FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Environmental Assessment and Restoration, Bureau of Watershed Management

NORTHEAST DISTRICT • LOWER ST. JOHNS BASIN

Final TMDL Report

Fecal Coliform TMDLs for Trout River, WBIDs 2203A and 2203

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Websites

Florida Department of Environmental Protection, Bureau of Watershed Management

Total Maximum Daily Load (TMDL) Program
http://www.dep.state.fl.us/water/tmdl/index.htm
Identification of Impaired Surface Waters Rule
http://www.dep.state.fl.us/legal/Rules/shared/62-303/62-303.pdf
STORET Program
http://www.dep.state.fl.us/water/storet/index.htm
2008 305(b) Report
http://www.dep.state.fl.us/water/docs/2008_Integrated_Report.pdf
Criteria for Surface Water Quality Classifications
http://www.dep.state.fl.us/water/wqssp/classes.htm
Basin Status Report for the Lower St. Johns Basin
http://www.dep.state.fl.us/water/tmdl/stat_rep.htm
Water Quality Assessment Report for the Lower St. Johns Basin
http://www.dep.state.fl.us/water/tmdl/stat_rep.htm

U.S. Environmental Protection Agency

Region 4: Total Maximum Daily Loads in Florida
http://www.epa.gov/region4/water/tmdl/florida/
National STORET Program
http://www.epa.gov/storet/

Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Load (TMDL) for fecal coliform for the Trout River, located in the North Mainstem Planning Unit of the Lower St. Johns Basin. The river has been verified as impaired for fecal coliform, and was included on the Verified List of impaired waters for the Lower St. Johns Basin that was adopted by Secretarial Order in May 2004. This TMDL establishes the allowable loadings to the Trout River that would restore the waterbody so that it meets its applicable water quality criterion for fecal coliform.

1.2 Identification of Waterbody

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. The Trout River, located in west-central Duval County, in northeast Florida (**Figure 1.1**), consists of three segments: WBIDs 2203A, 2203, and 2223. This TMDL addresses the two lower segments, WBID 2203A and WBID 2203, as shown in **Figure 1.2**.

The most downstream WBID, 2203A, is approximately 7.35 miles long and drains an area of about 12.1 square miles (mi^2). WBID 2203 is approximately 8.8 miles in length, drains an area of about 15.5 mi^2, and adjoins WBID 2203A on its western side. Water flows through WBID 2203 and through WBID 2203A before reaching the St. Johns River.

The two WBIDs occupy a combined area of approximately 27.6 mi^2, situated between the St. Johns River and the Duval/Nassau County line. The downstream WBID (2203A) is predominantly marine and tidally influenced, while WBID 2203 is not. Additional information about the river's hydrology and geology are available in the Basin Status Report for the Lower St. Johns Basin (Florida Department of Environmental Protection [Department], 2004).

The Trout River watershed is part of the Trout River Planning Unit. Planning units are groups of smaller watersheds (WBIDs) that are part of a larger basin unit, in this case the Lower St. Johns Basin. The Trout River Planning Unit consists of 18 WBIDs. **Figure 1.3** shows the Trout River's location in the planning unit and the boundaries of the other WBIDs in the planning unit.

Figure 1.1. Location of the Trout River, WBIDs 2203A and 2203, and Major Geopolitical Features in the Lower St. Johns Basin

Figure 1.2. Overview of the Trout River Watershed, WBIDs 2203A and 2203

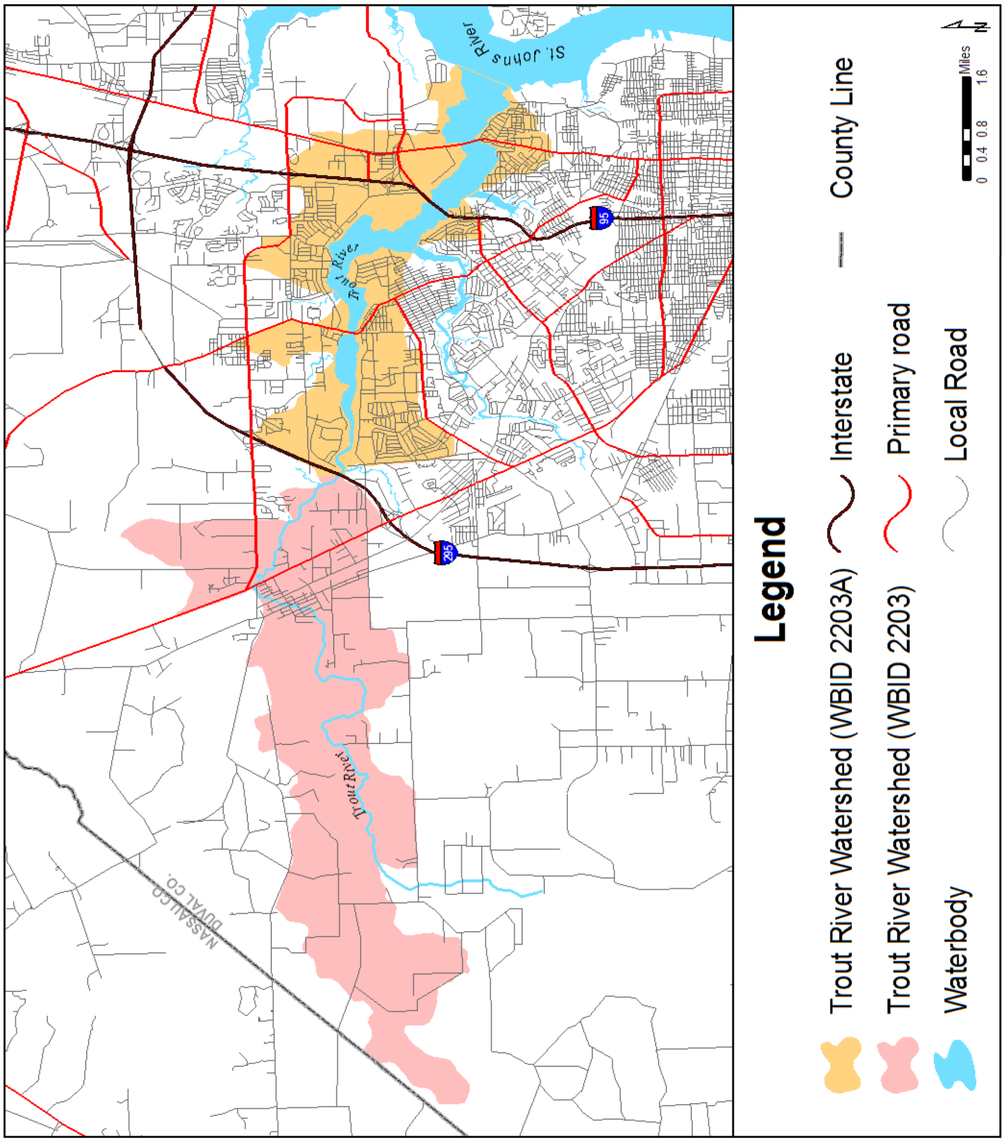


Figure 1.3. WBIDs in the Trout River Planning Unit

1.3 Background

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

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

This TMDL report will be followed by the development and implementation of a Basin Management Action Plan, or BMAP, to reduce the amount of fecal coliform that caused the verified impairment of the Trout River. These activities will depend heavily on the active participation of the St. Johns River Water Management District (SJRWMD), city of Jacksonville, Jacksonville Electric Authority (JEA), local businesses, and other stakeholders. The Department will work with these organizations and individuals to undertake or continue reductions in the discharge of pollutants and achieve the established TMDLs for impaired waterbodies.

Chapter 2: DESCRIPTION OF WATER QUALITY PROBLEM

2.1 Statutory Requirements and Rulemaking History

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

Florida's 1998 303(d) list included 55 waterbodies and 277 parameters 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 rule-making process, the Environmental Regulation Commission adopted the new methodology as Chapter 62-303, Florida Administrative Code (F.A.C.) (Identification of Impaired Surface Waters Rule, or IWR), in April 2001; the rule was amended in 2006 and again in 2007.

2.2 Information on Verified Impairment

The Department used the IWR to assess water quality impairments in the Trout River and has verified both segments of the river as impaired for fecal coliform based on data in the Department's IWR database. **Tables 2.1** through **2.3** provide summary results for fecal coliform data for the verification period (which for Group 2, Cycle 1 waters was January 1, 1996, to June 30, 2003), by month, season, and year, respectively. Additional data collected by the city of Jacksonville that were not included in the IWR database were submitted to the Department and are included in the tables as applicable.

For WBID 2203A, there is a 32.07 percent overall exceedance rate for fecal coliform and a 25.6 percent exceedance rate for the verified period. Data exist for all months except February and November (**Table 2.1**). The highest exceedance rate occurred in January (75.0 percent), followed by December (40.0 percent) and July (33.33 percent). March, May, and September had no exceedances. Seasonally, exceedance rates were highest in the winter and fall (33.33 percent each), followed by summer (22.22 percent; **Table 2.2**). A total of 38 samples was collected in the verified period, ranging from 20 counts per 100 milliliters (counts/mL) to 9,000 counts/100mL; 10 of the 38 observations exceeded the state criterion of 400 counts/100mL.

For WBID 2203, there is a 55.8 percent overall exceedance rate and a 52.9 percent exceedance rate for the verified period. There are data from all months except February. Several months (July, November, and December) had a 100 percent exceedance rate, but July and November only had one observation; March, April, and May had the lowest exceedance rate, all at 33.3 percent. As with WBID 2203A, fall had the highest exceedance rate among seasons (85.7 percent); spring had the lowest (37.5 percent; **Table 2.2**).

When considering the data by year, WBID 2203A had no exceedances in 2002 and 2003 (through June 30) and had a 42.9 percent exceedance rate in 2000. WBID 2203 had 100 percent exceedances in 1996 and 1998, with the fewest occurring in 2003 (33.33 percent). **Table 2.3** shows that the exceedance rates for WBID 2203 decreased between 1996 and 2003.

Table 2.1. Summary of Fecal Coliform Data by Month for the Verified Period (January 1, 1996–June 30, 2003), WBIDs 2203A and 2203

Month	N		Minimum		Maximum		Median		Number of Exceedances		% Exceedances		Mean Precipitation (inches)
	2203A	2203	2203A	2203	2203A	2203	2203A	2203	2203A	2203	2203A	2203	
January	4	3	20	60	3,000	3,000	1,100	1,700	3	2	75.0	66.7	3.26
February	0	0	-	-	-	-	-	-	-	-	-	-	3.52
March	5	3	70	40	190	800	170	110	0	1	0.0	33.3	3.90
April	4	3	40	90	2,400	700	200	300	1	1	25.0	33.3	2.89
May	2	3	176	250	220	2,400	198	256	0	1	0.0	33.3	3.41
June	5	2	20	380	800	800	200	590	1	1	20.0	50.0	6.31
July	3	1	40	160,000	500	160,000	170	160,000	1	1	33.3	100.0	6.5
August	5	3	20	244	1,100	1,700	130	1,300	1	2	20.0	66.7	7.05
September	1	2	100	30	100	1,000	100	515	0	1	0.0	50.0	7.52
October	4	2	70	230	9,000	1,700	235	965	1	1	25.0	50.0	3.82
November	0	1	-	5,000	-	5,000	-	5,000	-	1	-	100.0	2.04
December	5	4	140	800	500	2,200	177	1,267	2	4	40.0	100.0	2.61

Coliform counts are #/100mL.
Exceedances represent values above 400 counts/100mL.
Mean precipitation is for Jacksonville International Airport (JIA) in inches. Means are monthly means based on data from 1955 to 2008.
- = No data available for month shown.

