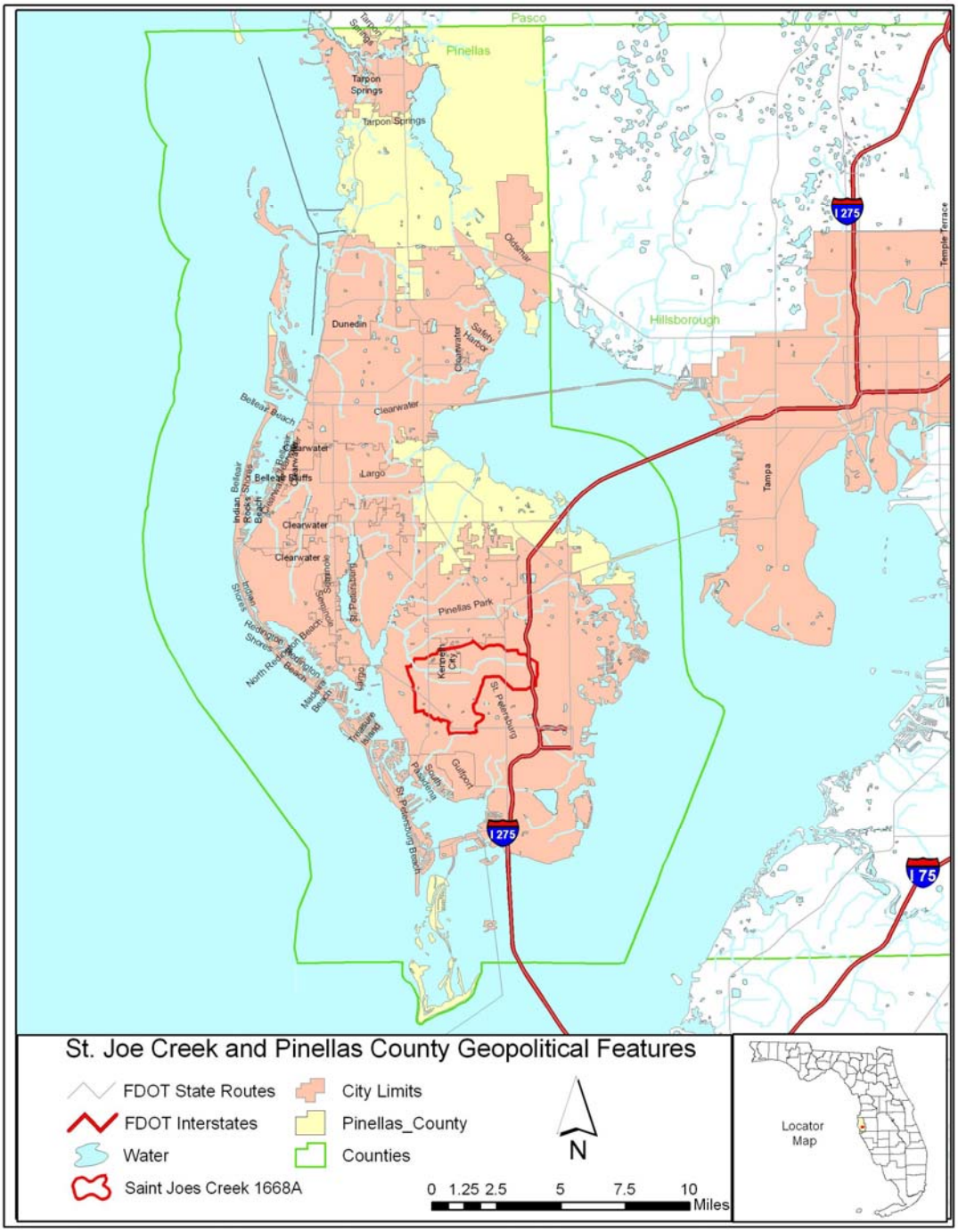

Figure 1.1. Saint Joes Creek, WBID 1668A, and Major Geopolitical Features in the Coastal Pinellas County Portion of the Springs Coast Basin

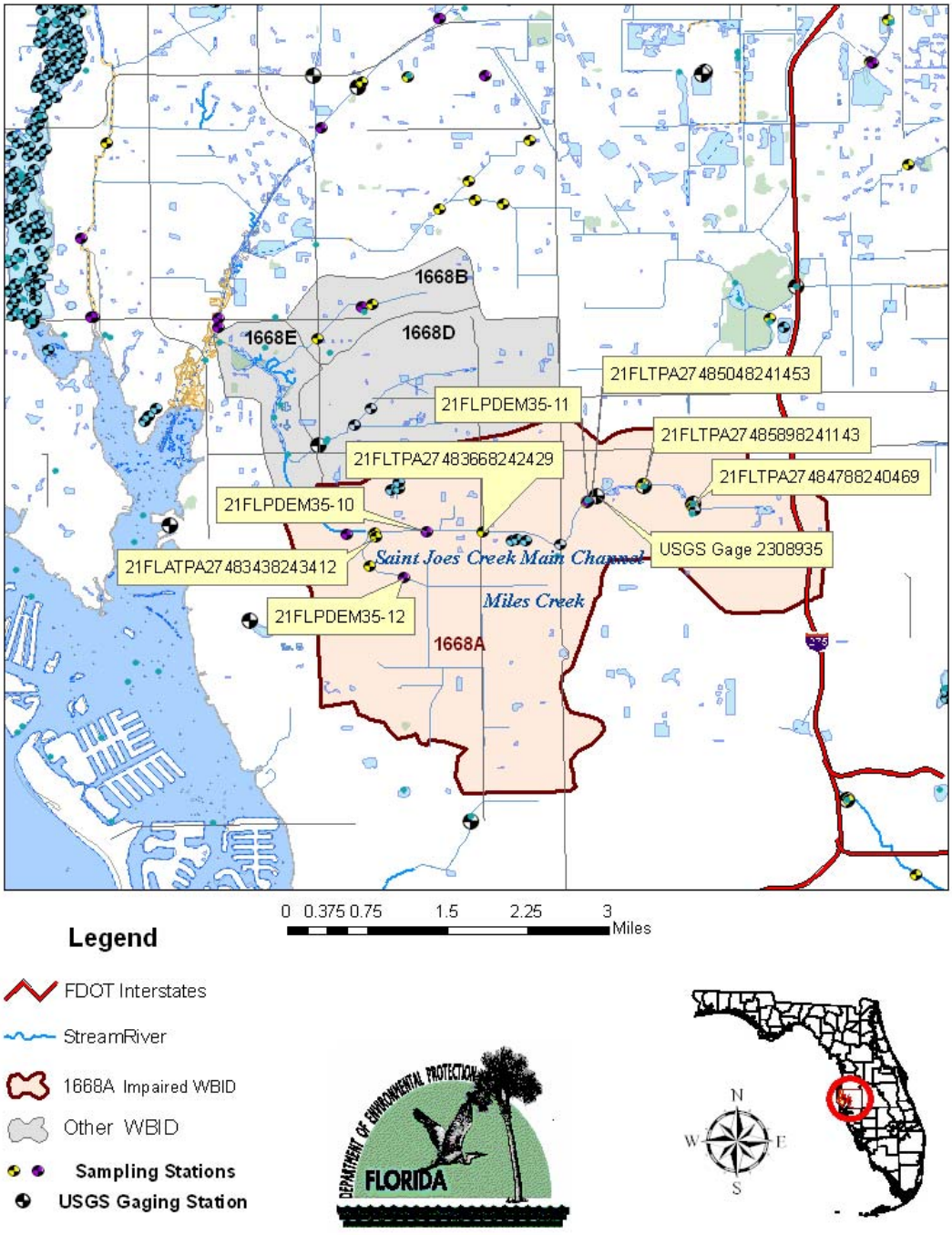

Figure 1.2. Saint Joes Creek, WBID 1668A, and Monitoring Locations

1.3 Background

This report was developed as part of FDEP'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 (U.S. Environmental Protection Agency [EPA] 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 Basin Management Action Plan, or BMAP, to reduce the amount of fecal coliform bacteria that caused the verified impairment of the Saint Joes Creek freshwater segment. These activities will depend heavily on the active participation of the Southwest Florida Water Management District (SWFWMD), local governments, businesses, and other stakeholders. FDEP 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 EPA a list of surface waters that do not meet applicable water quality standards (impaired waters) and establish a TMDL for each pollutant identified as causing the impairment of the listed waters on a schedule. FDEP 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 22 waterbodies (WBIDs) in the Springs Coast Basin. However, the FWRA (Section 403.067, F.S.) stated that all previous Florida 303(d) lists were for planning purposes only and directed FDEP 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, April 2001), and as amended.

2.2 Information on Verified Impairment

FDEP used the IWR to assess water quality impairments in the freshwater segment of Saint Joes Creek (WBID 1668A) and verified the impairments for fecal coliform bacteria (see Table 2.1). Table 2.2 summarizes the data collected during the verification period (January 1, 1999, to June 30, 2006). The segment was verified as impaired for fecal coliform bacteria because more than 10 percent of values exceeded the Class III freshwater criterion of 400 counts per 100 milliliters (counts/100mL) for fecal coliform (23 out of 62 samples in the verified period exceeded the criterion of 400 counts/100mL).

