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 the Ortega River (WBID 2213P)

Kyeongsik Rhew

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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 Ortega River in the Lower St. Johns Basin. The river was verified as impaired for fecal coliform and therefore was included on the Verified List of impaired waters for the Lower St. Johns Basin that was adopted by Secretarial Order on May 27, 2004. The TMDL establishes the allowable fecal coliform loadings to the Ortega River that would restore the waterbody so that it meets its applicable water quality criterion for fecal coliform.

1.2 Identification of Waterbody

The Ortega River, located in Duval County in northeast Florida, drains an area of approximately 88.6 square miles (mi^2). It is divided into two parts: a Cedar River portion and an Ortega River portion. The Cedar River portion flows approximately 2.5 miles from northwest to southeast before converging with the north-flowing Ortega River. The two rivers travel eastward another 1.5 miles and drain into the St. Johns River (**Figure 1.1**). The Ortega River watershed is located within the Jacksonville city limits, in the southern portion of Duval County, and on the west side of the St. Johns River. The watershed is highly urbanized. Additional information about the river's hydrology and geology are available in the Basin Status Report for the Lower St. Johns (Florida Department of Environmental Protection [Department], 2002).

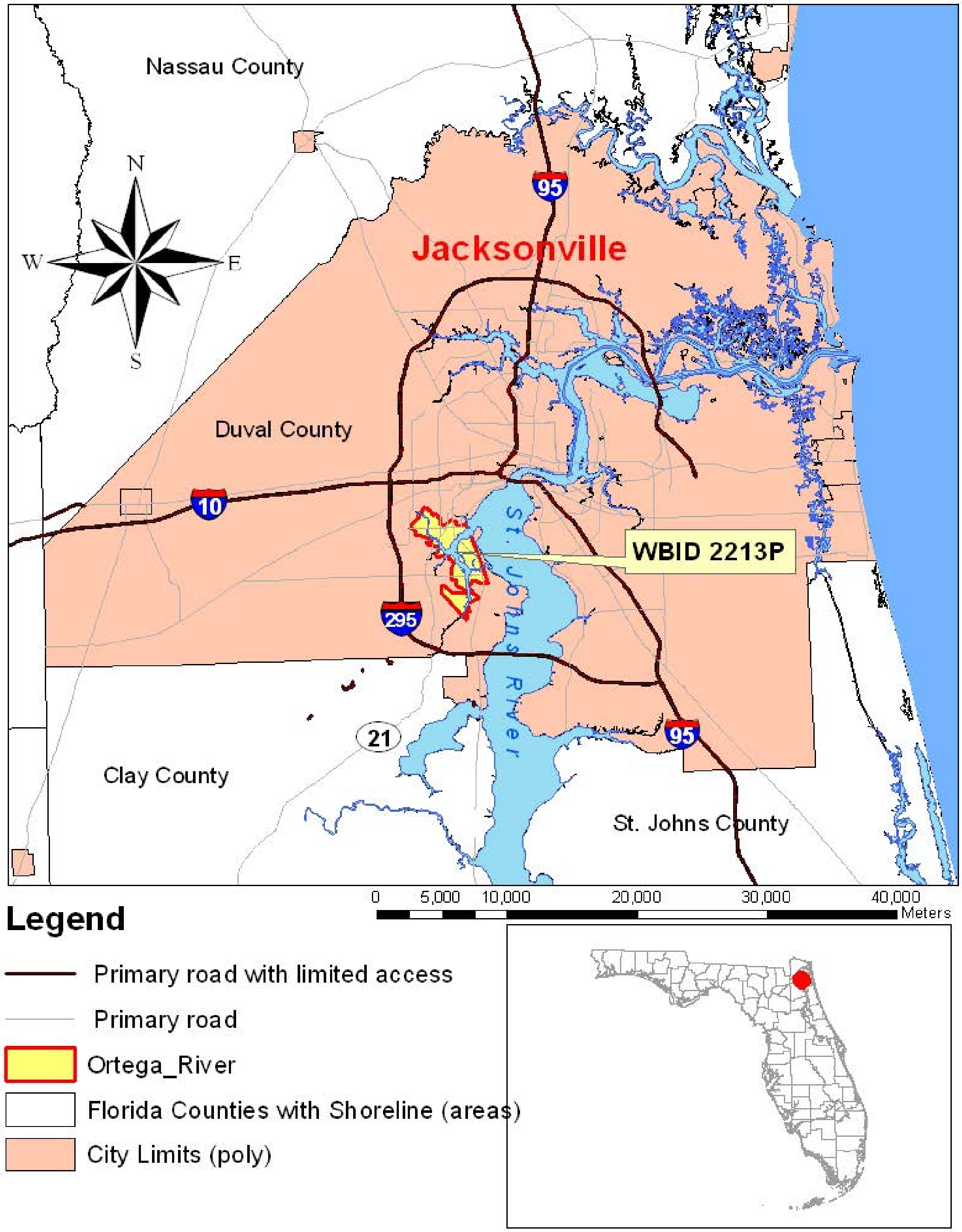
For assessment purposes, the Department has divided the Lower St. Johns Basin into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed or stream reach. This TMDL addresses the Ortega River, WBID 2213P, for fecal coliform.

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.

Figure 1.1. Location of the Ortega River (WBID 2213P) in Duval County and Major Hydrologic Features in the Area



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 the Ortega River. 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 the Ortega River and has verified that this waterbody segment is impaired for fecal coliform bacteria. The verification of impairment was based on the observation that 15 out of 45 fecal coliform samples collected during the cycle 1 verified period (January 1, 1996, through June 30, 2003) exceeded the applicable fecal coliform water quality criterion (Rule 62-302, F.A.C.). The waterbody is still impaired for fecal coliform bacteria based on the observation that 26 out of 95 samples collected during the cycle 2 verified period (January 1, 2001, through June 30, 2008) exceeded the applicable fecal coliform water quality criterion.

Tables 2.1 and **2.2** summarize the fecal coliform monitoring results for the cycle 1 and 2 verified periods for the Ortega River respectively. **Tables 2.3** through **2.5** also provide summary results for fecal coliform data for the verified period by month, season, and year, respectively.