Table 2.2. Summary of Fecal Coliform Data by Season for the Verified Period (January 1, 1996–June 30, 2003), WBIDs 2203A and 2203

Month	N		Minimum		Maximum		Median		Number of Exceedances		% Exceedances		Mean Precipitation (inches)
	2203A	2203	2203A	2203	2203A	2203	2203A	2203	2203A	2203	2203A	2203	
Winter	9	6	20	40	3,000	3,000	180	455	3	3	33.33%	50.00%	10.68
Spring	11	8	20	90	2,400	2,400	200	340	2	3	18.18%	37.50%	12.61
Summer	9	6	20	30	1,100	160,000	130	1,150	2	4	22.22%	66.67%	21.52
Fall	9	7	70	230	9,000	5,000	177	1,267	3	6	33.33%	85.71%	8.47

Winter is January to March; spring is April to June; summer is July to September; fall is October to December.
Coliform counts are #/100mL.
Exceedances represent values above 400 counts/100mL.
Mean precipitation is for JIA in inches. Means are based on the three months that constitute each season from 1955 to 2008.

Table 2.3. Summary of Fecal Coliform Data by Year for the Verified Period (January 1, 1996–June 30, 2003), WBIDs 2203A and 2203

Month	N		Minimum		Maximum		Median		Number of Exceedances		% Exceedances		Mean Precipitation (inches)
	2203A	2203	2203A	2203	2203A	2203	2203A	2203	2203A	2203	2203A	2203	
1996	-	1	-	5,000	-	5,000		5,000	-	1	-	100.00%	57.27
1998	6	3	40	1,700	9,000	160,000	260	2,400	2	3	33.33%	100.00%	56.72
1999	8	4	20	230	2,400	3,000	265	800	3	3	37.50%	75.00%	42.44
2000	7	6	40	30	3,000	1,700	170	525	3	4	42.86%	66.67%	39.77
2001	8	5	20	60	800	2,200	155	800	2	4	25.00%	80.00%	49.14
2002	5	5	56	40	177	1,267	156	256	0	2	0.00%	40.00%	54.72
2003[1]	4	3	70	110	200	700	185	380	0	1	0.00%	33.33%	44.47

Coliform counts are #/100mL.
Exceedances represent values above 400 counts/100mL.
Precipitation is for JIA in inches and represents the total precipitation for the year shown.
[1] 2003 only includes data through June 30, which is the end of the verified period.

Chapter 3: DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criteria Applicable to the TMDL

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

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

WBID 2203A is considered marine and is tidally influenced; WBID 2203 is not tidally influenced and is primarily fresh water. Both segments are Class III waterbodies (marine and fresh), 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.

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 Chapter 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. However, there were insufficient data (fewer than 10 samples in a given month) available to evaluate the geometric mean criterion for fecal coliform bacteria. Therefore, the criterion selected for the TMDLs was not to exceed 400 counts/100mL.

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 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 source" has meant discharges to surface waters that typically have a continuous flow via a discernable, confined, and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) are examples of traditional point sources. In contrast, the term "nonpoint sources" was used to describe intermittent, rainfall-driven, diffuse sources of pollution associated with everyday human activities, including runoff from urban land uses, agriculture, silviculture, and mining; discharges from failing septic systems; and atmospheric deposition.

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

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

4.2 Potential Sources of Coliform in the Trout River Watershed

4.2.1 Point Sources

WBID 2203A

There is one permitted NPDES discharger in the WBID. The Cemex-Main Street Concrete Batch Plant (CBP) (Permit FLG110368) is located close to the mouth of the Trout River near the St. Johns River (**Figure 4.1**). The facility is not required to monitor for fecal coliform in the discharge water and, due to the type of activity, is not expected to contribute to the exceedances in this segment of the Trout River.

WBID 2203

There are currently no facilities with a permit to discharge wastewater in WBID 2203 (**Figure 4.1**).

Figure 4.1. Permitted Discharge Facilities in the Trout River Watershed, WBIDs 2203A and 2203

Municipal Separate Storm Sewer System Permittees

The city of Jacksonville and Florida Department of Transportation (FDOT) District 2 are copermittees for a Phase I NPDES municipal separate storm sewer system (MS4) permit (Permit FLS000012) that includes all areas of the Trout River watershed.

WBID 2203A

Figure 4.2 shows the stormwater infrastructure in WBID 2203A. Outfalls represent points where a stormwater conveyance discharges into a separate stormwater system through a channelized or natural waterway. Inlets are a component of the stormwater system located along the curbed edge of paved surfaces or the low point of an area to provide for the collection of stormwater runoff, access for inspection and maintenance, pipe junctions, sediment traps, or conflicts with other utilities (K. Grable, personal communication, October 16, 2008). In WBID 2203A, there are 235 outfalls and 1,631 inlets.

WBID 2203

Figure 4.3 shows the stormwater infrastructure in WBID 2203. There are 33 outfalls and 212 inlets.

Figure 4.2. Stormwater Infrastructure in the Trout River Watershed, WBID 2203A

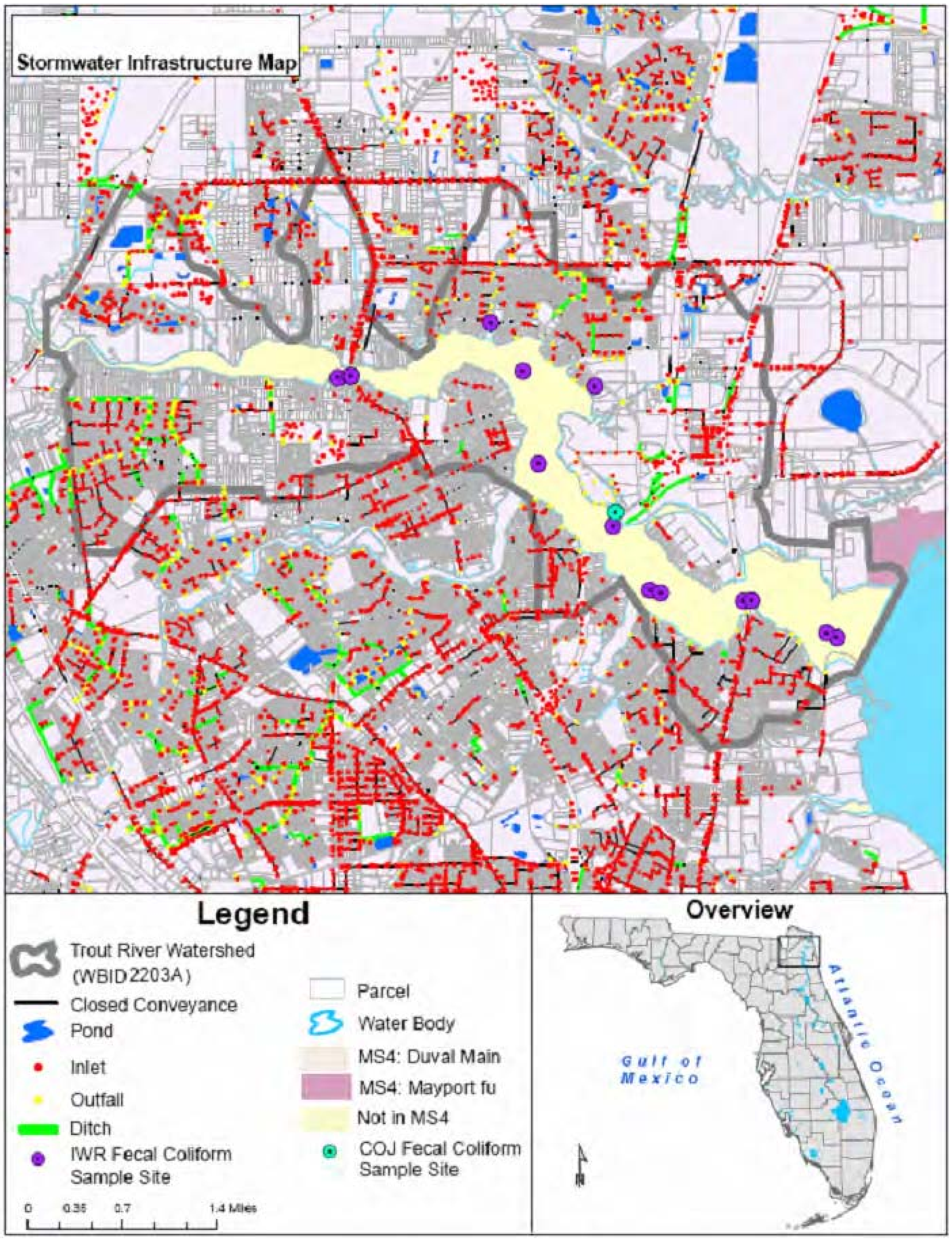
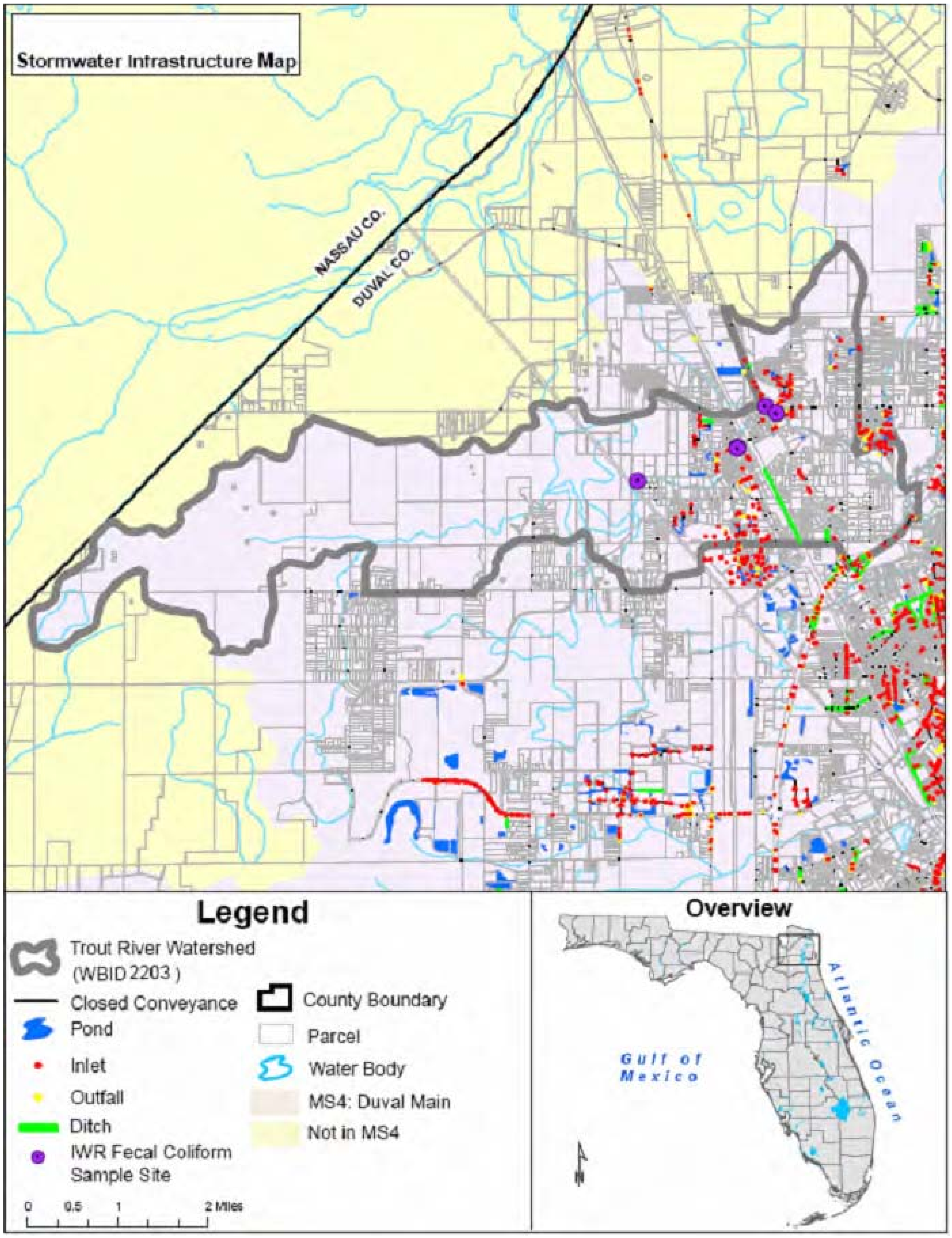


Figure 4.3. Stormwater Infrastructure in the Trout River Watershed, WBID 2203



Other Tributaries to the Trout River

A number of large tributaries discharge to both segments of the Trout River. These tributaries have the potential to significantly impact fecal coliform concentrations in the river. **Figure 4.4** shows the surrounding tributary WBIDs, as well as those for which TMDLs will be developed.