The verified impairments were based on data collected by the Pinellas County Watershed Management Division and FDEP. The assessment was based on data collected at 3 Pinellas County STORET stations (21FLPDEM35 -10, -11, and -12) and 5 FDEP STORET stations (Southwest District 21FLTPA STORET Stations -27483438243412, -27483668242429, -27484788240469, -2727485048241453, and -27485898241143). Seven of the stations are located on the main stem of Saint Joes Creek, and 1 station is located on Miles Creek (21FLPDEM35-12). Figure 1.2 shows the locations of the sampling sites. Figure 2.1 displays the fecal coliform data collected from 2004 through 2006, and Appendix A tabulates all available fecal coliform data for the impaired segment. Fecal coliform values exceeding the criterion of 400 counts/100mL during this period were used to develop the TMDL, as described in Chapter 5.

Table 2.1. Verified Impairment in Saint Joes Creek, WBID 1668A

Parameter Causing Impairment	Priority for TMDL Development	Projected Year for TMDL Development*
Fecal Coliform	High	2007

*The TMDL was scheduled to be completed by December 31, 2006, based on a Consent Decree between the EPA and EarthJustice, but the Consent Decree allows a nine-month extension for completing the TMDL.

Table 2.2. Summary of Fecal Coliform Data for Saint Joes Creek, WBID 1668A, March 2004–May 2006

Waterbody	Parameter Causing Impairment	Total Number of Samples	30-Day Geometric Mean	Percent Fecal Coliform Samples > 400 counts/100mL	Minimum Concentration (counts/100mL)	Maximum Concentration (counts/100mL)
Saint Joes Creek Main Channel	Fecal Coliform	50	N/A	28	1	3,500
Miles Creek	Fecal Coliform	12	N/A	75	86	7,300

N/A – Not available

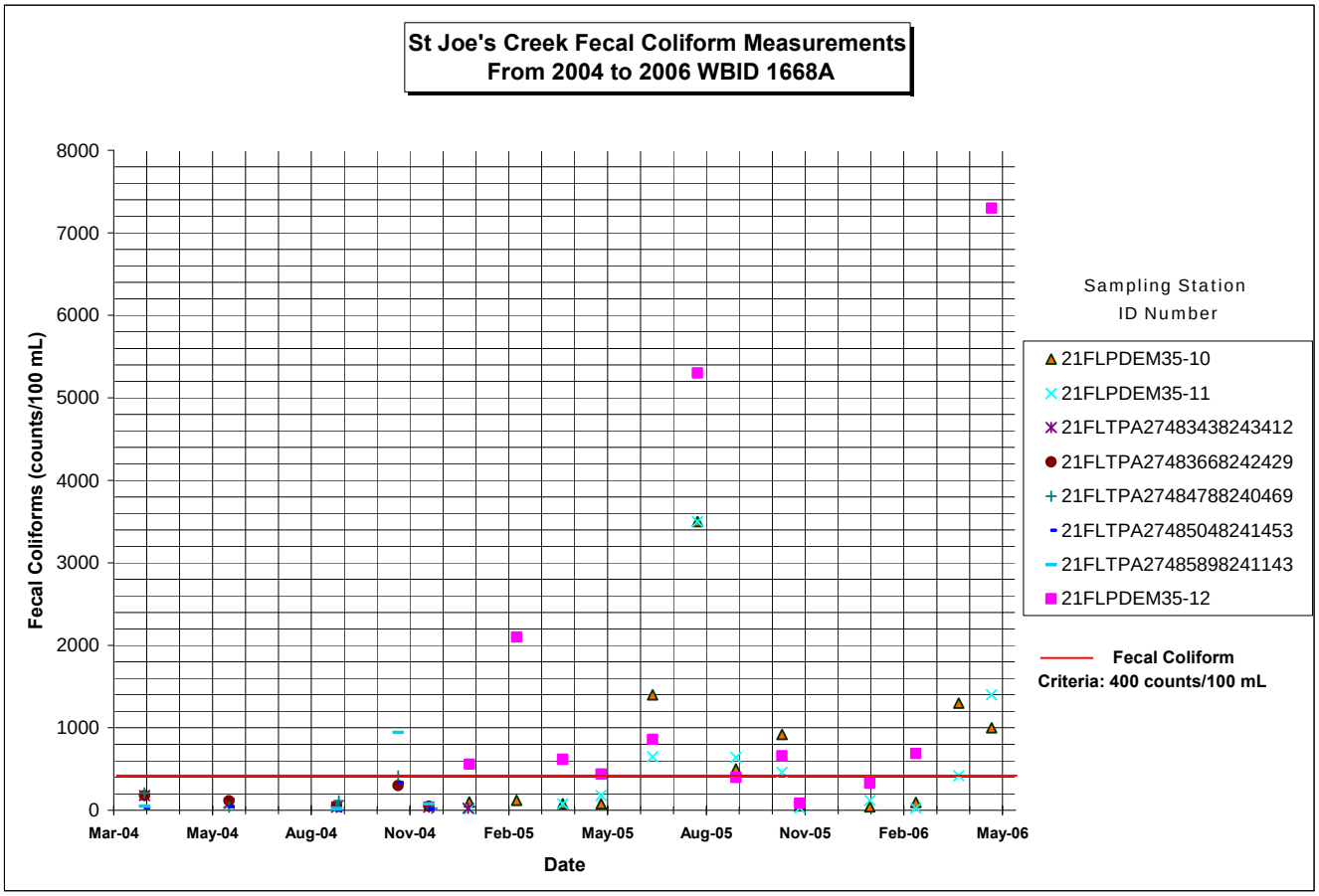

Figure 2.1. Fecal Coliform Measurements for Saint Joes Creek, WBID 1668A, March 2004–May 2006

Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS

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)**

Saint Joes Creek is a Class III waterbody, with a designated use of recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife. The Class III water quality criterion applicable to the impairment addressed by this TMDL is for fecal coliform bacteria.

3.2 Applicable Water Quality Standards and Numeric Water Quality Target

3.2.1 Fecal Coliform Criterion

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

> ***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.*

For fecal coliform, 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 segment (as described in subsequent chapters), 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 fecal coliform criterion selected for the TMDL is that values are not to exceed 400 counts/100mL in more than 10 percent of the samples. The 10 percent exceedance allowed by the water quality criterion was not used directly in estimating the target load, but was included in the TMDL margin of safety (MOS) (described in Section 6.4).

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 the pollutant causing impairment 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 5 acres, and a wide variety of industries (see Appendix B 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 Bacteria in Saint Joes Creek, WBID 1668A

4.2.1 Point Sources

There are no permitted domestic WWTFs that discharge fecal coliform loads into the freshwater segment of Saint Joes Creek. One facility, the Pinellas County Utilities' South Cross Bayou Water Reclamation Facility (NPDES No. FL0040436), discharges to the tidal segment of Saint Joes Creek, downstream of the reach that is the focus of this report.

Municipal Separate Storm Sewer System Permittees

Municipal separate storm sewer systems (MS4s) may also discharge pollutants to waterbodies in response to storm events. To address stormwater discharges, the EPA developed the NPDES stormwater permitting program in two phases. Phase I, promulgated in 1990, addresses large and medium-size MS4s located in incorporated areas and counties with populations of 100,000 or more. Phase II permitting began in 2003. Regulated Phase II MS4s, defined in Section 62-624.800, F.A.C., typically cover urbanized areas serving jurisdictions with a population of at least 10,000 or discharging into Class I or Class II waters, or into Outstanding Florida Waters.

There are two Phase I MS4 permits that cover the stormwater collection systems in the Saint Joes Creek watershed. Saint Joes Creek falls under the Phase I MS4 permits to Pinellas County (No. FLS000005) and the city of St. Petersburg (No. FLS000007). The copermittees of the Pinellas County permit are the town of Kenneth City and the Florida Department of Transportation (FDOT). Currently, no local governments in the watershed have applied for coverage under the Phase II NPDES MS4 permit.

4.2.2 Land Uses and Nonpoint Sources

Nonpoint source pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources. It is caused by rainfall moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even underground sources of drinking water (EPA, 1994). Potential nonpoint sources of fecal coliform bacteria include loadings from surface runoff, wildlife, livestock, pets, leaking sewer lines, and leaking septic tanks.

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.

Agricultural Animals

Agricultural animals are the source of several types of coliform bacteria loading to streams. Agricultural activities, including runoff from pastureland and cattle in streams, can affect water quality. A review of the land use categories found no Florida Land Use Cover Classification System (FLUCCS) codes involving animal feeding operations, or specialty farms that contain animals.

Land Uses

The spatial distribution and acreage of different land use categories were identified using the SWFWMD 2004 land use coverage (scale 1:40,000) contained in FDEP's geographic information system (GIS) library. Land use categories in Saint Joes Creek were aggregated using the simplified Level 1 codes (Table 4.1). Figure 4.1 shows the acreage of the principal land uses draining into the main channel and Miles Creek tributary, which make up the

watershed area in this segment. The urban and built-up category predominates, covering about 97 percent of the total area, with residential areas making up 73 percent of the total. The agricultural land uses (0.1 percent) are associated with nurseries, which are not typically sources of fecal coliform bacteria.