Table 2.1. Summary of Fecal Coliform Monitoring Data for the Ortega River (WBID 2213P) During the Cycle 1 Verified Period (January 1, 1996, through June 30, 2003)

- = Empty cell
[1] Most probable number per 100 milliliters

Waterbody (WBID)	Parameter	Fecal Coliform
Ortega River (2213P)	Total number of samples	45
Ortega River (2213P)	IWR-required number of exceedances for the Verified List	8
Ortega River (2213P)	Number of observed exceedances	15
Ortega River (2213P)	Number of observed nonexceedances	30
Ortega River (2213P)	Number of seasons during which samples were collected	4
Ortega River (2213P)	Highest observation (MPN/100mL)[1]	160,000
Ortega River (2213P)	Lowest observation (MPN/100mL)[1]	10
Ortega River (2213P)	Median observation (MPN/100mL)[1]	200
Ortega River (2213P)	Mean observation (MPN/100mL)[1]	4,506
-	**FINAL ASSESSMENT:**	**Impaired**

Table 2.2. Summary of Fecal Coliform Monitoring Data for the Ortega River (WBID 2213P) During the Cycle 2 Verified Period (January 1, 2001, through June 30, 2008)

- = Empty cell
[1] Most probable number per 100 milliliters

Waterbody (WBID)	Parameter	Fecal Coliform
Ortega River (2213P)	Total number of samples	95
Ortega River (2213P)	IWR-required number of exceedances for the Verified List	14
Ortega River (2213P)	Number of observed exceedances	26
Ortega River (2213P)	Number of observed nonexceedances	69
Ortega River (2213P)	Number of seasons during which samples were collected	4
Ortega River (2213P)	Highest observation (MPN/100mL)[1]	16,000
Ortega River (2213P)	Lowest observation (MPN/100mL)[1]	10
Ortega River (2213P)	Median observation (MPN/100mL)[1]	140
Ortega River (2213P)	Mean observation (MPN/100mL)[1]	638
-	**FINAL ASSESSMENT:**	**Impaired**

Table 2.3. Summary of Fecal Coliform Data by Month for the Verified Period (January 1, 1996, through June 30, 2008)

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

Month	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
January	7	66	9,000	116	1,424	1	14%
February	9	120	1,700	330	550	4	44%
March	12	10	1,700	66	200	1	8%
April	15	14	1,700	200	351	2	13%
May	9	10	16,000	56	1,830	1	11%
June	10	20	2,200	182	531	3	30%
July	7	14	160,000	124	23,102	2	29%
August	12	27	3,400	150	1,041	5	42%
September	12	20	3,100	340	697	5	42%
October	10	58	16,000	350	2,026	4	40%
November	9	42	900	200	272	2	22%
December	11	40	1,510	400	490	5	45%

Table 2.4. Summary of Fecal Coliform Data by Season for the Verified Period (January 1, 1996, through June 30, 2008)

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

Season	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
Winter	28	10	9,000	118	618	6	21%
Spring	34	10	16,000	126	796	6	18%
Summer	31	14	160,000	188	5,889	12	39%
Fall	30	40	16,000	285	937	11	37%

Table 2.5. Summary of Fecal Coliform Data by Year for the Verified Period (January 1, 1996, through June 30, 2008)

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

Year	Number of Samples	Minimum[1]	Maximum[1]	Median[1]	Mean[1]	Number of Exceedances[2]	% Exceedances
1996	5	230	800	270	366	1	20%
1997	6	88	1,700	170	465	2	33%
1998	8	14	160,000	135	22,074	2	25%
1999	4	60	9,000	890	2,710	2	50%
2000	5	40	1,000	300	472	2	40%
2001	11	10	1,800	100	432	3	27%
2002	4	44	833	382	410	2	50%
2003	4	270	1,700	620	803	2	50%
2004	19	20	3,400	420	953	10	53%
2005	19	32	1,700	112	229	2	11%
2006	4	40	16,000	135	4,078	1	25%
2007	33	10	3,000	120	370	6	18%
2008	1	67	67	67	67	0	0%

Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criterion Applicable to the TMDL

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

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

The Ortega River is a Class III waterbody, with a designated use of recreation, propagation, and the maintenance of a healthy, well-balanced population of fish and wildlife. The criterion applicable to this TMDL 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 TMDL 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 TMDL 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, including those from local government master drainage systems, construction sites over five acres, and a wide variety of industries (see **Appendix A** for background information on the federal and state stormwater programs).

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

4.2 Potential Sources of Fecal Coliform in the Ortega River Watershed

4.2.1 Point Sources

Wastewater Point Sources

Two NPDES-permitted wastewater facilities were identified in the Ortega River watershed: Advanced Auto AC & Heating (FLG912023) and Southwest District Wastewater Treatment Facility (FL0026468). Advanced Auto AC & Heating is located in the northern part of the watershed, but this facility’s discharge does not contribute fecal coliform bacteria to surface waters. The Southwest District Wastewater Treatment Facility, which is located in the southern part of the watershed, currently has a 10 million-gallon-per-day (mgd) annual average daily flow (AADF) permitted discharge that does not go to the Ortega River, but flows directly to the St. Johns River. Therefore, there are no NPDES-permitted wastewater facilities discharging fecal coliform to the Ortega River.

Municipal Separate Storm Sewer System Permittees

The city of Jacksonville and Florida Department of Transportation (FDOT) District 2 are co-permittees for a Phase I NPDES municipal separate storm sewer system (MS4) permit (FLS000012) that covers the Ortega River watershed. FDOT and the cities of Jacksonville, Neptune Beach, and Atlantic Beach share responsibility for the permit.

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 (scale 1:30,000) 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 **Table 4.1**. **Figure 4.1** shows the acreage of the principal land uses in the watershed.

As shown in **Table 4.1**, the total area of the Ortega River watershed is about 4,798 acres. The dominant land use category is urban land (urban and built-up; low-, medium-, and high-density residential; and transportation, communication, and utilities), which accounts for about 65.2 percent of the total watershed area. Of the 3,128 acres of urban lands, residential land use occupies about 2,364 acres, or about 49.3 percent of the total watershed area. Natural land uses, including water/wetlands, upland forest, and barren land, occupy about 1,641 acres, accounting for about 34.2 percent of the total area.