WBID 2203A

Nearly all of the tributaries to WBID 2203A are verified as impaired for fecal coliform and, like the Trout River, will have a TMDL developed for them. The TMDLs and resulting BMAPs will address potential impacts from each of these tributaries and in doing so will reduce fecal coliform loading to the Trout River.

WBID 2203

Most of the tributaries to WBID 2203 have no fecal coliform data in the Department's database, and therefore impacts cannot be considered. For these reasons, this TMDL analysis does not include estimated loadings from these tributaries.

4.2.2 Land Uses and Nonpoint Sources

Additional coliform loadings to the Trout River are generated from nonpoint sources in the watershed. Potential nonpoint sources of coliform include loadings from surface runoff, wildlife, pets, leaking or overflowing sewer lines, and leaking septic tanks.

Land Uses

The spatial distribution and acreage of different land use categories were identified using the 2004 land use coverage contained in the Department's Geographic Information System (GIS) library, initially provided by the SJRWMD. Land use categories and acreages in the watershed were aggregated using the Level 3 codes tabulated in **Table 4.1.**

WBID 2203A

WBID 2203A contains an urbanized area. Water (streams and other waterways) occupy 20.7 percent (1,602.3 acres) of the watershed; high-density residential areas occupy another 11.5 percent; and medium-density residential, 21.9 percent. In all, areas impacted by human activity consist of approximately 4,468.7 acres, or 57.8 percent; and natural areas, 3,261.1 acres, or 42.2 percent. There are no agricultural areas in this part of the Trout River watershed. **Figure 4.5** shows the principal land uses in the WBID based on Level 2 land use codes.

WBID 2203

In contrast, WBID 2203 is less developed than WBID 2203A (**Figure 4.6**). The principal land uses are coniferous pine (21.7 percent), and wetland forested mixed (10.9 percent). Residential areas total only 14.1 percent (1,402.0 acres); there are no high-density residential areas, only medium- and low-density residential and rural (**Table 4.1**), mainly in the eastern part of the watershed. Human-impacted areas are less than half of those in WBID 2203A, at 27.95 percent (2,772.2 acres); and natural areas cover 72.05 percent (7,145.6 acres). The watershed has some agricultural areas. For example, there are 45.4 acres of cattle-feeding operations comprising 0.46 percent of land use, and a 4.4-acre poultry-feeding operation comprising 0.04% of land use, in the eastern part of the watershed.

Figure 4.4. Tributary WBIDs to the Trout River, WBIDs 2203A and 2203

Table 4.1. Level 3 Land Use Categories in the Trout River Watershed, WBIDs 2203A and 2203

Land Use Code	Attribute	WBID 2203		WBID 2203A		Total of Both WBIDs	
		Acres	Total	Acres	% of Total	Acres	Total
1100	Residential, low density–less than 2 dwelling units/acre	1,009.59	10.18%	509.16	6.59%	1,518.75	8.61%
1180	Rural residential	14.77	0.15%	8.59	0.11%	23.35	0.13%
1190	Low density under construction	0.22	0.00%	-	-	0.22	0.00%
1200	Residential, medium density–2-5 dwelling units/acre	247.14	2.49%	1,690.11	21.87%	1,937.26	10.98%
1290	Medium density under construction	130.31	1.31%	9.96	0.13%	140.26	0.79%
1300	Residential, high density–6 or more dwelling units/acre	-	-	891.10	11.53%	891.10	5.05%
1390	High density under construction	-	-	36.27	0.47%	36.27	0.21%
1400	Commercial and services	79.84	0.81%	432.17	5.59%	512.01	2.90%
1490	Commercial and services under construction	-	-	3.93	0.05%	3.93	0.02%
1540	Oil and gas processing	-	-	4.22	0.05%	4.22	0.02%
1550	Other light industrial	1.30	0.01%	22.84	0.30%	24.14	0.14%
1560	Other heavy industrial	-	-	0.00	0.00%	0.00	0.00%
1600	Extractive	2.14	0.02%	14.40	0.19%	16.54	0.09%
1620	Sand and gravel pits (must be active)	-	-	24.24	0.31%	24.24	0.14%
1700	Institutional	31.17	0.31%	268.84	3.48%	300.01	1.70%
1800	Recreational	-	-	3.09	0.04%	3.09	0.02%
1840	Marinas and fish camps	4.09	0.04%	17.46	0.23%	21.54	0.12%
1850	Parks and zoos	1.33	0.01%	45.39	0.59%	46.73	0.26%
1860	Community recreational facilities	5.00	0.05%	50.10	0.65%	55.11	0.31%
1900	Open land	-	-	93.42	1.21%	93.42	0.53%
2110	Improved pastures (monoculture, planted forage crops)	351.57	3.54%	-	-	351.57	1.99%
2120	Unimproved pastures	251.87	2.54%	-	-	251.87	1.43%
2130	Woodland pastures	16.53	0.17%	-	-	16.53	0.09%
2150	Field crops	318.38	3.21%	-	-	318.38	1.80%
2310	Cattle-feeding operations	45.39	0.46%	-	-	45.39	0.26%
2320	Poultry-feeding operations	4.39	0.04%	-	-	4.39	0.02%
2410	Tree nurseries	11.53	0.12%	-	-	11.53	0.07%
2510	Horse farms	6.94	0.07%	-	-	6.94	0.04%
2520	Dairies	80.89	0.82%	-	-	80.89	0.46%
3100	Herbaceous upland nonforested	147.16	1.48%	64.17	0.83%	211.33	1.20%
3200	Shrub and brushland (wax myrtle or saw palmetto, occasionally scrub)	232.45	2.34%	5.24	0.07%	237.70	1.35%
3300	Mixed upland nonforested	55.54	0.56%	22.85	0.30%	78.39	0.44%
4110	Pine flatwoods	349.62	3.53%	386.20	5.00%	735.81	4.17%
4120	Longleaf pine–xeric oak	21.70	0.22%	-	-	21.70	0.12%

Land Use Code	Attribute	WBID 2203		WBID 2203A		Total of Both WBIDs	
		Acres	Total	Acres	% of Total	Acres	Total
4130	Sand pine	32.61	0.33%	-	-	32.61	0.18%
4200	Upland hardwood forests	2.55	0.03%	6.65	0.09%	9.20	0.05%
4340	Upland mixed coniferous/hardwood	283.58	2.86%	232.35	3.01%	515.92	2.92%
4410	Coniferous pine	2,156.13	21.74%	-	-	2,156.13	12.22%
4430	Forest regeneration	778.46	7.85%	5.90	0.08%	784.37	4.44%
5100	Streams and waterways	40.62	0.41%	1,541.51	19.94%	1,582.13	8.97%
5300	Reservoirs–pits, retention ponds, dams	44.30	0.45%	59.82	0.77%	104.11	0.59%
5430	Enclosed saltwater ponds within a salt marsh	-	-	1.02	0.01%	1.02	0.01%
6110	Bay swamp (if distinct)	27.24	0.27%	-	-	27.24	0.15%
6170	Mixed wetland hardwoods	511.05	5.15%	132.53	1.71%	643.58	3.65%
6210	Cypress	11.31	0.11%	9.94	0.13%	21.26	0.12%
6250	Hydric pine flatwoods	135.59	1.37%	16.18	0.21%	151.77	0.86%
6300	Wetland forested mixed	1,081.78	10.91%	282.47	3.65%	1,364.25	7.73%
6410	Freshwater marshes	18.24	0.18%	0.94	0.01%	19.18	0.11%
6420	Saltwater marshes	153.40	1.55%	399.12	5.16%	552.51	3.13%
6430	Wet prairies	405.15	4.09%	4.19	0.05%	409.34	2.32%
6440	Emergent aquatic vegetation	4.26	0.04%	0.49	0.01%	4.75	0.03%
6460	Mixed scrub-shrub wetland	602.88	6.08%	39.59	0.51%	642.47	3.64%
7400	Disturbed land	3.11	0.03%	30.85	0.40%	33.96	0.19%
7410	Rural land in transition without positive indicators of intended activity	40.26	0.41%	19.06	0.25%	59.31	0.34%
7430	Spoil areas	6.57	0.07%	-	-	6.57	0.04%
8140	Roads and highways (divided 4-lanes with medians)	66.73	0.67%	256.04	3.31%	322.77	1.83%
8150	Port facilities	-	-	78.29	1.01%	78.29	0.44%
8320	Electrical power transmission lines	79.36	0.80%	-	-	79.36	0.45%
8330	Water supply plants	-	-	7.72	0.10%	7.72	0.04%
8340	Sewage treatment	5.79	0.06%	-	-	5.79	0.03%
8370	Surface water collection basins	5.96	0.06%	1.35	0.02%	7.31	0.04%
	TOTAL:	**9,917.80**		**7,729.74**		**17,647.54**	

- = Not applicable

Figure 4.5. Principal Level 2 Land Uses in the Trout River Watershed, WBID 2203A, in 2004