Table 4.1. Classification of 2004 Land Use Categories in Saint Joes Creek, WBID 1668A

FLUCCS Code	Land Use	Acreage	Percentage of Total
1000	Recreational and Open Land	66	1%
1100	Residential Low Density < 2 Dwelling Units/Acre	52	1%
1200	Residential Medium Density 2-5 Dwelling Units/Acre	33	1%
1300	Residential High Density 6 or more Dwelling Units/Acre	4,159	71%
1400	Commercial	615	11%
1500	Industrial	293	5%
1700	Institutional	252	4%
2000	Agricultural	3	0.1%
4000	Forests	3	0.1%
5000	Water	102	2%
6000	Wetlands	8	0.1%
8000	Transportation, Communication and Utilities	263	4%
Totals		**5,847**	**100%**

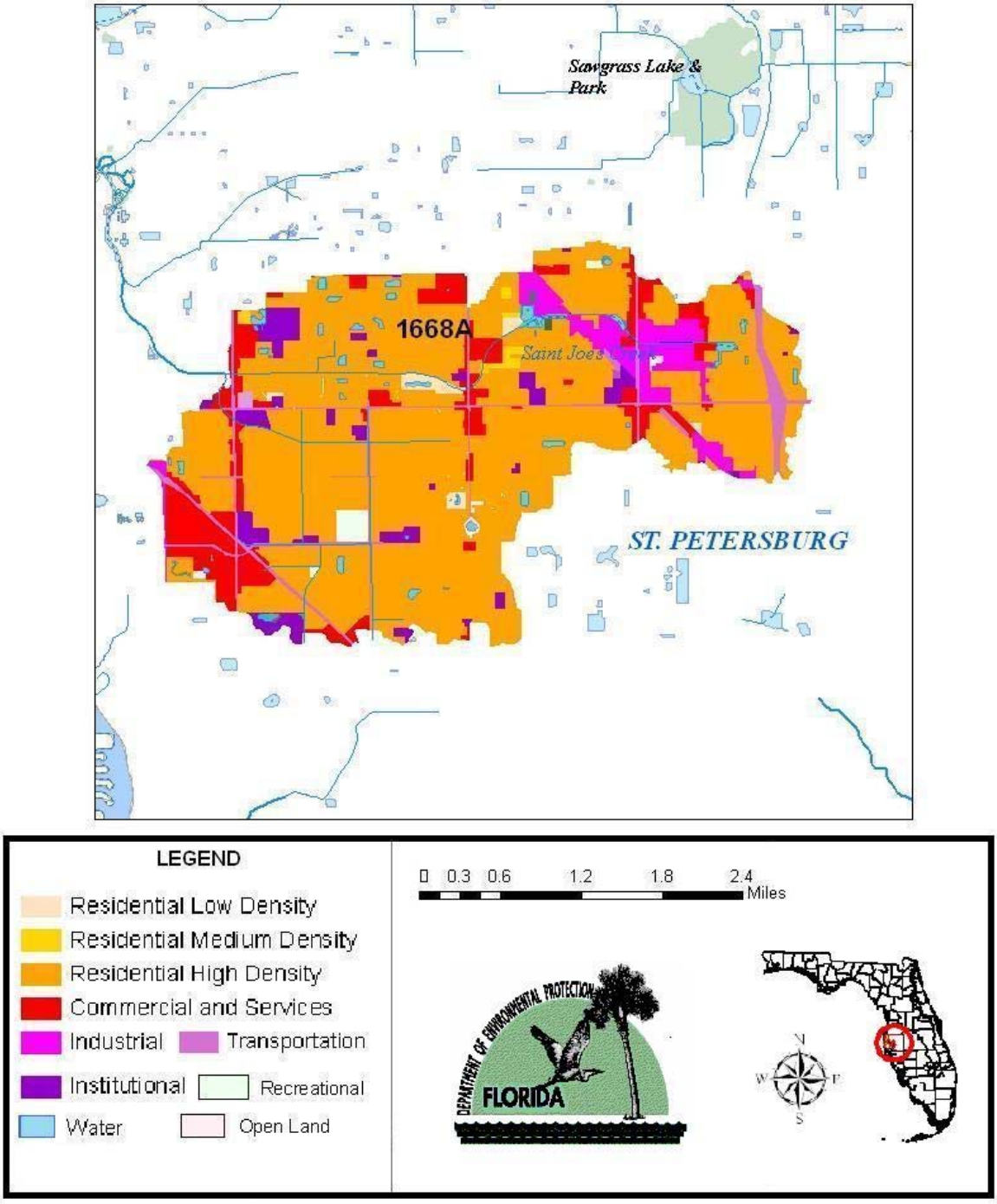

Figure 4.1. Principal Land Uses in Saint Joes Creek, WBID 1668A, in 2004

Urban Development

Coliform bacteria loading from urban areas is attributable to multiple sources, including stormwater runoff, leaks and overflows from sanitary sewer systems, illicit discharges of sanitary waste, runoff from improper disposal of waste materials, leaking septic systems, and domestic animals.

Since nearly 73 percent of the land area in the watershed is residential, it is possible that pets, especially dogs, are affecting coliform bacteria levels in Saint Joes Creek. FDEP obtained data on the number of dogs and cats in the area from the Pinellas County Animal Service Department (Pinellas County Environmental Management, November 2007); using these estimates, the coliform loading from dogs and cats may be estimated (Table 4.2), Assuming that 10 percent of coliforms reach the waterbody and are viable upon reaching it, the approximate total loading is 4.23×10^{12} organisms/day.

Table 4.2. Estimated Coliform Loading from Dogs and Cats in Saint Joes Creek, WBID 1668A

Pet	Estimated Number of Pets in WBID 1668A	Estimated Loading of Total	Estimated Number of Pets with Impact to WBID	Estimated Counts/Pet/Day[1]	Estimated Counts/Day
Dogs	5,533	10%	553	5.0×10^{9}	2.77×10^{12}
Cats	2,917	10%	292	5.0×10^{9}	1.46×10^{12}

[1] From the EPA document, *Protocol for Developing Pathogen TMDLs*, January 2001, pp. 5-7.

Population

According to the U.S. Census Bureau, the population density in Pinellas County in 2006 was at or less than 3,302.4 persons per square mile (Table 4.3). The U.S. Census Bureau reports that the total population in 2006 for Pinellas County, which includes (but is not exclusive to) WBID 1668A, was 924,413, with 495,191 housing units (2005 estimate). For all of Pinellas County, the bureau reported a housing unit density of 1,769 housing units per square mile. Pinellas County is above the average housing unit density of Florida of 153 housing units per square mile. In the Saint Joes Creek area, the estimated population density is about 4,163 people per square mile (U.S. Census Bureau for the city of St Petersburg). See Figure 4.2 for a U.S. Census Bureau map of the area.

Table 4.3. Population Density in Pinellas County, Florida, in 2006

Persons per Square Mile	Total Population	Housing Units per Square Mile	Housing Units
3,302	924,413	1769	495,191

Source: U.S. Census Bureau State & County QuickFacts Website, 2007. Available: http://quickfacts.census.gov/qfd/states/12/12103.html.