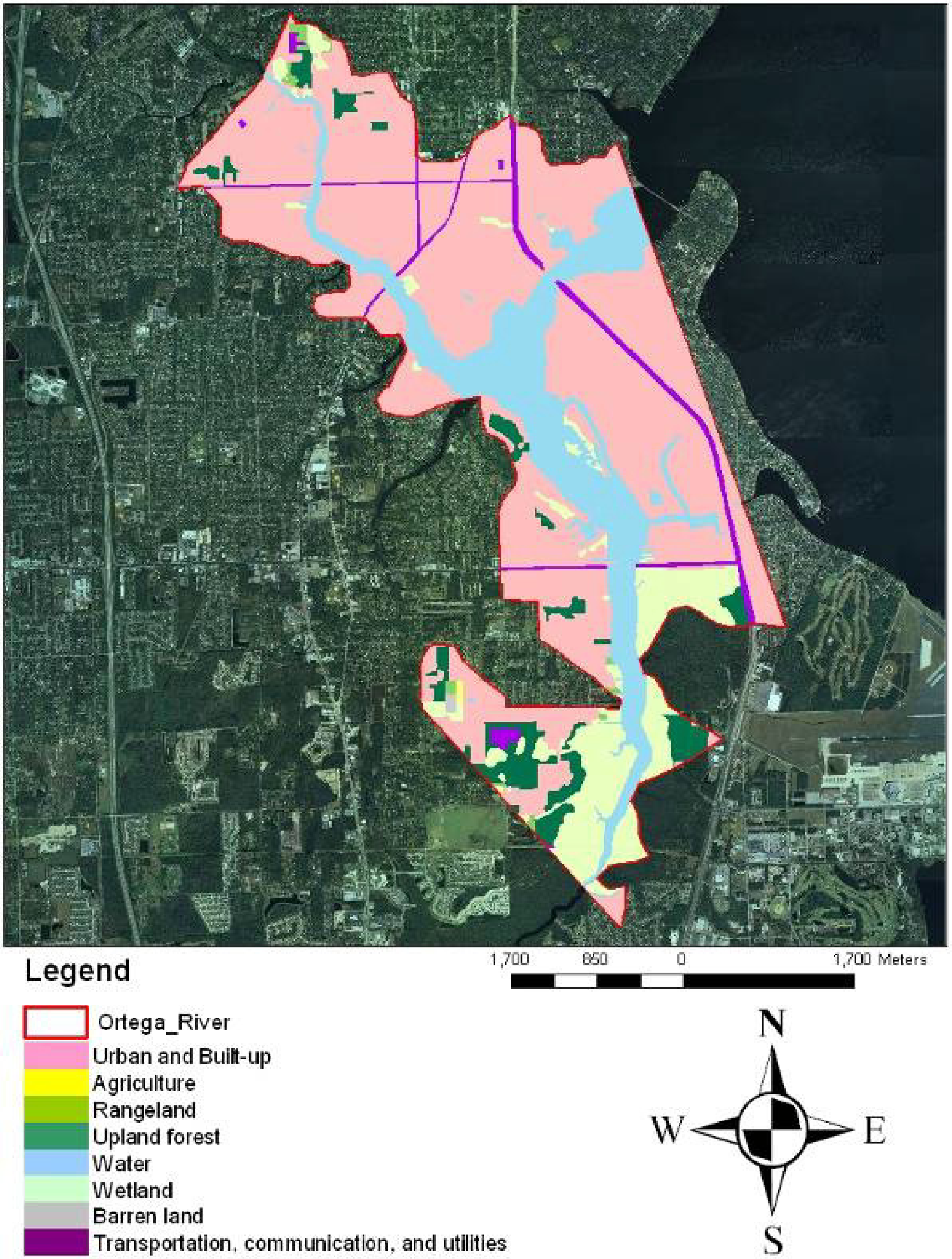
Because no conventional point sources were identified in the Ortega River watershed, the primary loadings of fecal coliform into the river are generated by nonpoint sources or MS4-permitted areas in the watershed. Nonpoint sources of coliform bacteria generally, but not always, come from the coliform 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 surface runoff.

Table 4.1. Classification of Land Use Categories in the Ortega River Watershed (WBID 2213P) in 2004

- = Empty cell

Level 1 Code	Land Use	Acreage	% Acreage
1000	Urban and built-up	617	12.9%
-	Low-density residential	139	2.9%
-	Medium-density residential	1,683	34.1%
-	High-density residential	587	12.2%
2000	Agriculture	4	0.1%
3000	Rangeland	25	0.5%
4000	Upland forest	250	5.2%
5000	Water	887	18.5%
6000	Wetland	499	10.4%
7000	Barren land	5	0.1%
8000	Transportation, communication, and utilities	147	3.1%
-	**TOTAL:**	**4,798**	**100.0%**

Figure 4.1. Principal Land Uses in the Ortega River Watershed (WBID 2213P) in 2004



Pets

Pets (especially dogs) could be a significant source of coliform pollution through surface runoff in the Ortega River watershed. 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 subwatersheds. 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 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 Ortega River watershed 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 Ortega River watershed, calculated based on the Tiger Track 2000 data (Department's GIS library) was 14,629. According to the U.S. Census Bureau, there was an average of 2.51 people per household in Duval County in 2000. This gives about 5,828 households in the entire watershed. Assuming that 40 percent of the households in this area have 1 dog, the total number of dogs in the watershed is about 2,331.

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 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 419,580 grams/day. The total produced by dogs is 9.23×10^{11} counts/day of fecal coliform. 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 4.3. 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 the Ortega River watershed can be made using **Equation 4.1**:

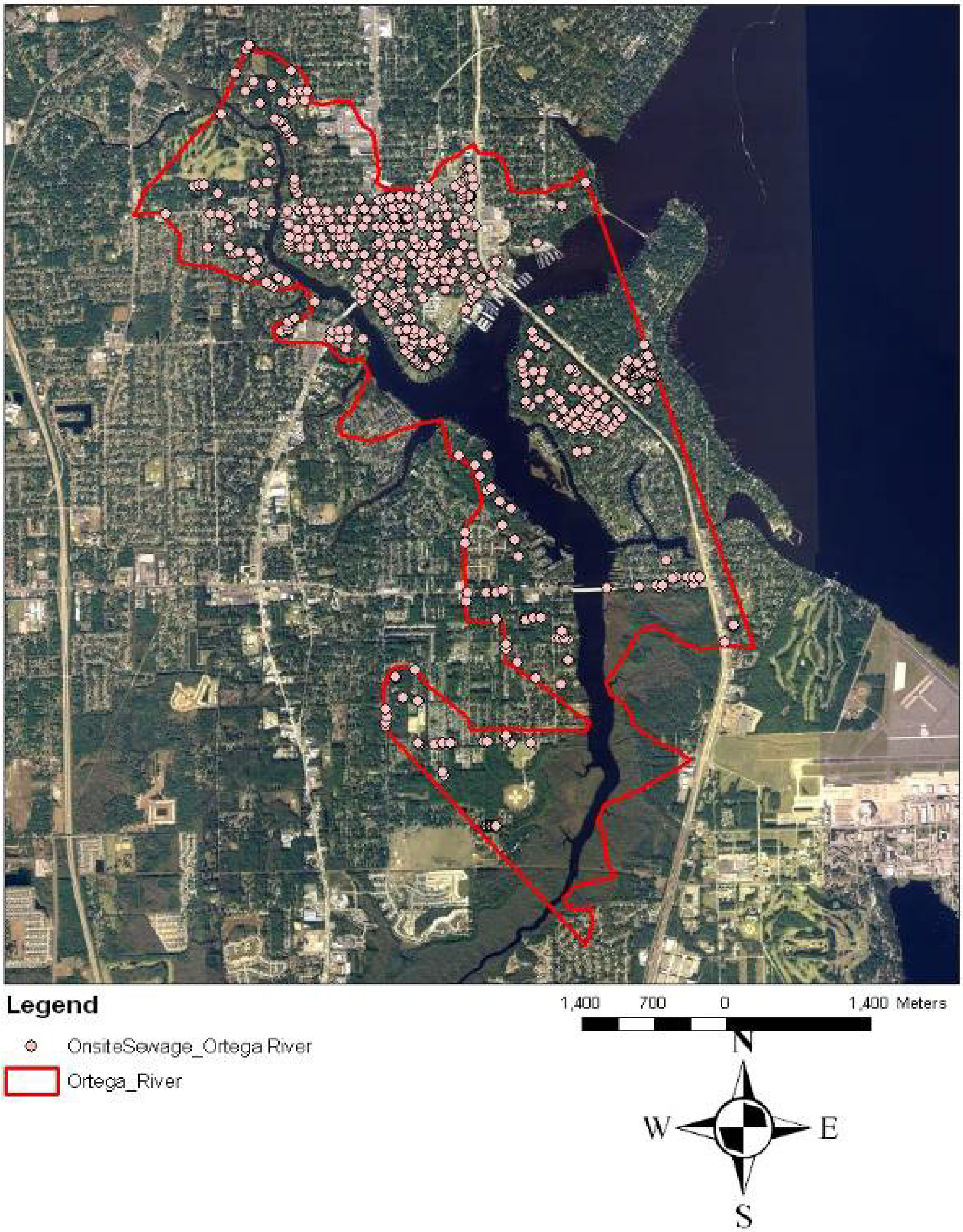
$$L = 37.85 * N * Q * C * F \qquad \text{(Equation 4.1)}$$

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 738 housing units *(N)* were identified as being on septic tanks in the Ortega River watershed (**Figure 4.2**). The discharge rate from each septic tank (*Q*) was calculated by multiplying the

Figure 4.2. Distribution of Onsite Sewage Disposal Systems (Septic Tanks) in the Ortega River Watershed (WBID 2213P)



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 for Duval County is about 2.51 people/household. The same population densities were assumed for the Ortega River watershed. 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 watershed at the time this TMDL was developed. Therefore, the failure rate was derived from the number of septic tank and septic tank repair permits for the county published by FDOH (available: http://www.doh.state.fl.us/environment/OSTDS/statistics/ostdsstatistics.htm). The number of septic tanks in Duval 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 0.34 percent for Duval 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, which is equal to 1.7 percent. Based on **Equation 4.1**, the estimated fecal coliform loading from failed septic tanks in the Ortega River watershed is about 8.3×10^{10} counts/day.

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, the 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 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 Ortega River watershed can be made using **Equation 4.2**.

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

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)* tied to sewer lines is 5,090 (total households minus households using septic tanks) in the Ortega River watershed. The discharge rate through sewers from each household (*Q*) was calculated by multiplying the average household size (2.51) by the per capita wastewater production rate per day (70 gallons). The commonly cited concentration (*C*) for domestic wastewater is $1x10^6$ 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 loading from sewer line leakage in the watershed is about 1.69×10^{11} counts/day.

Wildlife

Wildlife is another possible source of fecal coliform bacteria in the Ortega River watershed. As shown in **Figure 4.1**, there are wetland areas along the Ortega River, and these are likely habitats for small wildlife such as rabbits and raccoons.

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

- = Empty cell
[1] Failure rate is 5 times the failure discovery rate.

-	2002	2003	2004	2005	2006	2007	Average
New installation (septic tanks)	359	459	373	487	598	576	475
Accumulated installation (septic tanks)	88,062	88,421	88,880	89,253	89,740	90,338	89,116
Repair permit (septic tanks)	369	369	324	226	249	269	301
Failure discovery rate (%)	0.42%	0.42%	0.36%	0.25%	0.28%	0.30%	0.34%
Failure rate (%)[1]	2.1%	2.1%	1.8%	1.3%	1.4%	1.5%	1.7%

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

Typically, there are continuous flow measurements in a watershed that can be used to develop a bacteria TMDL. However, as most of the Ortega River where the fecal coliform data were collected is influenced by tides, this fecal coliform TMDL was developed using the "percent reduction" approach. For this method, the percent reduction needed to meet the applicable criterion is calculated for each value above the criterion, and then a median percent reduction is calculated.

5.1.1 Data Used in the Determination of the TMDL

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. This analysis used fecal coliform data collected during the cycle 2 verified period (January 1, 2001, through June 30, 2008). During this period, a total of 95 fecal coliform samples was collected from 8 sampling stations in the Ortega River.

Figure 5.2 shows the fecal coliform concentrations observed in the Ortega River. The concentration of fecal coliform ranged from 10 to 16,000 MPN/100mL and averaged 638 MPN/100mL during the verified period. Seasonally, the highest mean fecal coliform concentration was observed during the second quarter (April, May, and June), and the lowest exceedance rate (16 percent) was also observed during the same quarter (**Figure 5.3**). The lowest mean fecal coliform concentration was observed during the first quarter (January, February, and March), but the exceedance rate was 23 percent.