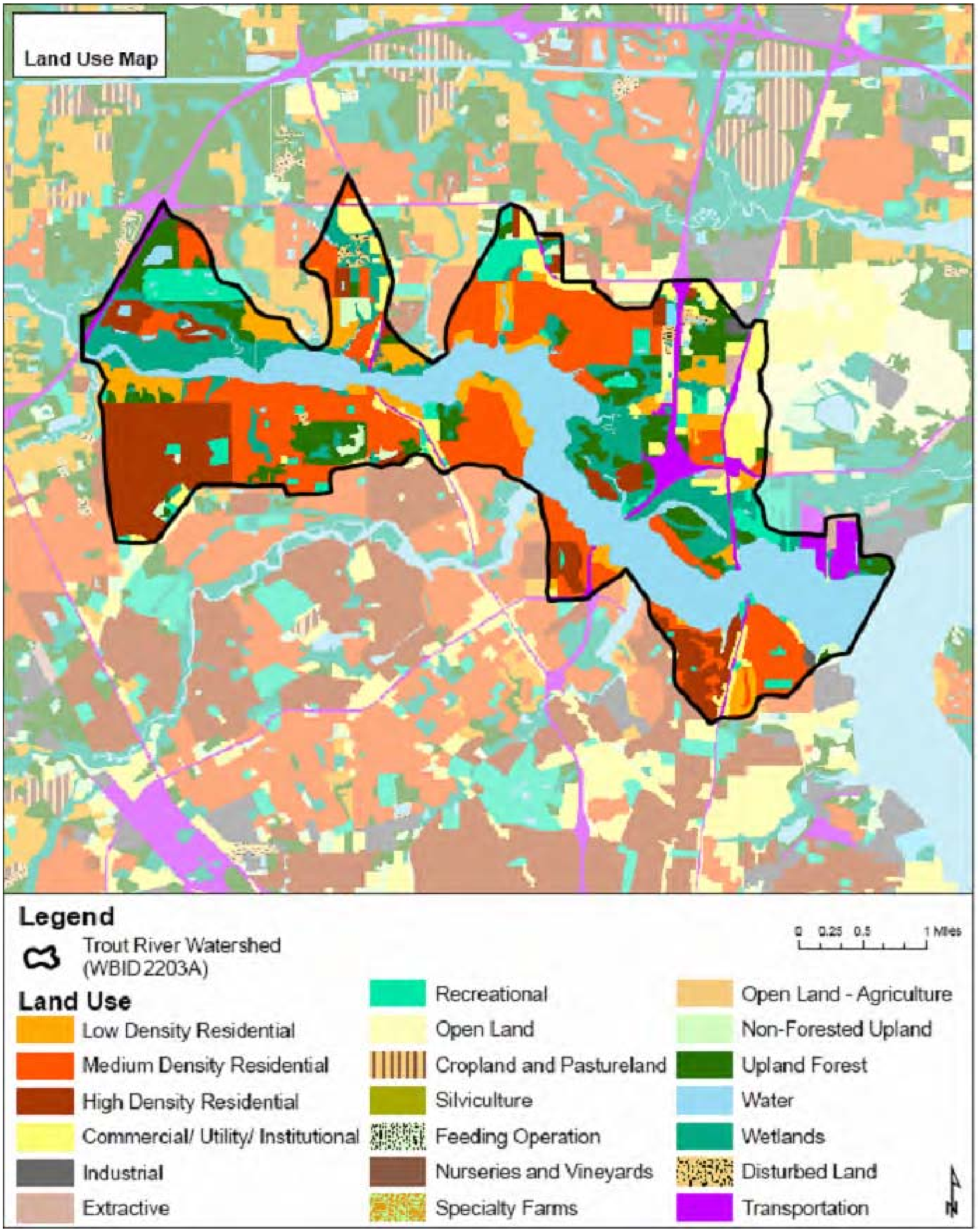
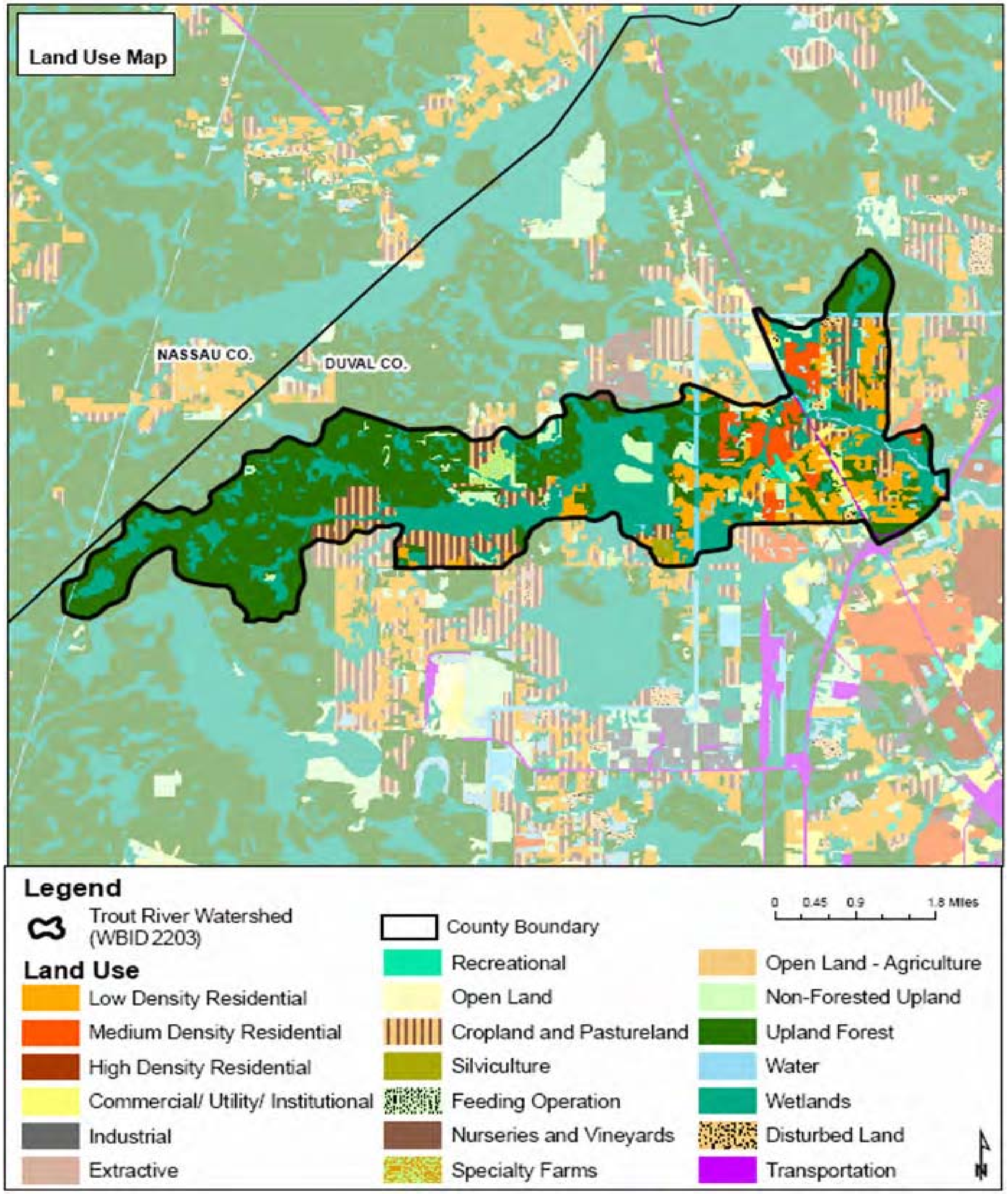


Figure 4.6. Principal Level 2 Land Uses in the Trout River Watershed, WBID 2203, in 2004



Population

WBID 2203A

According to the U.S. Census Bureau, census block (the smallest reported unit) population densities in WBID 2203A in the year 2000 ranged from 0 to 16,758 people/mi^2, with an average of 2,171 people/mi^2 in the watershed (**Figure 4.7**). The estimated population in the watershed is 26,224 people. The Census Bureau reports that, for all of Duval County, the total population for 2000 was approximately 780,000, with 329,778 housing units and an average occupancy rate of 92.1 percent (303,747 units); additionally, the Bureau reported a housing density of 426 houses per square mile. This places Duval County seventh in housing densities and population in Florida (U.S. Census Bureau Website, 2005). The estimated average housing density in Trout River is 826 houses/mi^2 (based on population), which is twice the county average.

WBID 2203

In WBID 2203, in 2000, census block population densities ranged from 0 to 5,266 people/mi^2, with an average of 159 people/mi^2 **(Figure 4.8)**. The estimated population in the WBID 2203 watershed is 2,461 people. The estimated average housing density is 61 units/mi^2 (based on population), which is a fraction of the county average of 426 units/mi^2.

Figure 4.7. Population Density in the Trout River Watershed, WBID 2203A, in 2000

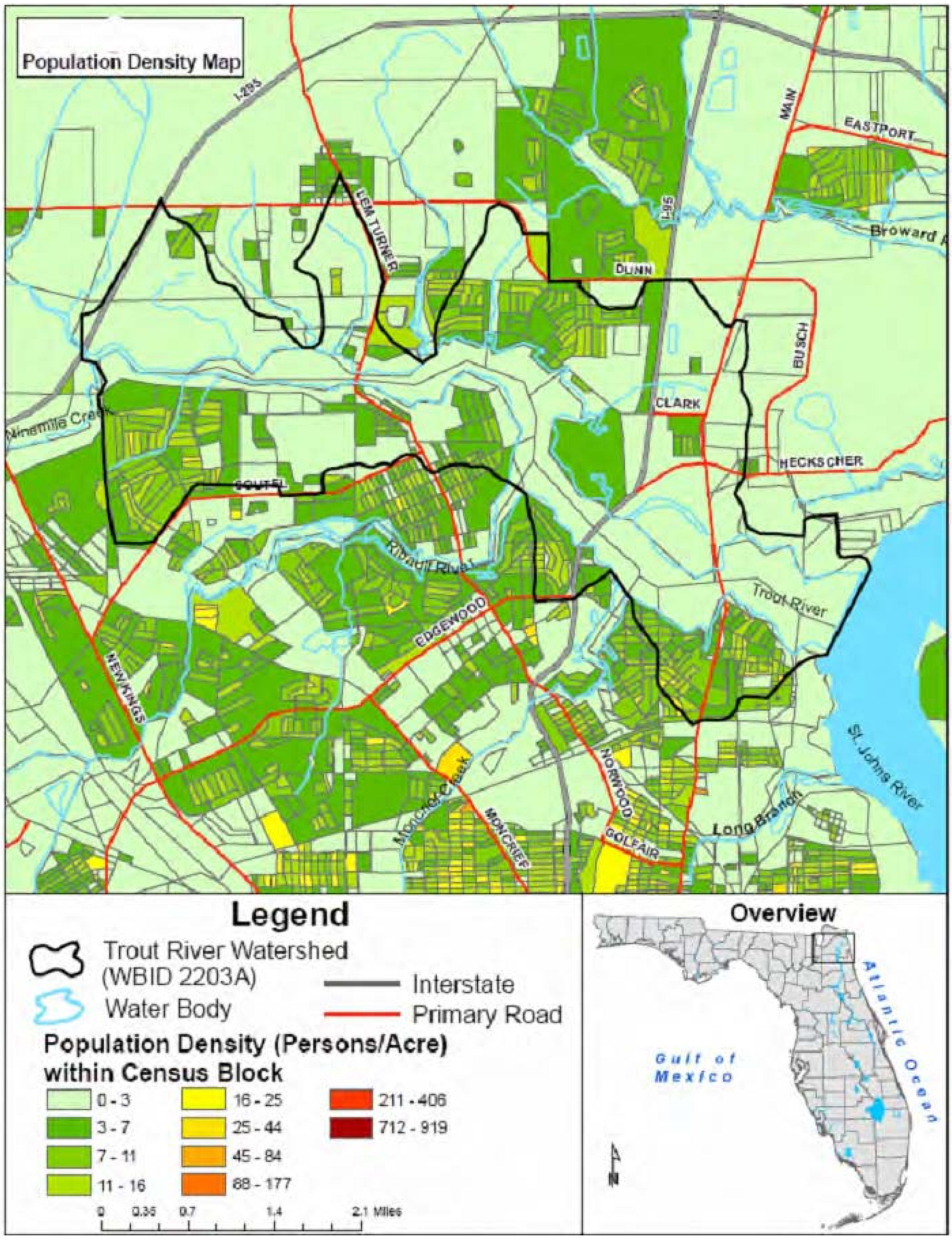
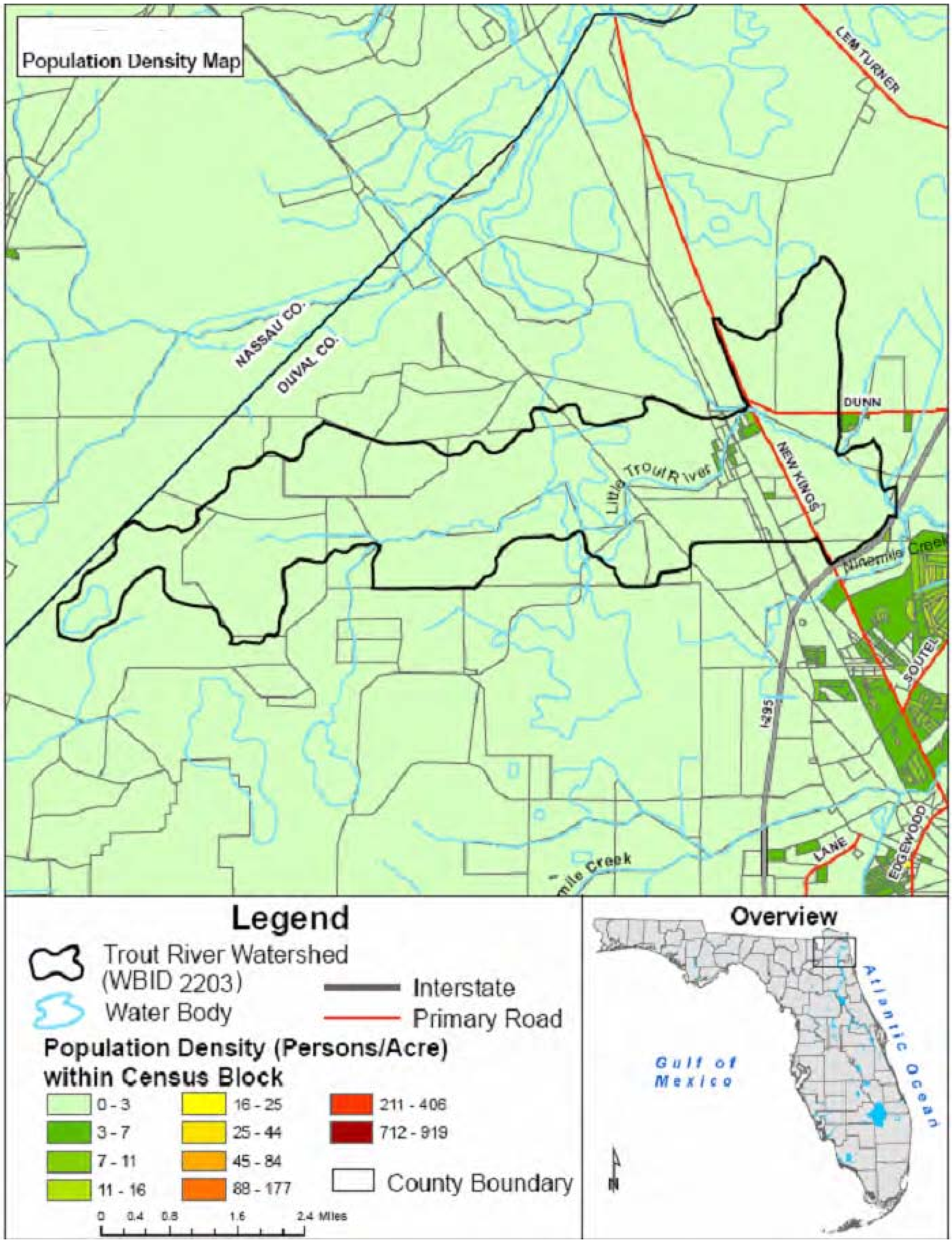