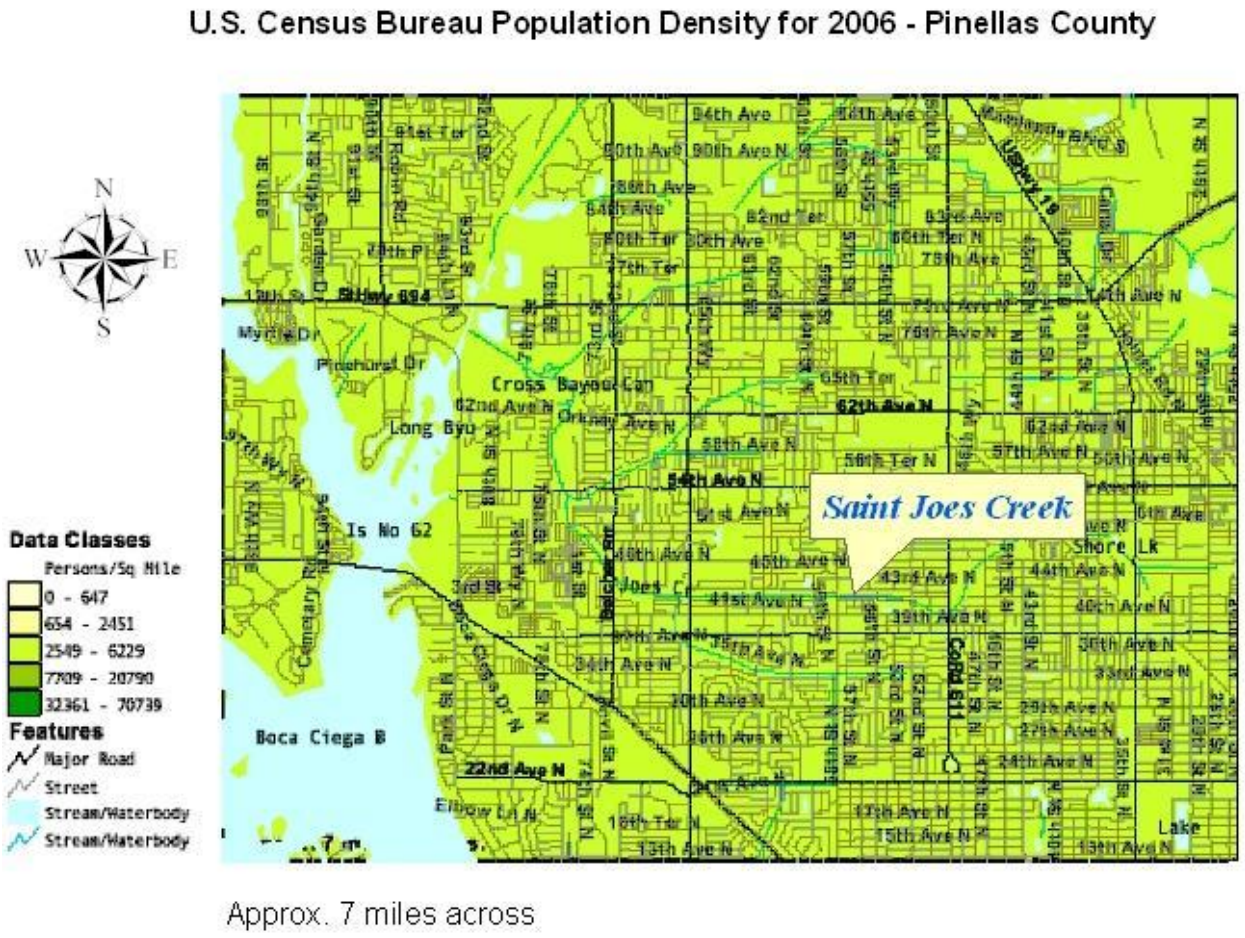

Figure 4.2. Population Density in the Area of Saint Joes Creek, WBID 1668A, in 2006

Septic Tanks

According to the city of St. Petersburg and Pinellas County Utilities' websites and sewer service maps, nearly all of the residences are connected to the sanitary sewer system, virtually eliminating septic tank effluent as a potential source to the creek. According to Pinellas County Utilities' Engineering Division, the area of WBID 1668A north of 38th Ave. in St. Petersburg is entirely served by sanitary sewers that connect to the South Cross Bayou Water Reclamation

Facility (WRF). The area south of 38th Ave. is sewered by the city of St. Petersburg and is connected to all four of the city's wastewater treatment and WRFs.

Domestic Sludge

When domestic wastewater is treated, the solid material that accumulates in the wastewater treatment plant must be removed periodically to keep the plant operating properly. The collected material, called "residuals," "biosolids," or more commonly, "sewage sludge," is the byproduct of these processes. The land application of sludge from domestic WWTFs is a potential source of coliform bacteria loading to surrounding surface waters.

There are no known residual land application sites in the Saint Joes Creek watershed. Pinellas County Utilities' South Cross Bayou WRF produces Class AA sludge residual. Class AA residuals (highest quality) are treated to eliminate pathogens and meet strict pollutant criteria. As a result, they may be used without restriction and may be sold to the public. Certain Class AA products are found in stores and garden centers. The city of St Petersburg's domestic facilities distribute their sludge residuals outside of Pinellas County.

Reclaimed Water Usage

Wastewater treatment plants with the ability to reuse effluent for irrigation are called WRFs. All of the four St Petersburg facilities and the South Cross Bayou wastewater treatment plants are WRFs. The effluent is reused as irrigation water for parks, golf courses and other sport fields, parks, cemeteries, and other open spaces where water irrigation is needed or beneficial. The effluent may also be used for industrial applications (e.g., closed circuit cooling systems).

The effluent, although of good water quality, is not potable, and direct human contact should be avoided or at least minimized for public health and safety. It is disinfected for fecal coliform destruction, tested daily, and stored prior to land application reuse. Effluent is not applied during rain events to preclude runoff to waterbodies. The permitted effluent limitation for 75 percent of fecal coliform values is "below detection limits," and "any one sample shall not exceed 25 fecal coliform values per 100 mL of sample."

All of the WRFs have a master reuse plan identifying permitted areas for irrigation and distribution. Some of the reclaimed water users are within the Saint Joes Creek watershed. The ground water is monitored periodically for fecal coliform bacteria. There is one monitoring well in WBID 1668A (St. Petersburg MWC-01). A review of the sampling results revealed that nearly all of the fecal coliform values were reported as "non-detect."

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Method Used To Determine Loading Capacity

The methodology used for this TMDL is the "load duration curve." Also known as the "Kansas Approach" because it was developed by the state of Kansas (Stiles, 2002), this method has been well documented in the literature, with improved modifications used by the EPA, Region 4. Basically, the method relates the pollutant concentration to the flow of the stream to establish the existing loading capacity and the allowable pollutant load (TMDL) under a spectrum of flow conditions. It then determines the maximum allowable pollutant load and load reduction requirement based on the analysis of the critical flow conditions. Using this method, it takes five steps to develop the TMDL and establish the required load reduction:

1. *Identify available flow and water quality data,*
2. *Develop the flow duration curve,*
3. *Develop the load duration curve for the existing loading,*
4. *Define the critical conditions, and*
5. *Establish the needed load reduction by comparing the existing loading with the allowable load under critical conditions.*

5.2 Data Used in the Determination of Loading Capacity

Fecal coliform bacteria concentrations and flow measurements were used to estimate both the allowable and existing coliform loads. TMDLs for fecal coliform bacteria are being developed for both the Saint Joes Creek main channel and Miles Creek because the number of criterion exceedances in each channel meet the IWR verified impaired listing requirements.

The primary collectors of water quality data in the watershed are the Pinellas County Watershed Management Division and FDEP. For the main channel of Saint Joes Creek, Pinellas County STORET stations include two 21FLPDEM35 stations: -10, and -11. FDEP's (Southwest District) main channel stations include five 21FLTPA STORET Stations: -27483438243412, -27483668242429, -27484788240469, -2727485048241453, and -27485898241143. For the Miles Creek tributary to Saint Joes Creek, the Pinellas County Watershed Management Division samples at STORET Station 21FLPDEM35-12 were included in the analysis.

Figure 1.2 shows the locations of these sampling sites, while Table 2.2 provides a statistical overview of the observed data at the sites. Figure 2.1 displays the data for fecal coliform bacteria used in this analysis, and Appendix A lists the water quality monitoring results for fecal coliform bacteria.

Flow measurements for TMDL development were obtained from a U.S. Geological Survey (USGS) gaging station located on Saint Joes Creek (USGS 02308935, at Pinellas Park, Florida, Latitude 27°48'50", Longitude 82°41'45" (Figure 1.2). The flow data from this gage were selected for this analysis because most of the fecal coliform data were collected at or near the gage site, and flows were measured and recorded during the verified period.

5.3 TMDL Development Process

The range of flows from the USGS flow gage was divided into "flow zones." The concept of zones is adopted from Dr. Bruce Cleland (Cleland, August 15, 2002, and September 2003). The purpose of the zones is to demarcate hydrologic conditions between drought and peak flood into flow ranges such as low, dry, average, moist, and high.

Expressing the flows in terms of frequency of recurrence (duration) allows exceedances of the criterion to be linked to specific flow intervals and durations. For example, if all of the exceedances occurred during low-flow conditions, point sources of the pollutant would be suspected. Conversely, if all the exceedances took place during higher-flow periods, then nonpoint sources of the pollutant would be suspected.

Following Cleland's approach (Cleland, September 2003), FDEP selected the following flow zones: "High" (0–10), "Moist" (11–40), "Mid-range" (41–60), "Dry" (61–90), and "Low" (91–100). To develop the flow duration curves and load duration curves for both the Saint Joes Creek main channel and Miles Creek, the daily flow at the downstream end of each channel was estimated by multiplying the gage flow by the ratio of each channel's watershed drainage area to the gage drainage area. Figure 5.1.a and Figure 5.1.b present the flow duration curves for the Saint Joes Creek main channel and Miles Creek watersheds, respectively.

Using the flows from the flow duration curves, load duration curves for fecal coliform bacteria (Figure 5.2.a and Figure 5.2.b) were calculated using the following equation:

(1) (observed flow) x (conversion factor) x (state criteria) = ([parameter quantity]/day or daily load)

The equation above yields the load duration curve or allowable load curve, shown as the fecal coliform target lines in Figure 5.2.a and Figure 5.2.b. Using Equation 1 (above), a table of fecal coliform loads exceeding the load target were calculated, substituting the observed coliform exceedances for the state criterion value (Table 5.1.a and Table 5.1.b). All the fecal coliform observations were then plotted, and it was noted where the samples were in relation to the allowable load curve (above or below the curve). Those above the curves in Figure 5.2.a and Figure 5.2.b are noted as exceedances to the state criterion, and are indicated by a red triangle.