Spatially, the fecal coliform concentrations and exceedance rates were higher at the upstream stations (21FLJXWQ CR85 on the Cedar River and 21FLWQA301400308142424 on the Ortega River) than at the downstream stations (21FLA 20030077 and 21FLJXWQJAXSJR25), where no fecal coliform concentrations exceeded the state criterion of 400 counts/100mL (**Figure 5.4**). The lower fecal coliform concentration at the downstream location was probably due to mixing from tidal action with the St. Johns River proper, where the fecal coliform concentration is significantly lower. Stations 21FLA 20030876 and 21FLWQA3016537081 44252 were combined into 21FLJXWQCR85 in the graph because those stations are at the same location (**Figure 5.1**).

Figure 5.1. Locations of Water Quality Stations in the Ortega River (WBID 2213P)

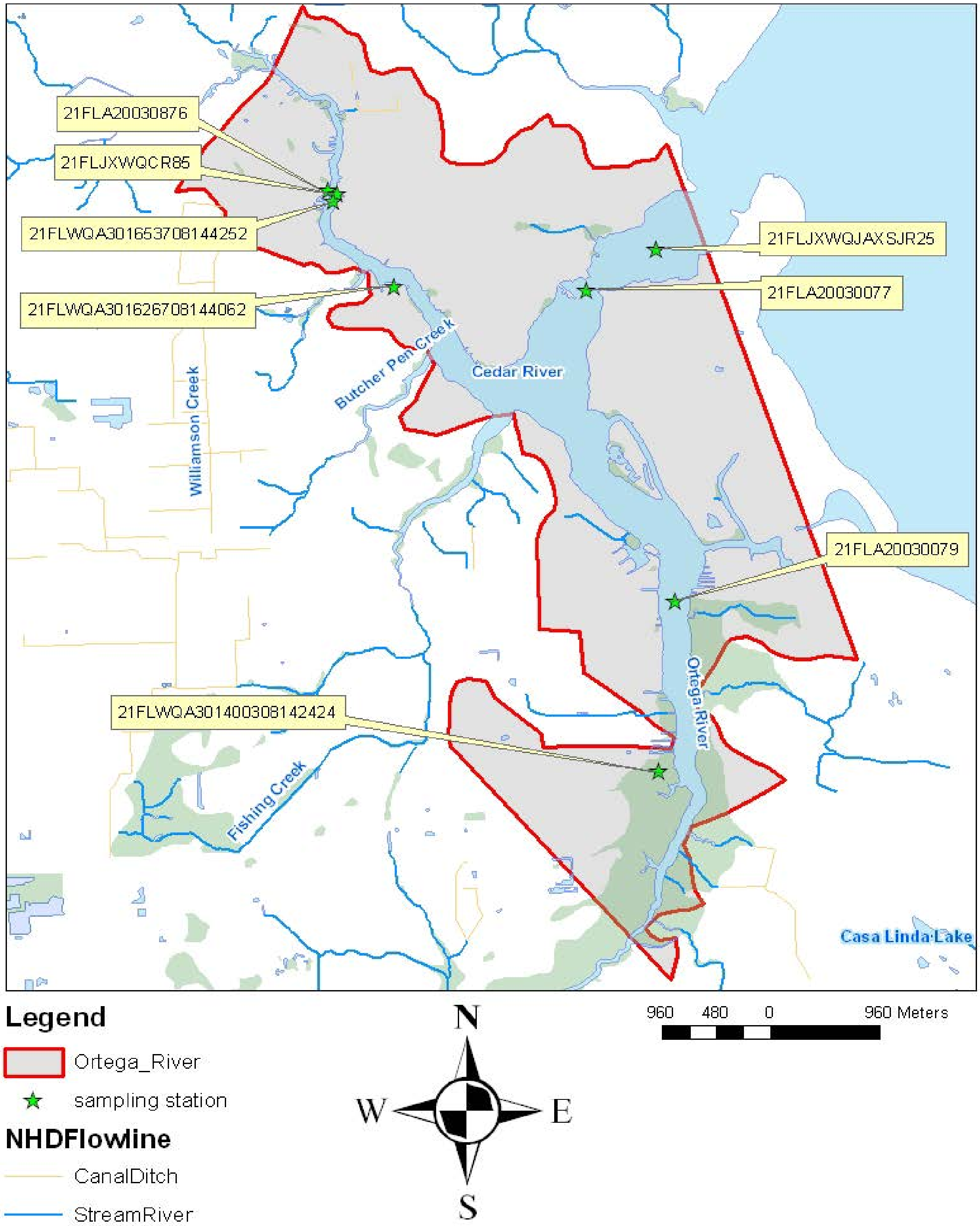


Figure 5.2. Trends of Fecal Coliform Concentrations in the Ortega River (WBID 2213P) during the Cycle 2 Verified Period

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

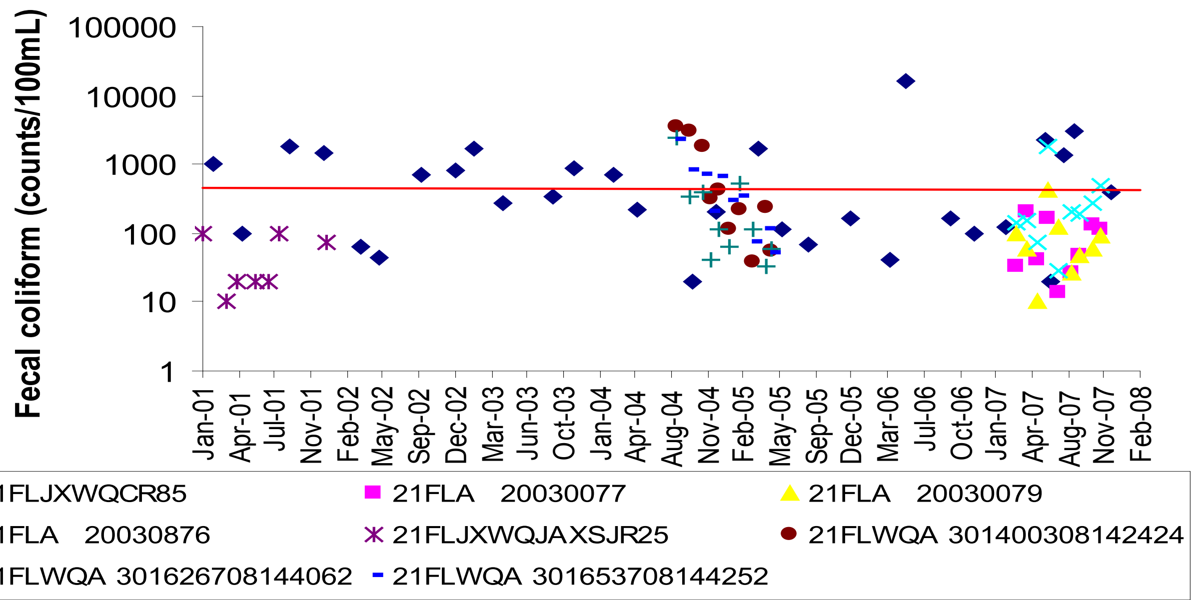


Figure 5.3. Seasonal Trend of Fecal Coliform Concentration Percent Exceedances in the Ortega River (WBID 2213P) during the Cycle 2 Verified Period