Figure 4.8. Population Density in the Trout River Watershed, WBID 2203, in 2000



Septic Tanks

Approximately 78 percent of Duval County residences are connected to a wastewater treatment plant, while the rest use septic tanks (JEA Water and Sewer Expansion Authority [WSEA] septic files) (PBS&J, 2007; and Florida Department of Health [FDOH] Website, 2006b). FDOH reports that in fiscal year 2003–04, there were 88,834 permitted septic tanks in Duval County, and for fiscal years 1993 to 2004, 5,479 permits for repairs were issued, or an average of approximately 457 repairs annually countywide.

WBID 2203A

There are an estimated 2,171 people/mi^2, or 26,224 people, in the WBID, with the average household consisting of 2.63 people (**Table 4.2**). Again, according to FDOH, there is an annual average of 450 repairs (fiscal years 1994 to 2004) in Duval County.

To focus on the Trout River watershed, the Department obtained septic tank repair permit data from JEA for its service area, which includes all of WBID 2203A. The data include septic tank repair permit records issued from 1990 to 2007, areas serviced by a WWTF, and areas where large numbers of failing septic tanks are present. **Figure 4.9** presents this information in map form.

In WBID 2203A, potential septic tank loadings are based on data provided by JEA, which are more watershed specific than the countywide FDOH data. An average of 12.5 permits was issued annually in the watershed for septic tank repairs. If this estimate is rounded up to 14 (to allow for those septic tanks where failures may not be known or have not been repaired), and using an estimate of 70 gallons/day/person (EPA, 2001), a loading of 9.76 x 10^{10} counts/day, or an annual loading of 3.56 x 10^{13} counts/year, is derived. **Table 4.3** shows these estimations.

There are two septic tank phase-out areas (areas that have the highest priority to be sewered and to have septic tanks eliminated due to their known high failure rate). One area of

Table 4.2. Estimated Average Household Size in the Trout River Watershed, WBIDs 2203A and 2203

	WBID 2203A			WBID 2203		
Household Size	**Number of Households**	**% of Total**	**Number of People**	**Number of Households**	**% of Total**	**Number of People**
1-person household	2,492	24.96%	2,492	217	22.82%	217
2-person household	3,042	30.47%	6,084	317	33.33%	634
3-person household	1,925	19.28%	5,775	188	19.77%	564
4-person household	1,388	13.90%	5,552	143	15.04%	572
5-person household	662	6.63%	3,310	55	5.78%	275
6-person household	307	3.08%	1,842	18	1.89%	108
7-or-more-person household	167	1.67%	1,169	13	1.37%	91
Total	**9,983**	**100.00%**	**26,224**	**951**	**100.00%**	**2,461**
	AVERAGE HOUSEHOLD SIZE:		**2.63**	**AVERAGE HOUSEHOLD SIZE:**		**2.59**
OVERALL AVERAGE HOUSEHOLD SIZE:						**2.62**

Figure 4.9. Septic Tank Overflows in the Trout River Watershed, WBID 2203A

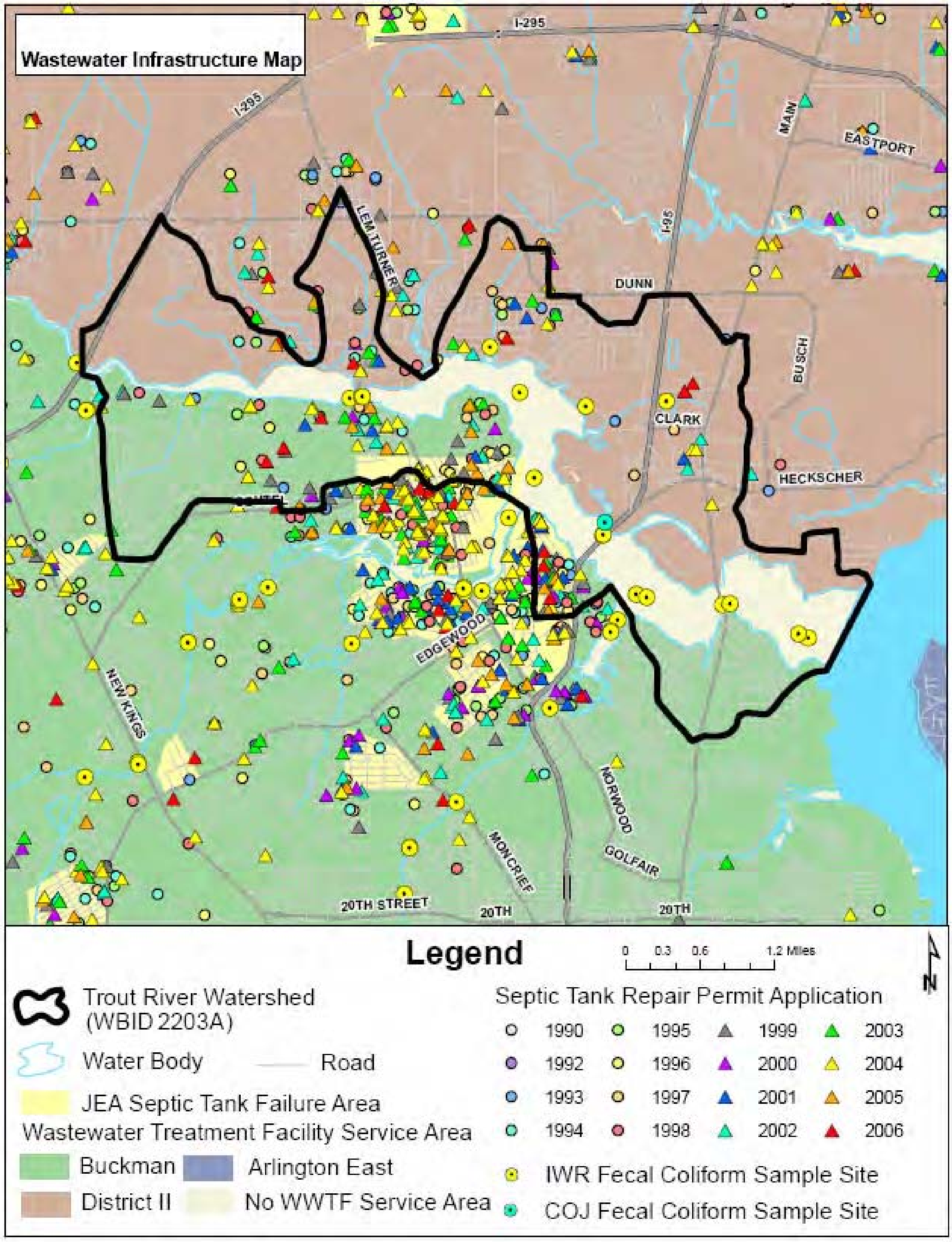


Table 4.3. Estimated Annual Fecal Coliform Loading from Failed Septic Tanks in the Trout River Watershed, WBIDs 2203A and 2203

WBID	Estimated Population Density (people/mi²)	WBID Area (mi²)	Estimated Population in Watershed	Estimated Number of Tank Failures[1]	Daily Estimated Load from Failed Tanks[2]	Gallons/ Person/ Day[2]	Estimated Number of People per Household[3]	Estimated Daily Load from Failing Tanks	Estimated Annual Load from Failing Tanks
2203A	2,171	12.1	26,224	14	1.00×10^4/mL	70	2.63	9.76×10^{10}	3.56×10^{13}
2203	158	15.5	2,461	6	1.00×10^4/mL	70	2.59	4.12×10^{10}	1.5×10^{13}

[1] Based on septic tank repair permits issued in the watershed from March 1990 to April 2004 (FDOH and JEA information); see text.
[2] EPA, 2001.
[3] From U.S. Census Bureau; see **Table 4.2** for more information on this estimate.

approximately 177.2 acres, situated in the south-central part of the watershed, is part of a larger 689-acre phase-out area. Of the 175 permits issued, 22 (12.6 percent) are located in this area.

A second, smaller phase-out area of 57.8 acres is located nearby, also in the south-central part of the watershed. This is actually a conglomeration of all or part of 7 phase-out areas, occupying approximately 57.8 acres in the WBID. Sixty-four permits were issued in this area, or 36.6 percent of those issued in the WBID. In total, there are 235 acres in the WBID (4.2 percent) of septic tank phase-out area, with 86 permits issued within them, or 49.1 percent of all permits issued.