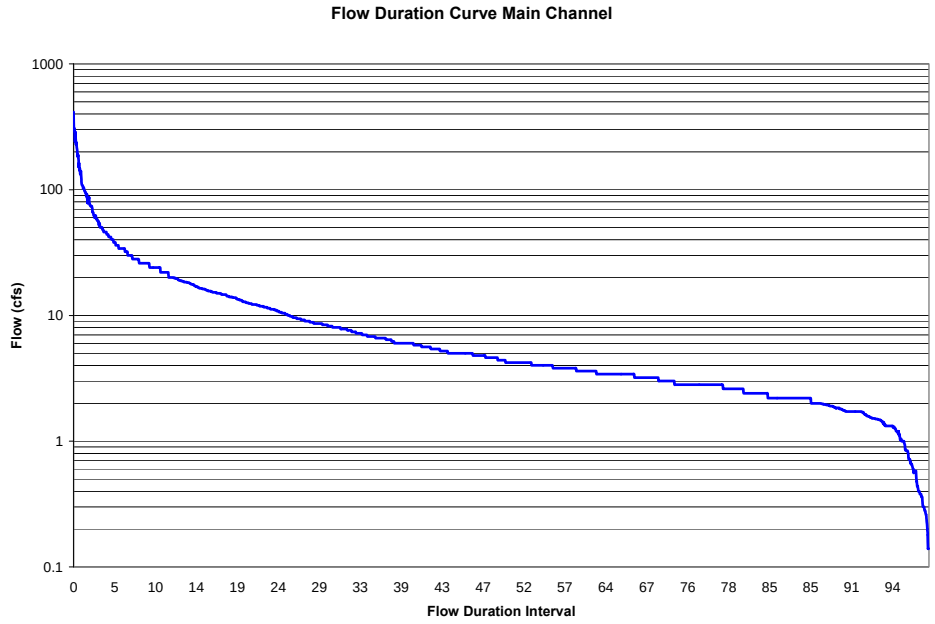

Figure 5.1.a. Flow Duration Curve for Saint Joes Creek, Main Channel, 2000–06 (Estimated Flow)

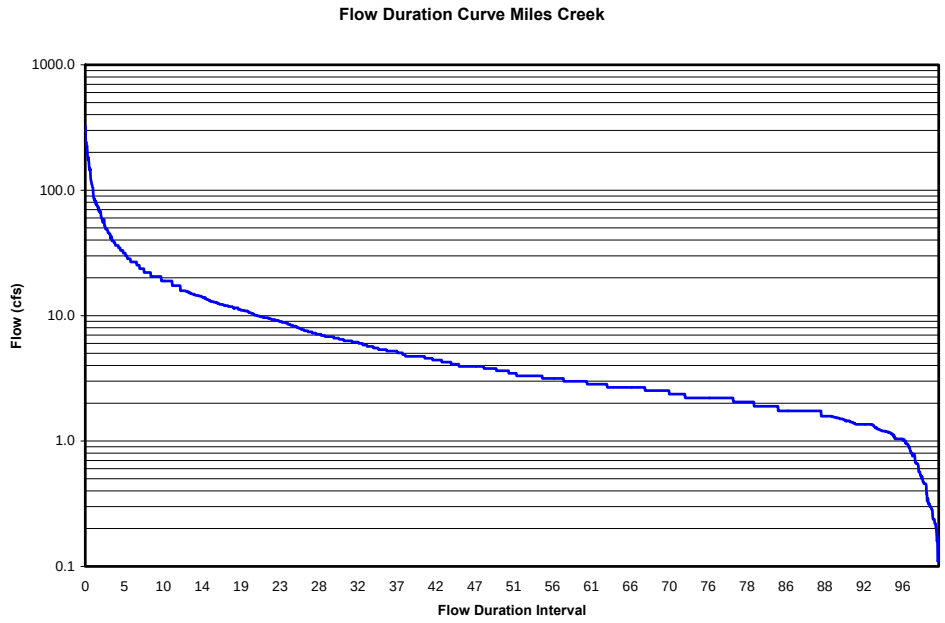

Figure 5.1.b. Flow Duration Curve for Miles Creek, 2000–06 (Estimated Flow)

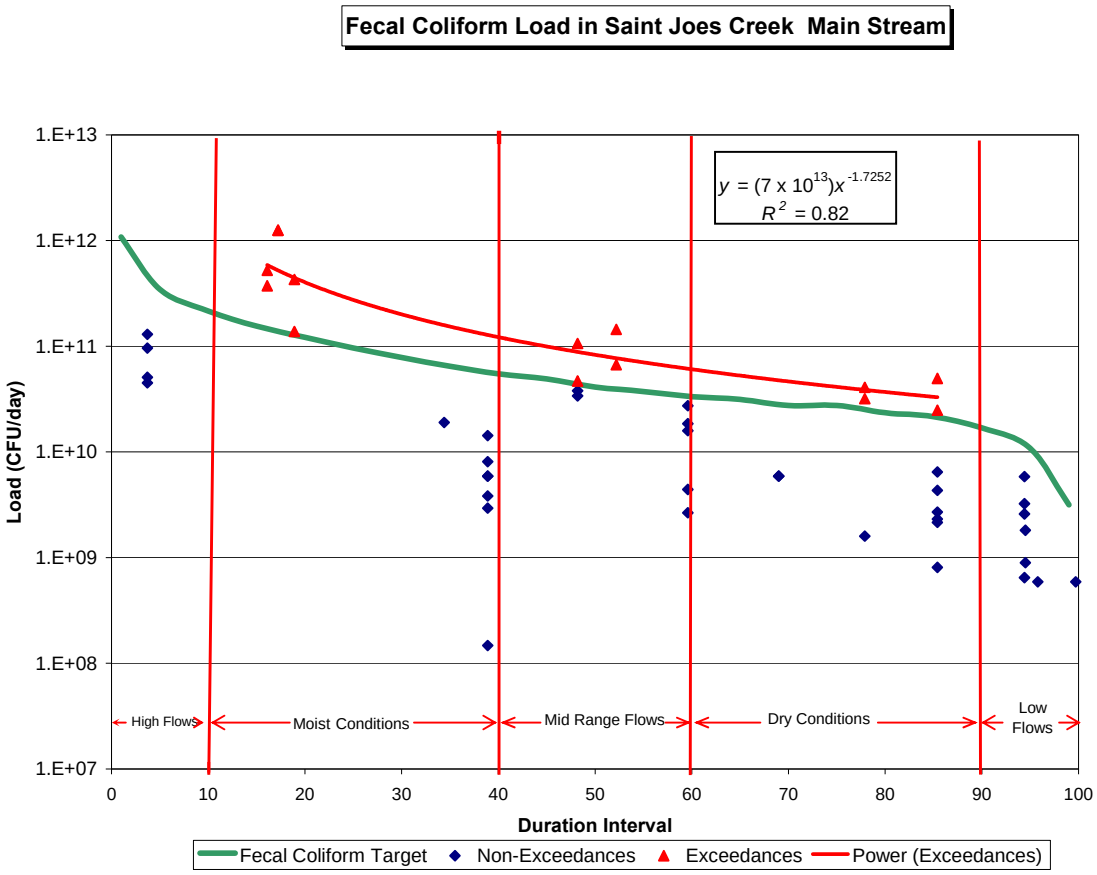

Figure 5.2.a. Load Duration Curve for Fecal Coliform in Saint Joes Creek, Main Channel, WBID 1668A