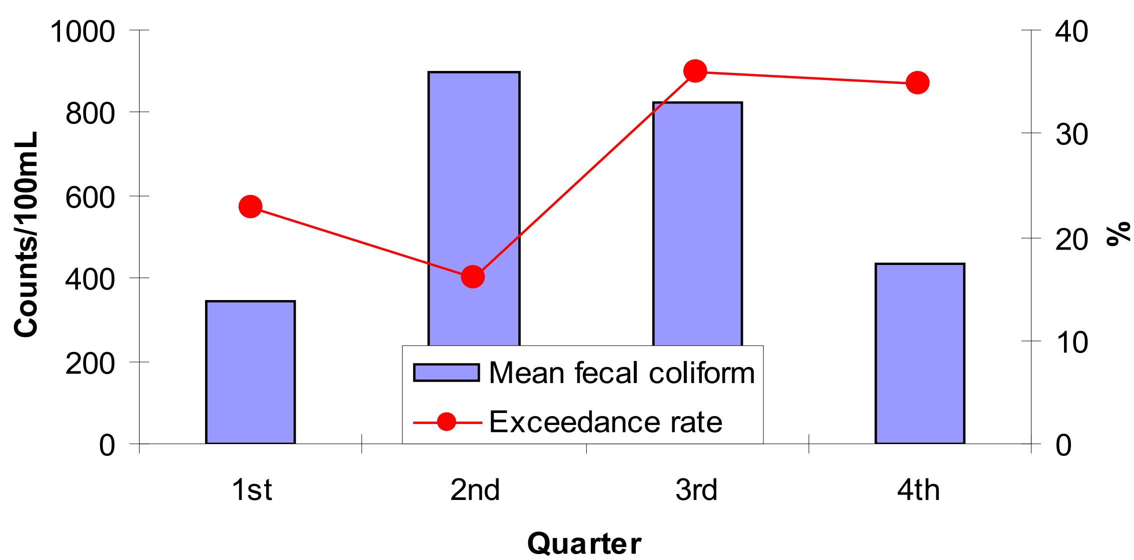
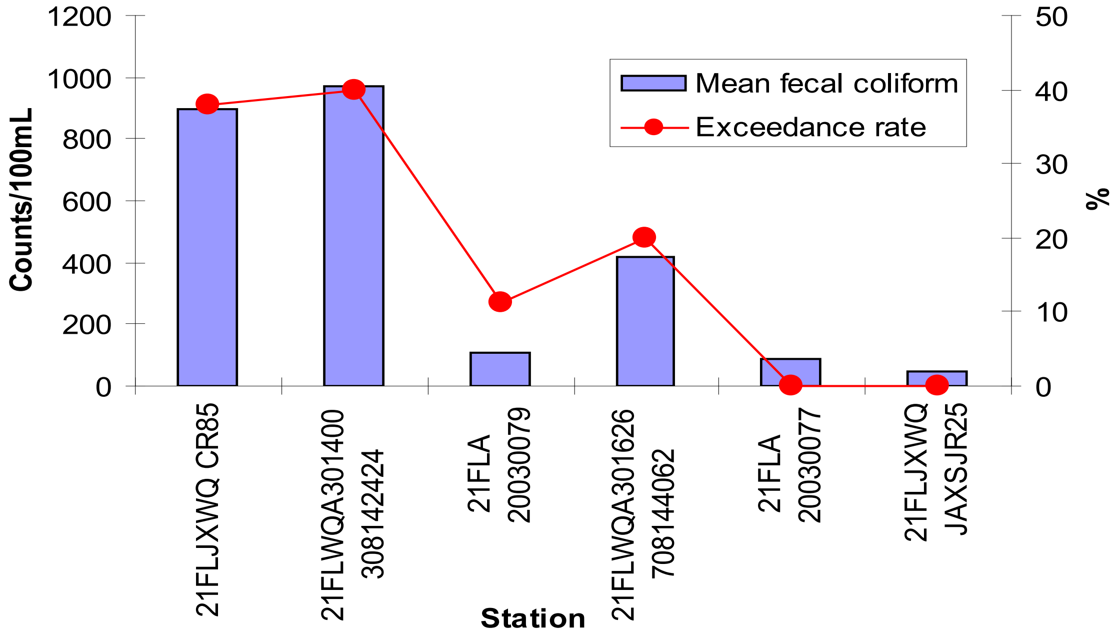


Figure 5.4. Spatial Trend of Fecal Coliform Concentration and Percent Exceedance in the Ortega River (WBID 2213P) during the Cycle 2 Verified Period



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. **Table 5.1** shows the individual reduction calculations for fecal coliform. The median reduction was 72.47 percent.

Table 5.1. Calculation of Fecal Coliform Reductions for the TMDL for the Ortega River (WBID 2213P)

- = 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
2/8/2001	21FLJXWQCR85	1,000	400	60.00%
9/5/2001	21FLJXWQCR85	1,800	400	77.78%
12/11/2001	21FLJXWQCR85	1,510	400	73.51%
9/9/2002	21FLJXWQCR85	700	400	42.86%
12/10/2002	21FLJXWQCR85	833	400	51.98%
2/3/2003	21FLJXWQCR85	1,700	400	76.47%
11/5/2003	21FLJXWQCR85	900	400	55.56%
2/25/2004	21FLJXWQCR85	700	400	42.86%
8/18/2004	21FLWQA 301653708144252	2,200	400	81.82%
8/18/2004	21FLWQA 301626708144062	2,500	400	84.00%
8/18/2004	21FLWQA 301400308142424	3,400	400	88.24%
9/20/2004	21FLWQA 301653708144252	809	400	50.56%
9/20/2004	21FLWQA 301400308142424	3,100	400	87.10%
10/25/2004	21FLWQA 301653708144252	682	400	41.35%
10/25/2004	21FLWQA 301400308142424	1,800	400	77.78%
12/13/2004	21FLWQA 301400308142424	420	400	4.76%
12/13/2004	21FLWQA 301653708144252	636	400	37.11%
2/8/2005	21FLWQA 301626708144062	510	400	21.57%
3/28/2005	21FLJXWQCR85	1,700	400	76.47%
5/10/2006	21FLJXWQCR85	16,000	400	97.50%
6/4/2007	21FLJXWQCR85	2,200	400	81.82%
6/13/2007	21FLA 20030079	430	400	6.98%
6/13/2007	21FLA 20030876	1,800	400	77.78%
7/23/2007	21FLJXWQCR85	1,400	400	71.43%
8/27/2007	21FLJXWQCR85	3,000	400	86.67%
11/5/2007	21FLA 20030876	489	400	18.20%
-	-	-	**Median % Reduction:**	**72.47%**