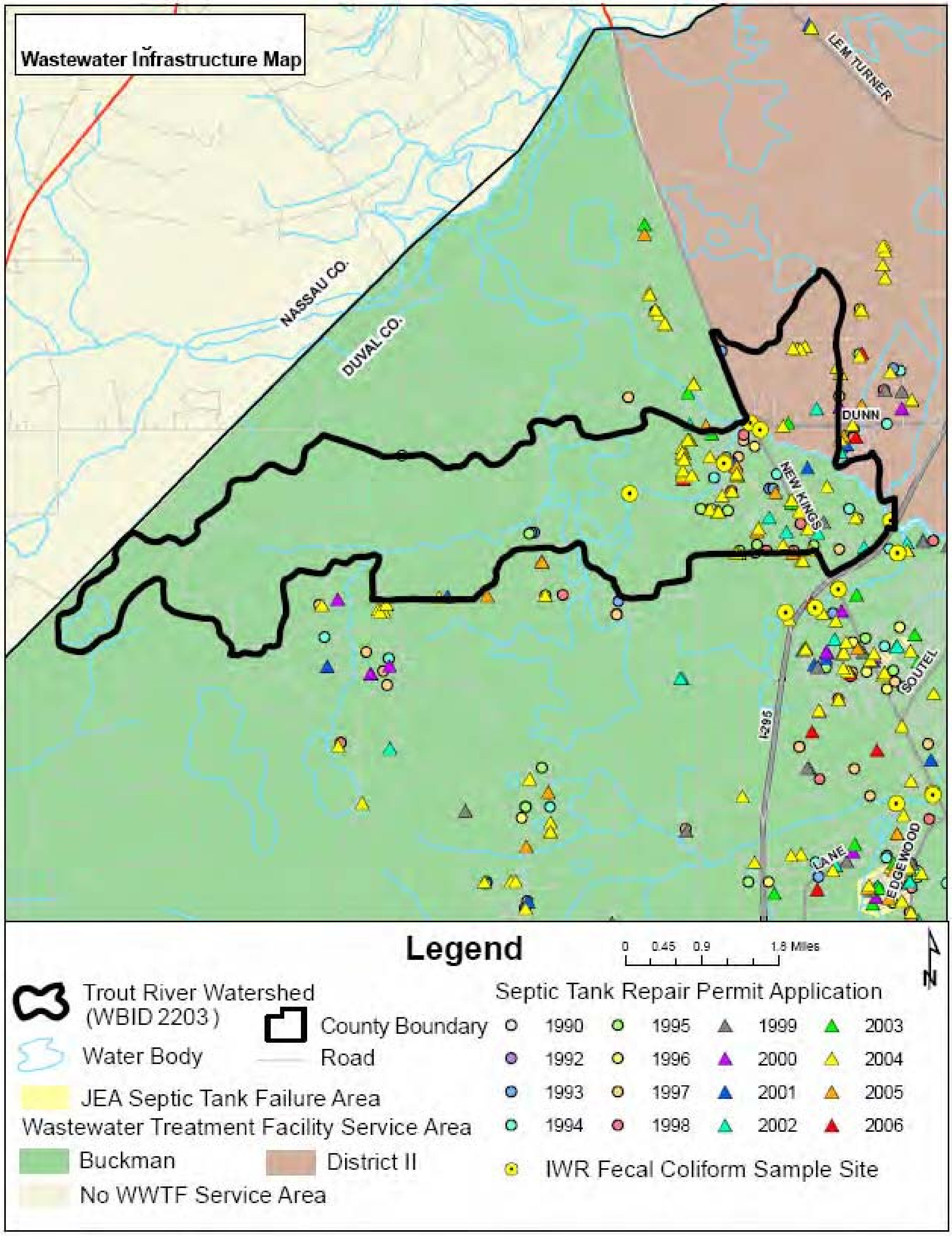
WBID 2203

There are an estimated 158 people/mi^2 in the WBID, or 2,461 people, with the average household consisting of 2.59 people (**Table 4.2**). Again, according to FDOH, there is an annual average of 450 repairs (fiscal years 1994 to 2004) in Duval County. Assuming that the failures are spread evenly throughout the county, there is an annual average of 6 failures in the Trout River watershed.

As with WBID 2203A, the Department obtained septic tank repair permit data from JEA for its service area, which includes part of WBID 2203. **Figure 4.10** presents this information in map form. JEA does not service all of WBID 2203; only about 45.8 percent in the eastern half of the WBID is included, and so estimates made using the JEA data for septic tank failures do not reflect all failures in the area. However, for the part that is covered, the data show that in WBID 2203 there were 90 permits for repairs issued during the 1990 – 2006 period in the watershed, or an average of 5.6 repairs annually, which is lower than that based on FDOH data. Unlike WBID 2203A, there are no septic tank phase-out areas in this part of the watershed.

As previously mentioned, not all of the WBID is within JEA's jurisdiction. Only about 45.8 percent of the watershed area is serviced by a WWTF (9.8 percent by the District II WWTF and 36 percent by the Buckman Street WWTF).

Figure 4.10. Septic Tank Overflows in the Trout River Watershed, WBID 2203



In WBID 2203, data provided by JEA include the entire watershed; thus it is more appropriate to base calculations on the countywide estimate of 9.1 annual failures, which is for the whole area. If this estimate is rounded up to 10 (to allow for those septic tanks where failures may not be known or have not been repaired), a loading of 6.86×10^{10} counts/day, or an annual loading of 2.50×10^{13} counts/year is derived. **Table 4.3** also shows these estimations.

4.2.3 Other Potential Sources

Agriculture

There are no agricultural areas in WBID 2203A, but there are some in WBID 2203. The largest total agricultural activity is cattle-feeding operations. There are 29 parcels totaling 413.3 acres, or 4.17 percent of the land area. Most of these areas appear to be used for dairy cattle management, and loading estimates are calculated as such. However, it should be noted that most dairies have some sort of a manure management plan, and so the effects of cattle waste on the river are expected to be considerably less than what is presented here, although the extent to which is beyond the scope of this document. For example, the Bowie Dairy facility, mentioned in **Section 4.2.1**, was required to obtain a permit but is not permitted to discharge to surface waters. Therefore, it is assumed that a manure management plan or best management practices (BMPs) are in place to address the potential contamination of nearby waterways and keep it to a minimum, except possibly for the occasional heavy precipitation event.

Potential loadings to the Trout River from cattle operations in the area have been estimated. According to the Florida Department of Agriculture and Consumer Services (FDACS) (2005), in 2004 there was an average of 3,000 dairy cattle in Duval County. According to land use data, approximately 413 acres are dedicated to cattle-feeding operations in WBID 2203 and 1,916.8 acres in all of Duval County; thus there is an average of 1.56 head of cattle per acre of cattle lands in the county. If this average applies to the 413 acres in WBID 2203, then there are 646 head of cattle in the WBID.

Based on this information, the potential loading from dairy cattle in the area is approximately 6.46×10^{13} per day, or 2.35×10^{16} annually (**Table 4.4**). However, it is suspected that this overestimates the actual contribution due to management practices. It is not the intent of this report to investigate the effectiveness of the manure management practices and BMPs that these facilities may have in place.

Table 4.4. Estimated Maximum Fecal Coliform Loading from Cattle in the Trout River Watershed, WBID 2203

WBID	Total Number of Cattle-Feeding Acres	Average Number of Cattle per Acre	Estimated Number of Cattle in Watershed	Estimated Daily Fecal Coliform Load per Cow (counts/day)	Estimated Daily Fecal Coliform Load from Cattle (counts/day)	Estimated Annual Fecal Coliform Load from Cattle (counts/year)
2203	413	1.56	646	1.00×10^{11}	6.46×10^{13}	2.35×10^{16}

Pets

Pets, especially dogs, may have an impact on the waterbody. The Department has been unable to obtain data on the number of dogs in the area; however, estimates can be made using literature-based values of dog ownership rates (**Table 4.5**). For example, using household-to-dog ratio estimates from the American Veterinary Medical Association (AVMA) (2006), the approximate loading is 1.72×10^{11} and 1.80×10^{12}.organisms/day for WBIDs 2203 and 2203A, respectively.

Table 4.5. Estimated Fecal Coliform Loading from Dogs in the Trout River Watershed, WBIDs 2203A and 2203

WBID	Estimated Number of Households	Estimated Household:Dog Ratio[1]	Estimated Total Dog Population in Watershed	Estimated Number of Pets with Impact to Creek	Estimated Counts/ Pet/ Day[2]	Estimated Daily Load (counts/day)	Estimated Annual Load (counts/year)
2203A	9,983	0.361	3,604	360	5.00×10^{9}	1.80×10^{12}	6.58×10^{14}
2203	951	0.361	343	34.3	5.00×10^{9}	1.72×10^{11}	6.27×10^{13}

[1] From the AVMA website, which states the original source to be the *U.S Pet Ownership and Demographics Sourcebook, 2002*.
[2] EPA, 2001.

Leaking or Overflowing Wastewater Collection Systems

As noted previously, since an estimated 78 percent of households in Duval County are connected to a wastewater facility, according to information supplied to the Department by JEA, most of WBIDs 2203A and 2203 are serviced by a WWTF (this does not imply that all residences and businesses are connected).

Iin WBID 2203A, assuming that there are approximately 9,983 housing units, with 2.63 people per household, and a 70-gallon-per-person-per-day discharge, and also assuming that the countywide average of 78 percent of homes connected to a WWTF applies in this area, a daily flow of approximately 3.97×10^{6} liters (L) (1.01 MGD) is transported through the collection system. The EPA (Davis, 2002) suggests that a 5 percent leakage rate from collection systems is a realistic estimate. Based on this rate and EPA values for fecal coliform in raw sewage, the potential daily loading of fecal coliform from leaking sewer lines is 1.36×10^{13} counts/day, or 4.95×10^{15} counts/year (**Table 4.6**).

WBID 2203 contains about 951 housing units; however, according to JEA, only about 46 percent of the area is serviced by a WWTF. Using the same assumptions as for WBID 2203A, except for the projected 46 percent of houses in the WWTF service area, a daily loading of 1.01 $\times 10^{12}$ counts/day or 3.68×10^{14} counts/year is derived.

Table 4.6. Estimated Fecal Coliform Loading from Wastewater Collection Systems in the Trout River Watershed, WBIDs 2203A and 2203

WBID	Estimated Homes on Central Sewer	Estimated Daily Flow (L)	Daily Leakage (L)	Raw Sewage (counts/100mL)	Estimated Counts/Day	Estimated Counts/Year
2203A	7,787	5.43×10^{6}	2.71×10^{5}	5.00×10^{6}	1.36×10^{13}	4.95×10^{15}
2203	579[1]	4.03×10^{5}	2.02×10^{4}	5.00×10^{6}	1.01×10^{12}	3.68×10^{14}

[1] There are an estimated 951 housing units in WBID 2203, but only about 46 percent (456 units) are in an area serviced by a WWTF. It is assumed that the countywide average of 78 percent is connected to a WWTF.

4.3 Source Summary

Table 4.7 summarizes the loading estimates from various sources. It is important to note that this is not a complete list (wildlife, for example, is missing) and represents estimates of potential loadings. Proximity to the waterbody, rainfall frequency and magnitude, soil types, drainage features, and temperature are just a few of the factors that could influence and determine the actual loadings from these sources that reach the Trout River.