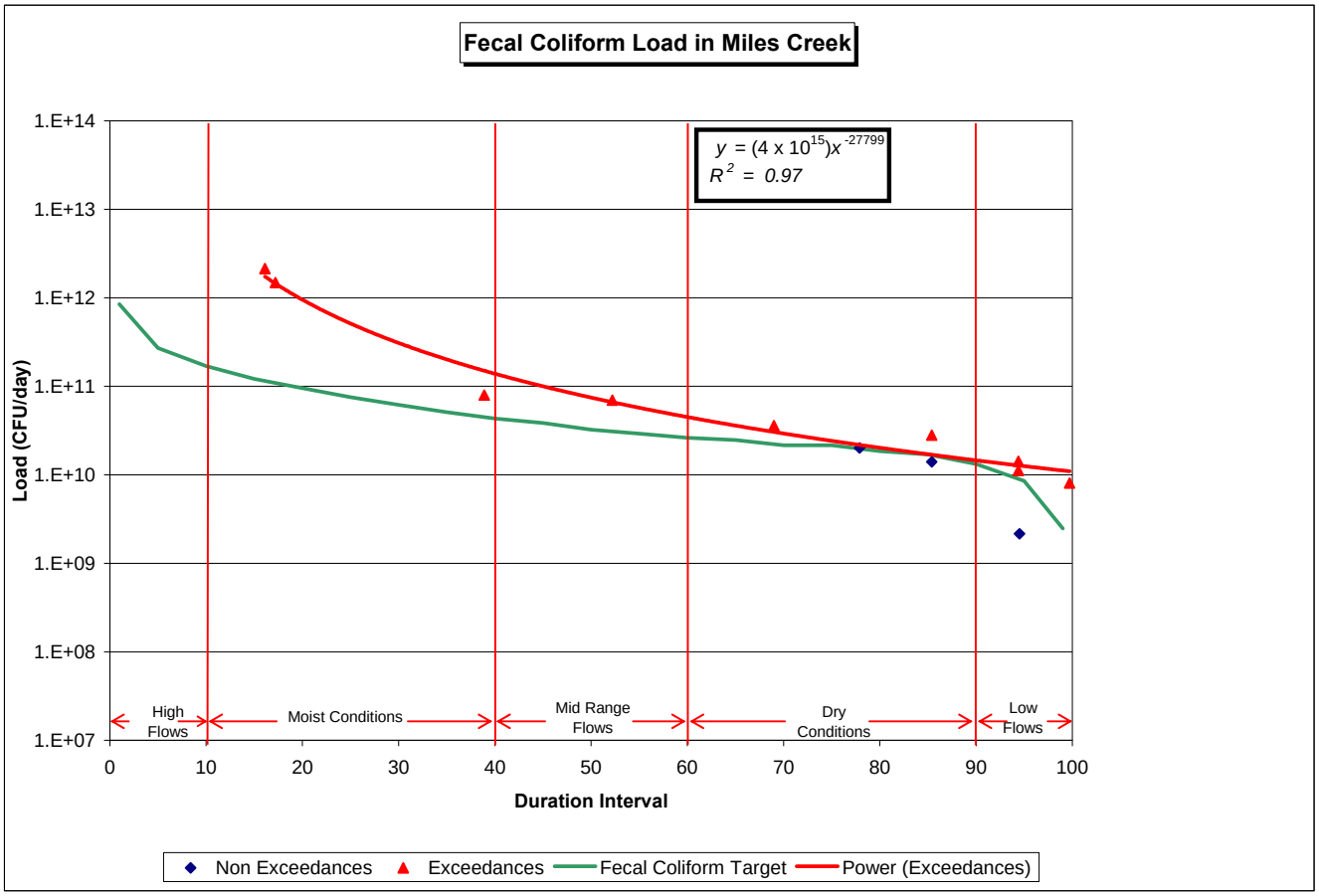

Figure 5.2.b. Load Duration Curve for Fecal Coliform in Miles Creek, WBID 1668A

Table 5.1.a. Observed Fecal Coliform Data for Calculating Exceedances to the State Criterion for Saint Joes Creek, Main Channel, WBID 1668A

Fecal Coliform Station	Sample Date	Flow (cfs)	Flow Rank (%)	Fecal Coliform (CFU/100mL)	Fecal Coliform Load (CFU/day)
21FLTPA 27485898241143	11/15/2004	4.61	48.2	944	1.06×10^{11}
21FLTPA 27484788240469	11/15/2004	4.61	48.2	416	4.69×10^{10}
21FLPDEM35-10	7/5/2005	4.21	52.2	1,400	1.44×10^{11}
21FLPDEM35-11	7/5/2005	4.21	52.2	650	6.69×10^{10}
21FLPDEM35-11	8/15/2005	14.63	17.2	3,500	1.25×10^{12}
21FLPDEM35-10	8/15/2005	14.63	17.2	3,500	1.25×10^{12}
21FLPDEM35-11	9/19/2005	2.61	77.9	640	4.08×10^{10}
21FLPDEM35-10	9/19/2005	2.61	77.9	500	3.19×10^{10}
21FLPDEM35-10	10/31/2005	2.20	85.4	920	4.96×10^{10}
21FLPDEM35-11	10/31/2005	2.20	85.4	460	2.48×10^{10}
21FLPDEM35-10	4/10/2006	13.43	18.9	1,300	4.27×10^{11}
21FLPDEM35-11	4/10/2006	13.43	18.9	420	1.38×10^{11}
21FLPDEM35-11	5/10/2006	15.23	16.1	1,400	5.22×10^{11}
21FLPDEM35-10	5/10/2006	15.23	16.1	1,000	3.73×10^{11}

Note: Flow and concentration data analyzed for the TMDL were from March 2004 through May 2006. The Group 5 verification period is from January 1, 1999, through June 30, 2006. Flow data were estimated using flow data from USGS Gage 02308935, located in WBID 1668A.

cfs – cubic feet per second.
CFU – colony-forming units

Table 5.1.b. Observed Fecal Coliform Data for Calculating Exceedances to the State Criterion for Miles Creek, WBID 1668A

Station	Sample Date	Flow (cfs)	Flow Rank (%)	Fecal Coliform (CFU/100mL)	Fecal Coliform Load (CFU/day)
21FLPDEM35-12	1/19/2005	1.04	94.4	**560**	1.43×10^{10}
21FLPDEM35-12	3/3/2005	0.16	99.7	**2,100**	8.10×10^{9}
21FLPDEM35-12	4/14/2005	2.36	69	**620**	3.59×10^{10}
21FLPDEM35-12	5/19/2005	1.04	94.4	**440**	1.12×10^{10}
21FLPDEM35-12	7/5/2005	3.31	52.2	**860**	6.97×10^{10}
21FLPDEM35-12	8/15/2005	11.5	17.2	**5,300**	1.49×10^{12}
21FLPDEM35-12	10/31/2005	1.73	85.4	**660**	2.80×10^{10}
21FLPDEM35-12	3/2/2006	4.73	38.9	**690**	7.98×10^{10}
21FLPDEM35-12	5/10/2006	12	16.1	**7,300**	2.14×10^{12}

Note: Flow and concentration data analyzed for the TMDL were from January 2005 through May 2006. The Group 5 verification period is from January 1, 1999, through June 30, 2006. Flow data were estimated using flow data from USGS Gage 02308935, located in WBID 1668A.

As noted previously, values on the load duration curve can generally be grouped by hydrologic conditions to identify the most likely potential sources. Exceedances falling into the 10th through 40th percentile flows are typically associated with moist conditions when stormwater loads are the most likely source, and exceedances falling into the 60th through 90th percentiles are typically associated with dry conditions when point sources are likely the dominant source. As shown in Figure 5.2.a, the fecal coliform exceedances in the Saint Joes Creek main channel are nearly distributed equally within the 10th to 40th percentile, 40th to 60th percentile, and 60th to 90th percentile of flows, with no exceedances within the 0 to 10th or 90th to 100th percentiles. For Miles Creek, as shown in Figure 5.2.b, exceedances occur during most hydrologic conditions except for the very highest flows (0 to 10th percentile).

Table 5.2.a and Table 5.2.b depict the allowable fecal coliform bacteria load for peak flow, low flow, and 5-percentile increments in flow for the Saint Joes Creek main channel and Miles Creek, respectively. The tables were created by taking the Nth-percentile flow (flow rank in the table) from the measured flow data and multiplying each percentile flow by the fecal coliform criterion of 400 counts/100mL and converting into bacteria counts/day. This conversion was accomplished by multiplying the criterion by [(28317/100)*60*60*24]. The factor 28317/100 converts counts/100mL into counts per cubic foot, and the 60*60*24 converts seconds to days.

Finally, the actual needed load reduction for compliance with the state criterion was calculated using the following equation:

$$(2) \qquad \frac{\text{(existing load)} - \text{(allowable load)}}{\text{(existing load)}} \times 100$$

On the load duration curve, all points higher than the allowable load were considered an exceedance of the fecal coliform criterion. A regression analysis was performed to determine the best correlation for the exceedances. The existing loading of a given flow duration interval was calculated using the regression equation displayed in Figure 5.2.a for Saint Joes Creek, and Figure 5.2.b for Miles Creek, and a given flow duration interval between the 10^{th} and 90^{th} percentile, in 5-percentile increments. The allowable loading of a given flow duration interval was calculated using Equation (1), within the flow duration interval with 5-percentile increments. Using Equation (2), the load reduction was determined for each flow interval. Table 5.3.a and Table 5.3.b list the flow duration intervals, allowable loadings, existing loadings, and needed load reductions for fecal coliform bacteria for Saint Joes Creek and Miles Creek, respectively.

5.4 Critical Conditions/Seasonality

The critical conditions for coliform loadings in a given watershed depend on the existence of point sources and land use patterns in the watershed. Typically, the critical condition for nonpoint sources is an extended dry period, followed by a rainfall runoff event. During wet weather periods, coliform bacteria that have built up on the land surface under dry weather conditions are washed off by rainfall, resulting in wet weather exceedances. However, significant nonpoint source contributions could also occur under dry weather conditions without any major surface runoff event. This usually happens when nonpoint sources contaminate the surficial aquifer, and coliform bacteria are brought into the receiving waters through baseflow. Animals with direct access to the receiving water could also contribute to the exceedances during dry weather conditions. The critical condition for point source loading typically occurs during periods of low stream flow, when dilution is minimized.