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, 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 from 1990 to 2008 instead. 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 (**Table 5. 2** and **Figure 5.5**).

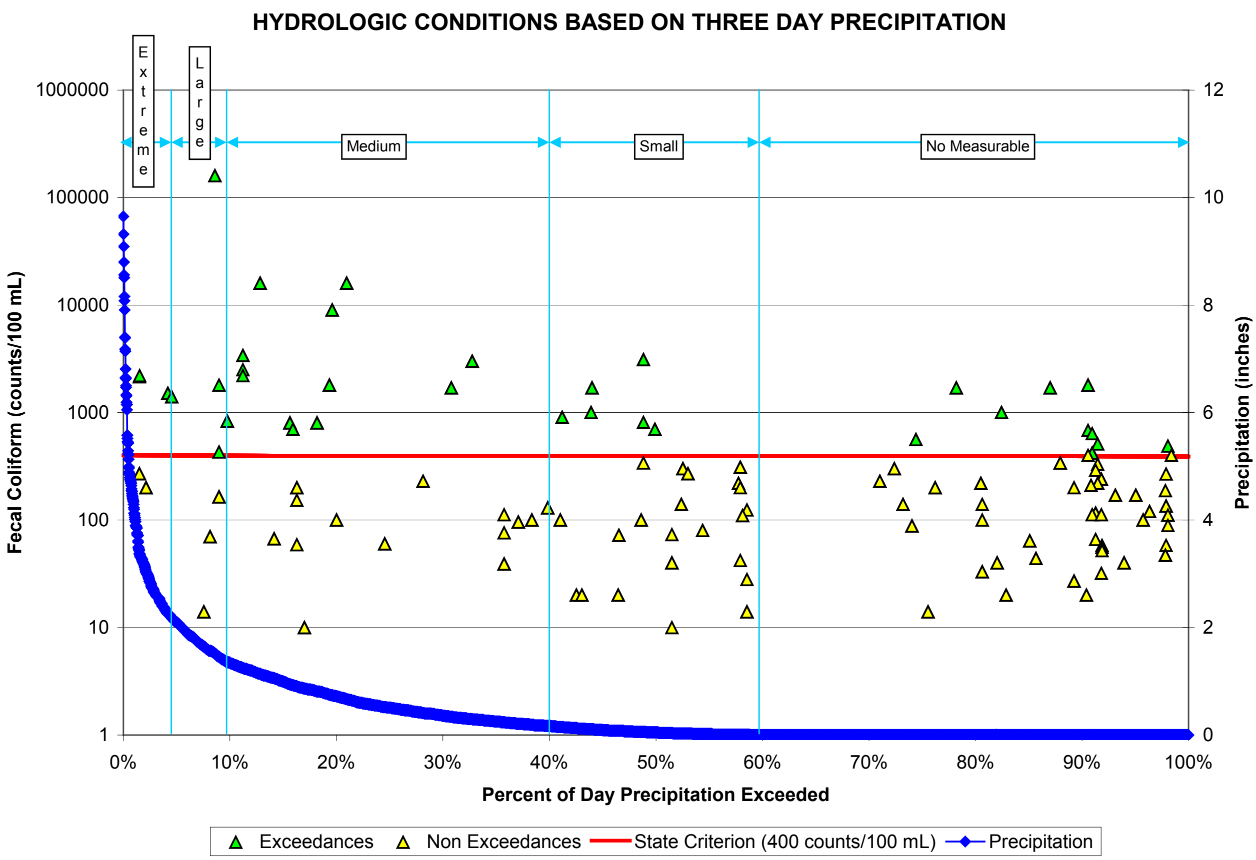
Historical data show that fecal coliform exceedances occurred over all hydrologic conditions. The lowest percentage of exceedances occurred during the period of no measurable precipitation events (15.4 percent). The highest percentage of exceedances (100 percent) occurred after extreme precipitation events, but this period also had the fewest samples (n=5). Exceedance rates increased from conditions when rainfall was not measurable to extreme precipitation conditions, indicating that nonpoint sources are probably a major contributing factor. The exceedance rate for a no measurable precipitation event is not insignificant, reaching 15.4 percent. These exceedances at baseflow can be attributed to ground water contributions from failed septic tanks and/or leaking collection systems. **Table 5.2** and **Figure 5.5** show fecal coliform data by hydrologic condition.

Table 5.2. Summary of Historical Fecal Coliform Data by Hydrologic Condition

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

Precipitation Event	Event Range (inches)	Total Samples	Number of Exceedances[1]	% Exceedance	Number of Nonexceedances[1]	Percent Nonexceedances
Extreme	>2.1"	5	3	60.00%	2	40.00%
Large	1.33" - 2.1"	7	4	57.14%	3	42.86%
Medium	0.18" - 1.33"	25	12	48.00%	13	52.00%
Small	0.01" - 0.18"	21	6	28.57%	15	71.43%
None/Not Measurable	<0.01"	65	10	15.38%	55	84.62%

Figure 5.5. Historical Fecal Coliform Data by Hydrologic Condition Based on Rainfall



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:

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

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

$$\textbf{TMDL} \cong \sum \textbf{WLAs}_{\textbf{wastewater}} + \sum \textbf{WLAs}_{\textbf{NPDES Stormwater}} + \sum \textbf{LAs} + \textbf{MOS}$$

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

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

This approach is consistent with federal regulations (40 CFR § 130.2[I]), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or other appropriate measure. The TMDL for the Ortega River is expressed in terms of MPN/day and percent reduction, and represents the maximum daily fecal coliform load the stream can assimilate without exceeding the fecal coliform criterion (**Table 6.1**).