Table 4.7. Summary of Estimated Potential Coliform Loading from Various Sources in the Trout River Watershed, WBIDs 2203A and 2203

Source	WBID 2203A		WBID 2203	
	Estimated Daily Load (counts/day)	Estimated Annual Load (counts/year)	Estimated Daily Load (counts/day)	Estimated Annual Load (counts/year)
NPDES Facilities	N/A[1]	N/A[1]	N/A[1]	N/A[1]
Agriculture	N/A[2]	N/A[2]	6.46×10^{13}	2.35×10^{16}
Septic Tanks	9.76×10^{10}	3.56×10^{13}	6.86×10^{10}	2.50×10^{13}
Dogs	1.80×10^{12}	$6.58 \text{ X } 10^{14}$	1.72×10^{11}	$6.27 \text{ X } 10^{13}$
Collection Systems	1.36×10^{13}	4.95×10^{15}	1.01×10^{12}	3.68×10^{14}

[1] There are no permitted NPDES discharges in either WBID at this time.
[2] There are no known agricultural areas in WBID 2203A.

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

The methodology used for this TMDL was the "percent reduction" methodology. The Department generally prefers to use the load duration curve or "Kansas" method for coliform TMDLs, but this method could not be used because there are not enough flow data for the Trout River. There are no stream gauging stations in WBID 2203A. There is one stream gauging station in WBID 2203 (U.S. Geological Survey [USGS] Station 02246599), but the data span less than 4 years, and making a reasonable determination of loading capacity would require at least 10 years of flow data. Therefore, to determine the TMDL, the percent reduction that would be required for each of the exceedances to meet the applicable criterion was determined, and the median value of all of these reductions for fecal coliform in each WBID determined the overall required reduction, and therefore the TMDL.

5.1.1 Data Used in the Determination of the TMDL

In addition to data in the Department's IWR database, the city of Jacksonville submitted additional data collected in both WBIDs after the verified period. These data are included below and all were considered in TMDL development.

WBID 2203A

Six stations in WBID 2203A have historical fecal coliform data (**Figure 5.1**). Of the 122 observations, 104 were collected by the city of Jacksonville (**Table 5.1**). The majority of the samples were collected on Highlands Creek at Broward Avenue (STORET ID 21FLJXWQTR34), which had the highest exceedance rate (44.4 percent). Due to safety concerns, the city of Jacksonville no longer samples at Lem Turner Road but instead uses the Bert Maxwell boat ramp. **Table 5.2** is a summary of observed data by station, and **Figure 5.2** shows the data visually over time.

WBID 2203

There are 6 sampling sites with historical fecal coliform data in WBID 2203 (**Figure 5.3**). **Table 5.3** presents sample collection summaries. Most of the samples were collected at U.S. 1 near the boat ramp, which also had the highest percent exceedance (69.8 percent) and the highest median (900 counts/100mL). The lowest exceedance rate is at Old Kings Road, which was sampled by the Department. **Table 5.4** contains a summary of observed values.

Figure 5.1. Historical Sampling Sites in the Trout River, WBID 2203A

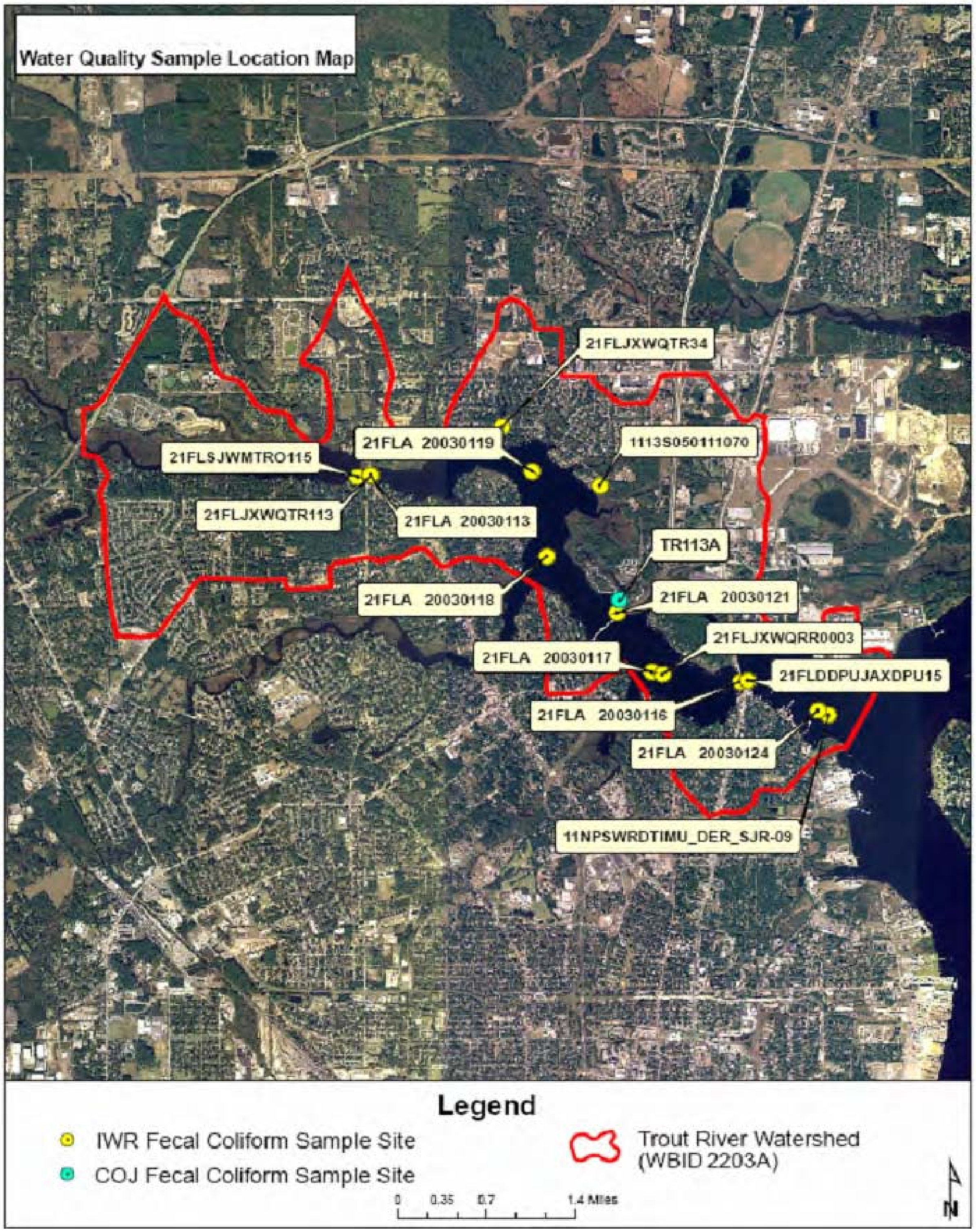


Table 5.1. Sampling Station Summary for the Trout River, WBID 2203A

STORET ID	Station	Station Owner	Year 1996	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
21FLA 20030113	Trout R @ Lem Turner Rd	Department											1
21FLA 20030116	Trout River at US 17	Department										1	6
21FLA 20030121	Trout R @ I 95 Burt Maxwell Park Dock	Department						1		1		1	7
21FLJXWQTR 113	Trout River at Lem Turner Rd	City of Jacksonville	2	6	8	6	8		4	1			
21FLJXWQTR 113A	Trout River at Bert Maxwell Boat Ramp	City of Jacksonville								3	4	4	4
21FLJXWQTR 34	Highlands Creek at Broward Rd	City of Jacksonville		6	8	8	8	4	4	4	4	4	4
		N	**2**	**12**	**16**	**14**	**16**	**5**	**8**	**9**	**8**	**10**	**22**
		TOTAL N	**122**										

Table 5.2. Statistical Summary of Historical Data for the Trout River, WBID 2203A

Station	N	Max	Min	Median	Number of Exceedances	% Exceedances
Trout R @ Lem Turner Rd	1	15	15	15	0	0.0
Trout River at US 17	7	218	4	8	0	0.0
Trout R @ I 95 Burt Maxwell Park Dock	10	2,200	7	92.5	2	20.0
Trout River at Lem Turner Rd	35	1,700	0	130	4	11.4
Trout River at Bert Maxwell Boat Ramp	15	2,500	20	40	2	13.3
Highlands Creek at Broward Rd	54	9,000	40	300	24	44.4

Coliform concentrations are counts/100mL.

Figure 5.2. Historical Fecal Coliform Observations in the Trout River, WBID 2203A, 1996–2006