Table 5.2.a. Fecal Coliform Target Loads for Flow, Saint Joes Creek, Main Channel

Flow Rank	Flow Rank (%)	Flow (cfs)	Allowable Loads	
			Fecal Coliform Load (counts/day)	Flow Conditions
0.04%		414.81	4.06×10^{12}	*Peak*
0.10%		291.48	2.85×10^{12}	
0.27%		231.21	2.26×10^{12}	*1-day*
1%	1	110.04	1.08×10^{12}	
5%	5	35.17	3.44×10^{11}	
10%	10	22.04	2.16×10^{11}	
15%	15	15.83	1.55×10^{11}	
20%	20	12.42	1.22×10^{11}	
25%	25	9.82	9.61×10^{10}	
30%	30	8.02	7.84×10^{10}	
35%	35	6.61	6.47×10^{10}	
40%	40	5.61	5.49×10^{10}	
45%	45	5.01	4.90×10^{10}	
50%	50	4.21	4.12×10^{10}	
55%	55	3.81	3.73×10^{10}	
60%	60	3.41	3.33×10^{10}	
65%	65	3.21	3.14×10^{10}	
70%	70	2.81	2.75×10^{10}	
75%	75	2.81	2.75×10^{10}	
80%	80	2.40	2.35×10^{10}	
85%	85	2.20	2.16×10^{10}	
90%	90	1.72	1.69×10^{10}	
95%	95	1.11	1.09×10^{10}	
99%	99	0.32	3.16×10^{9}	
100%	100	0.06	5.88×10^{8}	*Low*

Table 5.2.b. Fecal Coliform Target Loads for Flow, Miles Creek

Flow Rank	Flow Rank (%)	Flow (cfs)	Allowable Loads	
			Fecal Coliform Load (counts/day)	Flow Conditions
0.04%		326.33	3.19×10^{12}	*Peak*
0.10%		229.31	2.24×10^{12}	
0.27%		181.89	1.78×10^{12}	*1 - Day*
1%	1	86.56	8.47×10^{11}	
5%	5	27.67	2.71×10^{11}	
10%	10	17.34	1.70×10^{11}	
15%	15	12.45	1.22×10^{11}	
20%	20	9.77	9.57×10^{10}	
25%	25	7.72	7.56×10^{10}	
30%	30	6.31	6.17×10^{10}	
35%	35	5.20	5.09×10^{10}	
40%	40	4.41	4.32×10^{10}	
45%	45	3.94	3.86×10^{10}	
50%	50	3.31	3.24×10^{10}	
55%	55	3.00	2.93×10^{10}	
60%	60	2.68	2.62×10^{10}	
65%	65	2.52	2.47×10^{10}	
70%	70	2.21	2.16×10^{10}	
75%	75	2.21	2.16×10^{10}	
80%	80	1.89	1.85×10^{10}	
85%	85	1.73	1.70×10^{10}	
90%	90	1.36	1.33×10^{10}	
95%	95	0.87	8.55×10^{9}	
99%	99	0.25	2.48×10^{9}	
100%	100	0.05	4.63×10^{8}	*Low*

Table 5.3.a. Fecal Coliform Percentage Reductions Required for Saint Joes Creek, Main Channel

Flow Ranking (%)	Allowable Load (colonies/day)	Existing Load (colonies/day)	% Reduction Required
10	2.16×10^{11}	1.32×10^{12}	83.6
15	1.55×10^{11}	6.55×10^{11}	76.3
20	1.22×10^{11}	3.99×10^{11}	69.5
25	9.61×10^{10}	2.71×10^{11}	64.6
30	7.84×10^{10}	1.98×10^{11}	60.4
35	6.47×10^{10}	1.52×10^{11}	57.4
40	5.49×10^{10}	1.21×10^{11}	54.5
45	4.90×10^{10}	9.84×10^{10}	50.2
50	4.12×10^{10}	8.20×10^{10}	49.8
55	3.73×10^{10}	6.96×10^{10}	46.5
60	3.33×10^{10}	5.99×10^{10}	44.3
65	3.14×10^{10}	5.22×10^{10}	39.9
70	2.75×10^{10}	4.59×10^{10}	40.2
75	2.75×10^{10}	4.08×10^{10}	32.6
80	2.35×10^{10}	3.65×10^{10}	35.5
85	2.16×10^{10}	3.28×10^{10}	34.3
90	1.69×10^{10}	2.98×10^{10}	43.3
Median	4.12×10^{10}	8.20×10^{10}	49.8

Table 5.3.b. Fecal Coliform Percentage Reductions Required for Miles Creek

Flow Ranking (%)	Allowable Load (colonies/day)	Existing Load (colonies/day)	% Reduction Required
10	1.70×10^{11}	6.64×10^{12}	97.4
15	1.22×10^{11}	2.15×10^{12}	94.3
20	9.57×10^{10}	9.67×10^{11}	90.1
25	7.56×10^{10}	5.20×10^{11}	85.5
30	6.17×10^{10}	3.13×10^{11}	80.3
35	5.09×10^{10}	2.04×10^{11}	75.0
40	4.32×10^{10}	1.41×10^{11}	69.3
45	3.86×10^{10}	1.01×10^{11}	62.0
50	3.24×10^{10}	7.57×10^{10}	57.2
55	2.93×10^{10}	5.81×10^{10}	49.5
60	2.62×10^{10}	4.56×10^{10}	42.5
65	2.47×10^{10}	3.65×10^{10}	32.4
70	2.16×10^{10}	2.97×10^{10}	27.3
75	2.16×10^{10}	2.45×10^{10}	11.9
80	1.85×10^{10}	2.05×10^{10}	9.7
85	1.70×10^{10}	1.73×10^{10}	2.0
90	1.33×10^{10}	1.48×10^{10}	10.2
Median	3.24×10^{10}	5.81×10^{10}	57.2

As shown in Figure 5.2.a and Figure 5.2.b, exceedances of fecal coliform bacteria in the Saint Joes Creek watershed appeared during nearly all flow regimes. In general, exceedances on the right side of the curve typically occur during low-flow events, implying a contribution from either point sources or baseflow. In contrast, exceedances on the left side of the curve usually represent potential sources accumulated on the land surface that could result from the land application of biosolids, wildlife, livestock, and pets. As discussed in Chapter 4, there are no active permitted facility discharges of fecal coliform loads directly into Saint Joes Creek, WBID 1668A; therefore, nonpoint sources are the contributory sources to the fecal coliform bacteria load.

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 percentage reduction, and the WLA for wastewater is typically expressed as mass per day).

WLAs for stormwater discharges are typically expressed as a percentage 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 fecal coliform bacteria TMDL for the Saint Joes Creek main channel and Miles Creek are expressed in terms of colonies per day for the overall TMDL and as a percent reduction for MS4 areas and other nonpoint sources to meet the applicable criterion. The TMDL represents the maximum daily fecal coliform load the river can assimilate and maintain the applicable fecal coliform bacteria criterion (Table 6.1).

Table 6.1. Fecal Coliform TMDL for Saint Joes Creek, WBID 1668A

Channel	TMDL	TMDL (colonies/day)	WLA		LA (% reduction)	MOS
			Wastewater (colonies/day)	NPDES Stormwater (% reduction)		
Saint Joes Main Channel	Median 10th to 90th Percentile	4.1×10^{10}	N/A	50	50	Implicit
Miles Creek	Median 10th to 90th Percentile	3.2×10^{10}	N/A	57	57	Implicit

N/A – Not applicable

6.2 Load Allocation

Based on a load duration curve approach similar to that developed by the state of Kansas (Stiles, 2002), the load allocation for nonpoint sources in the Saint Joes Creek main channel is a 50 percent reduction for all flow periods. For Miles Creek, the load allocation for nonpoint sources is a 57 percent reduction of instream coliform concentrations for all flow periods.

It should be noted that the LA includes loading from stormwater discharges that are not part of the NPDES stormwater program (see Appendix B).

6.3 Wasteload Allocation

6.3.1 NPDES Wastewater Discharges

As previously mentioned, there are no permitted domestic wastewater treatment facilities that discharge fecal coliform loads into the Saint Joes Creek main channel and Miles Creek.

6.3.2 NPDES Stormwater Discharges

The WLA for the Pinellas County, City of St Petersburg, and FDOT MS4 permits calls for reductions of 49.8 and 57.2 percent in current anthropogenic fecal coliform loading contributing to the criteria exceedances in the Saint Joes Creek's main channel and Miles Creek, respectively. It should be noted that any MS4 permittee is only responsible for reducing the 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.

While the LA and WLA for fecal coliform bacteria have been expressed as the percent reduction needed to attain the applicable Class III criterion, it is the combined reductions from both anthropogenic point and nonpoint sources that will result in the required reduction of instream fecal coliform concentrations. However, it is not the intent of the TMDL to abate natural background conditions.

6.4 Margin of Safety

Consistent with the recommendations of the Allocation Technical Advisory Committee (FDEP, February 1, 2001), an implicit MOS was used in the development of this TMDL. An implicit MOS was provided by the conservative decisions associated with the analytical assumptions and the development of assimilative capacity, which only focuses on exceedances. An 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. Additionally, the implicit MOS is appropriate, as existing loads are based on instream coliform measurements. These measurements include decay processes occurring instream and do not represent the maximum load that can be applied to the land and transported to the stream during a rain event.

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, referred to as the Basin Management Action Plan (BMAP). This document will be developed over the next year in cooperation with local stakeholders, who will attempt to reach consensus on detailed allocations and on how load reductions will be accomplished. The BMAP will include, among other things:

- *Appropriate load reduction allocations among the affected parties,*
- *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,*
- *Confirmed and potential funding mechanisms,*
- *Any applicable signed agreement(s),*
- *Local ordinances defining actions to be taken or prohibited,*
- *Any applicable local water quality standards, permits, or load limitation agreements,*
- *Milestones for implementation and water quality improvement, and*
- *Implementation tracking, water quality monitoring, and follow-up measures.*

An assessment of progress toward the BMAP milestones will be conducted every five years, and revisions to the plan will be made as appropriate, in cooperation with basin stakeholders.