Table 6.1. TMDL Components for Fecal Coliform in the Ortega River Watershed (WBID 2213P)

NA = Not applicable

Parameter	TMDL (counts/100mL)	Wasteload Allocation for Wastewater (counts/100mL)	Wasteload Allocation for NPDES Stormwater (% reduction)	LA (% reduction)	MOS
Fecal coliform	400	NA	72%	72%	Implicit

6.2 Load Allocation

Based on the percent reduction approach, the load allocation is a 72 percent reduction in fecal coliform from nonpoint sources. 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**).

Several tributaries of the Ortega River have also been assessed under the TMDL Program: the Cedar River (WBID 2262), Wills Branch (WBID 2277), Williamson Creek (WBID 2316), and Butcher Pen Creek (WBID 2322). The calculated reductions were 83, 80, 83, and 83 percent for the Cedar River, Wills Branch, Williamson Creek, and Butcher Pen Creek, respectively (**Figure 6.1**). These waterbodies flow directly into the northern branch of the Ortega River. They could be the sources of fecal coliform in the Ortega River, and restoration projects for these upstream tributaries may fix the fecal coliform problem in the Ortega River. However, it is not clear how much these waterbodies contribute fecal coliform to the Ortega River because of the lack of flow data for the tributaries. As the Department has determined that there are several nonpoint sources contributing fecal coliform to the Ortega River, the watershed itself also has enough potential nonpoint sources of fecal coliform. To be conservative, the Department maintains the fecal coliform reduction of 72 percent for the Ortega River (WBID 2213P).

6.3 Wasteload Allocation

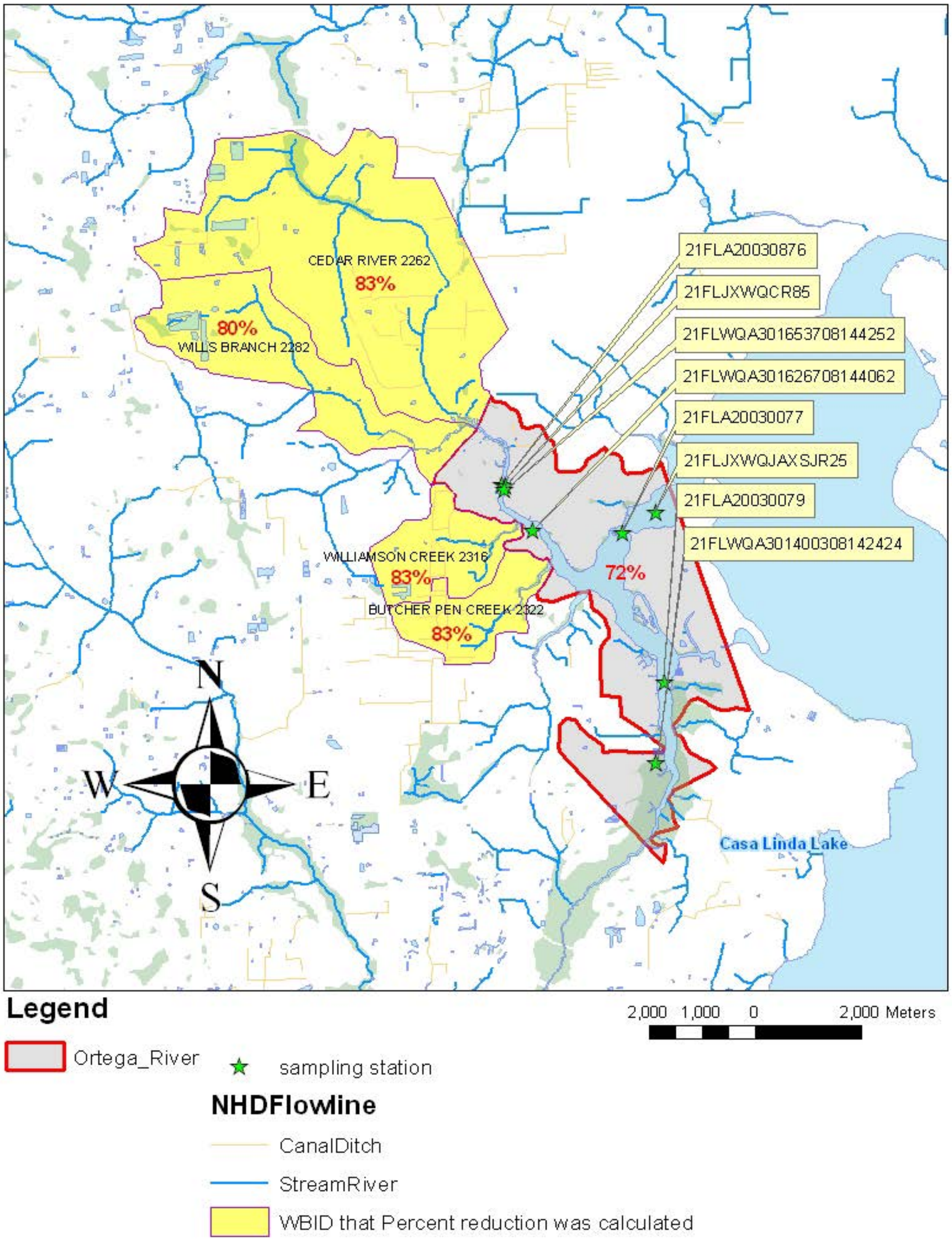
6.3.1 NPDES Wastewater Discharges

No NPDES-permitted wastewater facilities with fecal coliform limits were identified in the Ortega River watershed. The state already requires all NPDES point source dischargers to meet bacteria criteria at the end of the pipe. It is the Department's current practice not to allow mixing zones for bacteria. Any point sources that may discharge in the watershed in the future will be required to meet end-of-pipe standards for coliform bacteria.

6.3.2 NPDES Stormwater Discharges

The WLA for stormwater discharges with an MS4 permit is a 72 percent reduction in current fecal coliform for the Ortega River (WBID 2213P). 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.

Figure 6.1. Tributaries of the Ortega River for which Percent Reductions Were Calculated



6.4 Margin of Safety

Consistent with the recommendations of the Allocation Technical Advisory Committee (Department, 2001), an implicit MOS was used in the development of this TMDL 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 TMDL calculated for fecal coliform was 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 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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