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Appendices

Appendix A.1: Summary of Monitoring Results for Fecal Coliform in Saint Joes Creek, Main Channel, WBID 1668A

Station	Sample Date	Flow (cfs)	Flow Rank	Flow Rank (%)	Fecal Coliform (CFU/100mL)	Fecal Coliform Load (CFU/day)	Remark Code
21FLTPA 27485048241453	3/29/2004	3.61	59.6%	59.6	30	2.65×10^{9}	B
21FLTPA 27485898241143	3/29/2004	3.61	59.6%	59.6	50	4.41×10^{9}	B
21FLTPA 27483438243412	3/29/2004	3.61	59.6%	59.6	180	1.59×10^{10}	
21FLTPA 27484788240469	3/29/2004	3.61	59.6%	59.6	210	1.85×10^{10}	
21FLTPA 27483668242429	3/29/2004	3.61	59.6%	59.6	310	2.74×10^{10}	
21FLTPA 27484788240469	6/14/2004	46.09	3.7%	3.7	40	4.51×10^{10}	B
21FLTPA 27485048241453	6/14/2004	46.09	3.7%	3.7	45	5.07×10^{10}	B
21FLTPA 27483438243412	6/14/2004	46.09	3.7%	3.7	85	9.58×10^{10}	B
21FLTPA 27483668242429	6/14/2004	46.09	3.7%	3.7	115	1.30×10^{11}	
21FLTPA 27485048241453	9/20/2004	6.01	38.9%	38.9	1	1.47×10^{8}	K
21FLTPA 27485898241143	9/20/2004	6.01	38.9%	38.9	20	2.94×10^{9}	B
21FLTPA 27484788240469	9/20/2004	6.01	38.9%	38.9	40	5.88×10^{9}	B
21FLTPA 27483438243412	9/20/2004	6.01	38.9%	38.9	40	5.88×10^{9}	B
21FLTPA 27483668242429	9/20/2004	6.01	38.9%	38.9	55	8.09×10^{9}	B
21FLTPA 27484788240469	9/22/2004	6.81	34.4%	34.4	114	1.90×10^{10}	
21FLTPA 27483668242429	11/15/2004	4.61	48.2%	48.2	300	3.38×10^{10}	
21FLTPA 27485048241453	11/15/2004	4.61	48.2%	48.2	336	3.79×10^{10}	
21FLTPA 27484788240469	11/15/2004	4.61	48.2%	48.2	**416**	4.69×10^{10}	
21FLTPA 27485898241143	11/15/2004	4.61	48.2%	48.2	**944**	1.06×10^{11}	

Station	Sample Date	Flow (cfs)	Flow Rank	Flow Rank (%)	Fecal Coliform (CFU/100mL)	Fecal Coliform Load (CFU/day)	Remark Code
21FLTPA 27485048241453	12/13/2004	2.20	85.4%	85.4	15	8.09×10^{8}	B
21FLTPA 27483438243412	12/13/2004	2.20	85.4%	85.4	40	2.16×10^{9}	B
21FLTPA 27483668242429	12/13/2004	2.20	85.4%	85.4	50	2.70×10^{9}	B
21FLTPA 27485898241143	12/13/2004	2.20	85.4%	85.4	80	4.31×10^{9}	B
21FLTPA 27484788240469	12/13/2004	2.20	85.4%	85.4	25	1.35×10^{9}	B
21FLTPA 27483438243412	1/18/2005	0.96	95.8%	95.8	25	5.88×10^{8}	B
21FLPDEM35-11	1/19/2005	1.32	94.4%	94.4	20	6.47×10^{8}	
21FLPDEM35-10	1/19/2005	1.32	94.4%	94.4	100	3.24×10^{9}	
21FLPDEM35-10	3/3/2005	0.20	99.7%	99.7	120	5.88×10^{8}	B
21FLPDEM35-11	4/14/2005	3.01	69.0%	69	80	5.88×10^{9}	B
21FLPDEM35-10	4/14/2005	3.01	69.0%	69	80	5.88×10^{9}	B
21FLPDEM35-10	5/19/2005	1.32	94.4%	94.4	80	2.59×10^{9}	B
21FLPDEM35-11	5/19/2005	1.32	94.4%	94.4	180	5.82×10^{9}	B
21FLPDEM35-11	7/5/2005	4.21	52.2%	52.2	**650**	6.69×10^{10}	
21FLPDEM35-10	7/5/2005	4.21	52.2%	52.2	**1,400**	1.44×10^{11}	B
21FLPDEM35-11	8/15/2005	14.63	17.2%	17.2	**3,500**	1.25×10^{12}	B
21FLPDEM35-10	8/15/2005	14.63	17.2%	17.2	**3,500**	1.25×10^{12}	B
21FLPDEM35-10	9/19/2005	2.61	77.9%	77.9	**500**	3.19×10^{10}	
21FLPDEM35-11	9/19/2005	2.61	77.9%	77.9	**640**	4.08×10^{10}	
21FLPDEM35-11	10/31/2005	2.20	85.4%	85.4	**460**	2.48×10^{10}	
21FLPDEM35-10	10/31/2005	2.20	85.4%	85.4	**920**	4.96×10^{10}	
21FLPDEM35-11	11/16/2005	1.30	94.5%	94.5	28	8.92×10^{8}	B
21FLPDEM35-10	11/16/2005	1.30	94.5%	94.5	57	1.82×10^{9}	B
21FLPDEM35-10	1/19/2006	2.20	85.4%	85.4	43	2.32×10^{9}	B
21FLPDEM35-11	1/19/2006	2.20	85.4%	85.4	120	6.47×10^{9}	
21FLPDEM35-11	3/2/2006	6.01	38.9%	38.9	26	3.82×10^{9}	B
21FLPDEM35-10	3/2/2006	6.01	38.9%	38.9	97	1.43×10^{10}	
21FLPDEM35-11	4/10/2006	13.43	18.9%	18.9	**420**	1.38×10^{11}	
21FLPDEM35-10	4/10/2006	13.43	18.9%	18.9	**1,300**	4.27×10^{11}	B
21FLPDEM35-10	5/10/2006	15.23	16.1%	16.1	**1,000**	3.73×10^{11}	
21FLPDEM35-11	5/10/2006	15.23	16.1%	16.1	**1,400**	5.22×10^{11}	J

Note: Flow and concentration data analyzed for the TMDL were from March 2004 through May 2006. The Group 5 verification period is from January 1, 1999, through June 30, 2006. Flow data were from USGS Gage 02308935, located in WBID 1668A on Saint Joes Creek.
Bold fecal coliform numbers indicate measurements that exceeded the 400 criteria.cfs – cubic feet per second

Remark Codes: B- Results based on colony counts outside the acceptable range
J – Estimated value
K – Actual value is known to be less than the value given

Appendix A.2: Summary of Monitoring Results for Fecal Coliform in Miles Creek, WBID 1668A

Station	Sample Date	Estimated Flow (cfs)	Flow Rank	Flow Rank (%)	Fecal Coliform (counts/100mL)	Fecal Coliform Load (counts/day)	Remark Code
21FLPDEM35-12	1/19/2005	1.04	94.4%	94.4	**560**	1.43×10^{10}	
21FLPDEM35-12	3/3/2005	0.16	99.7%	99.7	**2,100**	8.10×10^{9}	
21FLPDEM35-12	4/14/2005	2.36	69.0%	69.0	**620**	3.59×10^{10}	
21FLPDEM35-12	5/19/2005	1.04	94.4%	94.4	**440**	1.12×10^{10}	
21FLPDEM35-12	7/5/2005	3.31	52.2%	52.2	**860**	6.97×10^{10}	
21FLPDEM35-12	8/15/2005	11.51	17.2%	17.2	**5,300**	1.49×10^{12}	B
21FLPDEM35-12	9/19/2005	2.05	77.9%	77.9	**400**	2.01×10^{10}	
21FLPDEM35-12	10/31/2005	1.73	85.4%	85.4	**660**	2.80×10^{10}	
21FLPDEM35-12	11/16/2005	1.02	94.5%	94.5	86	2.16×10^{9}	
21FLPDEM35-12	1/19/2006	1.73	85.4%	85.4	330	1.40×10^{10}	
21FLPDEM35-12	3/2/2006	4.73	38.9%	38.9	**690**	7.98×10^{10}	B
21FLPDEM35-12	5/10/2006	11.98	16.1%	16.1	**7,300**	2.14×10^{12}	B

Note: Flow and concentration data analyzed for the TMDL were from January 2005 through May 2006. The Group 5 verification period is from January 1, 1999, through June 30, 2006. Flow data was estimated using data from USGS Gage 02308935, located in WBID 1668A, on Saint Joes Creek.
Bold fecal coliform numbers indicate measurements that exceeded the 400 criteria.

Remark Codes: B- Results based on colony counts outside the acceptable range
J – Estimated value
K – Actual value is known to be less than the value given

Appendix B: 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.

The rule 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 the implementation of 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 FDOT throughout the 15 counties meeting the population criteria. FDEP received authorization to implement the NPDES stormwater program in 2000.

An important difference between the NPDES and other state stormwater permitting programs is that the NPDES Program covers both new and existing discharges, while the other state programs focus on new discharges. 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.

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
(850) 245-8555
http://www.dep.state.fl.us/water/