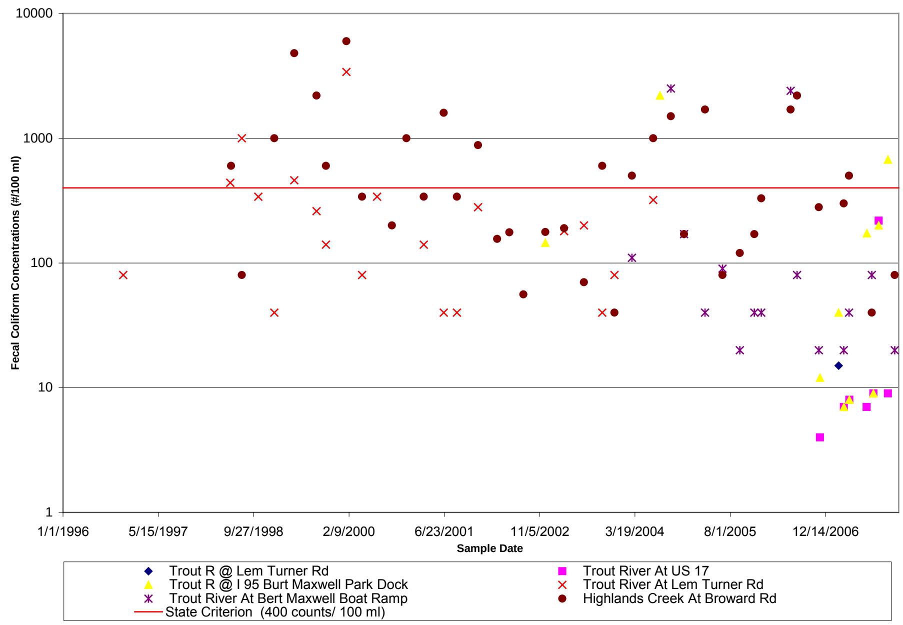


Figure 5.3. Historical Sampling Sites in the Trout River, WBID 2203

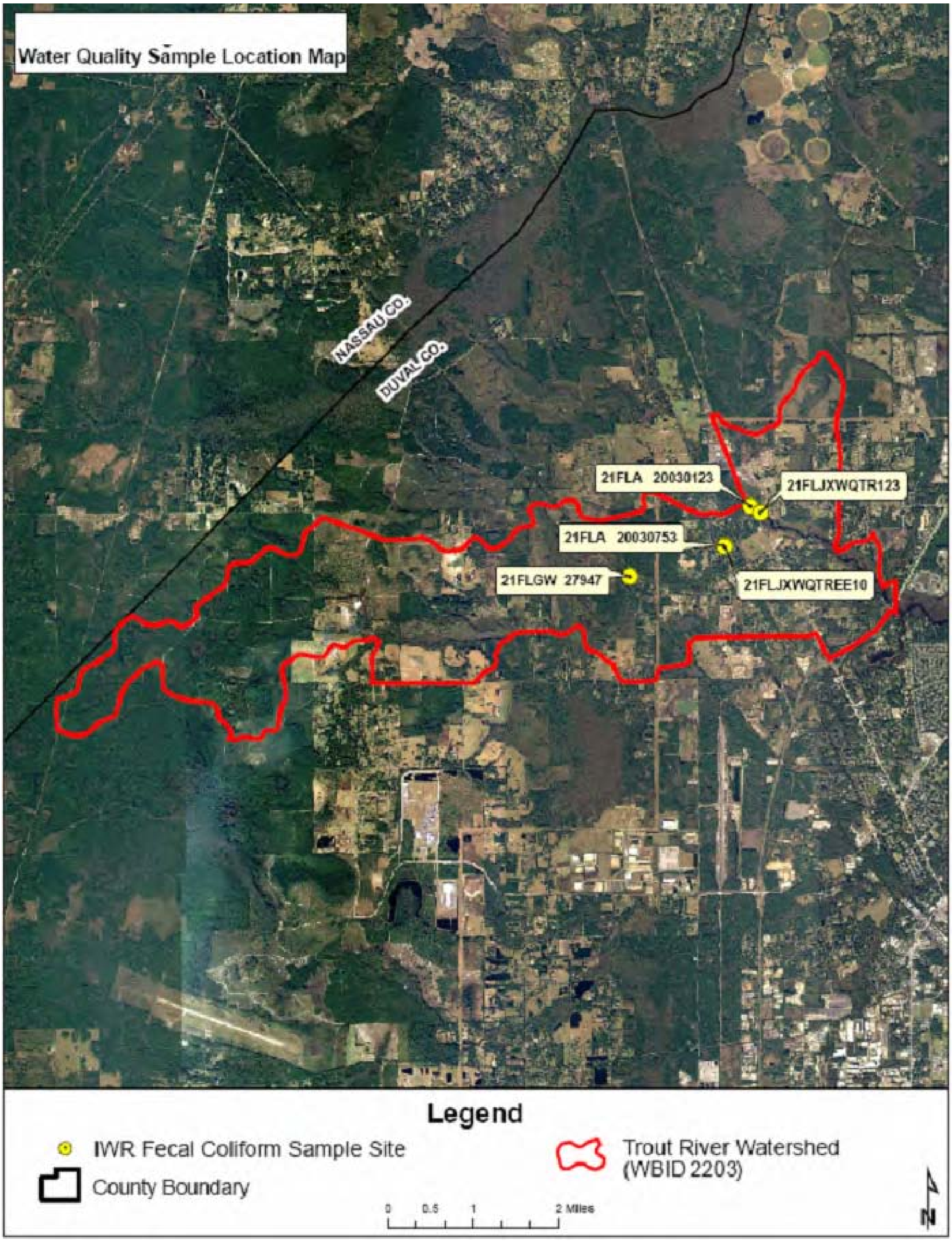


Table 5.3. Sampling Station Summary for the Trout River, WBID 2203

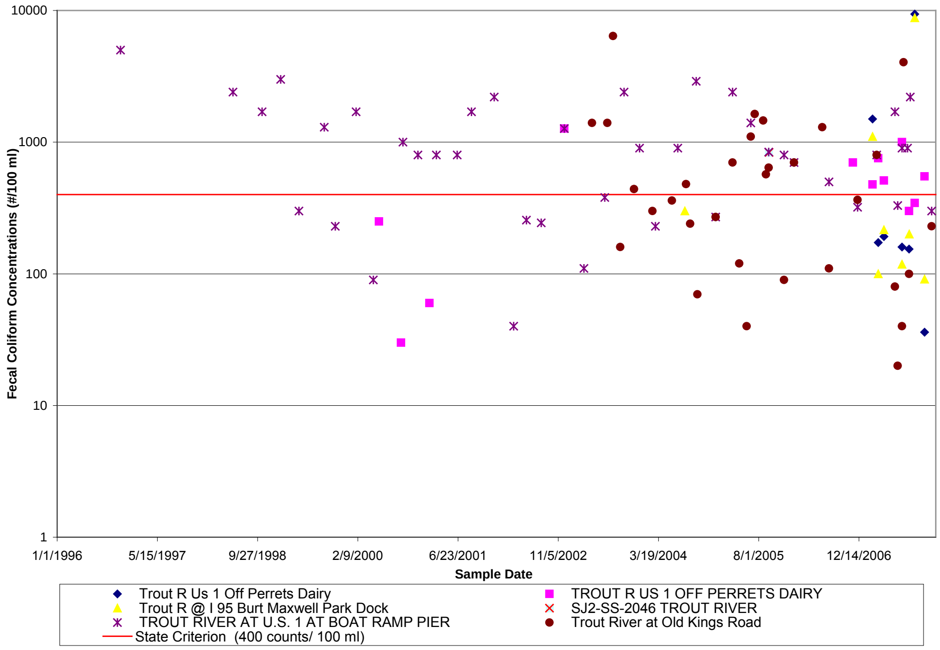
STORET ID	Station	Station Owner	Year										
			1996	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
21FLA 20030047	Trout R US 1 off Perrets Dairy	Department											7
21FLA 20030123	Trout R US 1 off Perrets Dairy	Department				2	1	1				1	7
21FLA 20030753	Trout River at Old Kings Rd	Department								1			7
21FLGW 27947	SJ2-SS-2046 Trout River	Department									1		
21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	City of Jacksonville	1	3	4	4	4	4	4	4	4	4	7
21FLJXWQTREE10	Trout River at Old Kings Road	City of Jacksonville							10	8	9	4	7
		N	**1**	**3**	**4**	**6**	**5**	**5**	**14**	**13**	**14**	**9**	**35**
		TOTAL N	**109**										

Table 5.4. Statistical Summary of Historical Data for the Trout River, WBID 2203A

Station	N	Max	Min	Median	Number of Exceedances	% Exceedances
Trout R US 1 off Perrets Dairy	7	9,400	36	173	2	28.6
Trout R US 1 off Perrets Dairy	12	1,267	30	494	7	58.3
Trout River at old Kings Rd	8	8,800	91	208	2	25.0
SJ2-SS-2046 Trout River	1	836	836	836	1	100.0
Trout River at U.S. 1 at Boat Ramp Pier	43	160,000	40	900	30	69.8
Trout River at Old Kings Road	38	4,050	20	255	16	42.1

Coliform concentrations are counts/100mL

Figure 5.4. Historical Fecal Coliform Observations in the Trout River, WBID 2203, 1996–2006



5.1.2 TMDL Development Process

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

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

After the individual results were calculated, the median of the individual values was calculated, which is 60 percent in WBID 2203A and 55.6 percent in WBID 2203. This means that in order to meet the state criterion of 400 counts/100mL in WBID 2203A, a 67 percent reduction in current loading is necessary, and for WBID 2203 a 66 percent reduction is required; thus these are the TMDLs for these 2 segments of the Trout River. **Tables 5.5** and **5.6** show the individual exceedances used in calculating the TMDL for Trout River.

Table 5.5. Calculations To Determine the Fecal Coliform TMDL for the Trout River, WBID 2203A

Sample Date	Location	Observed Exceedance*	Required % Reduction
5/27/1998	Trout River at Lem Turner Rd	440	9.1%
6/1/1998	Highlands Creek at Broward Rd	600	33.3%
7/27/1998	Trout River at Lem Turner Rd	1,000	60.0%

Sample Date	Location	Observed Exceedance*	Required % Reduction
10/14/1998	Highlands Creek at Broward Rd	18,000	97.8%
10/14/1998	Highlands Creek at Broward Rd	1,000	60.0%
4/28/1999	Trout River at Lem Turner Rd	460	13.0%
4/28/1999	Highlands Creek at Broward Rd	4,800	91.7%
4/28/1999	Highlands Creek at Broward Rd	2,200	81.8%
4/28/1999	Highlands Creek at Broward Rd	600	33.3%
1/26/2000	Trout River at Lem Turner Rd	3,400	88.2%
1/26/2000	Highlands Creek at Broward Rd	6,000	93.3%
12/6/2000	Highlands Creek at Broward Rd	1,000	60.0%
12/6/2000	Highlands Creek at Broward Rd	1,600	75.0%
12/6/2000	Highlands Creek at Broward Rd	880	54.5%
	MEDIAN:	**1,000**	**60.0%**

Observed values are #/100mL.

Table 5.6. Calculations To Determine the Fecal Coliform TMDL for the Trout River, WBID 2203

Sample Date	Location	Observed Exceedance*	Required % Reduction
11/12/1996	Trout River at U.S. 1 At Boat Ramp Pier	5,000	92.0%
5/27/1998	Trout River at U.S. 1 At Boat Ramp Pier	2,400	83.3%
7/27/1998	Trout River at U.S. 1 At Boat Ramp Pier	160,000	99.8%
10/19/1998	Trout River at U.S. 1 At Boat Ramp Pier	1,700	76.5%
1/20/1999	Trout River at U.S. 1 At Boat Ramp Pier	3,000	86.7%
8/25/1999	Trout River at U.S. 1 At Boat Ramp Pier	1,300	69.2%
1/31/2000	Trout River at U.S. 1 At Boat Ramp Pier	1,700	76.5%
9/21/2000	Trout River at U.S. 1 At Boat Ramp Pier	1,000	60.0%
12/5/2000	Trout River at U.S. 1 At Boat Ramp Pier	800	50.0%
3/7/2001	Trout River at U.S. 1 At Boat Ramp Pier	800	50.0%
6/19/2001	Trout River at U.S. 1 At Boat Ramp Pier	800	50.0%
8/29/2001	Trout River at U.S. 1 At Boat Ramp Pier	1,700	76.5%
12/20/2001	Trout River at U.S. 1 At Boat Ramp Pier	2,200	81.8%
12/5/2002	Trout R US 1 off Perrets Dairy	1,267	68.4%
12/5/2002	Trout River at U.S. 1 at Boat Ramp Pier	1,267	68.4%
4/22/2003	Trout River at Old Kings Road	1,400	71.4%
7/8/2003	Trout River at Old Kings Road	1,400	71.4%
8/5/2003	Trout River at Old Kings Road	6,400	93.8%
9/29/2003	Trout River at U.S. 1 at Boat Ramp Pier	2,400	83.3%
11/18/2003	Trout River at Old Kings Road	440	9.1%
12/15/2003	Trout River at U.S. 1 at Boat Ramp Pier	900	55.6%
6/23/2004	Trout River at U.S. 1 at Boat Ramp Pier	900	55.6%
8/3/2004	Trout River at Old Kings Road	480	16.7%
9/23/2004	Trout River at U.S. 1 At Boat Ramp Pier	2,900	86.2%

Sample Date	Location	Observed Exceedance*	Required % Reduction
3/23/2005	Trout River at U.S. 1 At Boat Ramp Pier	2,400	83.3%
3/23/2005	Trout River at Old Kings Road	700	42.9%
6/22/2005	Trout River at U.S. 1 At Boat Ramp Pier	1,400	71.4%
6/22/2005	Trout River at Old Kings Road	1,100	63.6%
7/12/2005	Trout River at Old Kings Road	1,635	75.5%
8/23/2005	Trout River at Old Kings Road	1,460	72.6%
9/6/2005	Trout River at Old Kings Road	570	29.8%
9/20/2005	Trout River at U.S. 1 At Boat Ramp Pier	840	52.4%
9/20/2005	Trout River at Old Kings Road	640	37.5%
9/21/2005	Sj2-Ss-2046 Trout River	836	52.2%
12/5/2005	Trout River at U.S. 1 at Boat Ramp Pier	800	50.0%
1/24/2006	Trout River at U.S. 1 at Boat Ramp Pier	700	42.9%
1/24/2006	Trout River at Old Kings Road	700	42.9%
6/14/2006	Trout River at U.S. 1 at Boat Ramp Pier	17,000	97.6%
6/14/2006	Trout River at Old Kings Road	1,300	69.2%
7/17/2006	Trout River at U.S. 1 at Boat Ramp Pier	500	20.0%
11/14/2006	Trout R US 1 off Perrets Dairy	700	42.9%
2/20/2007	Trout R @ End Of Colorado Springs Rd	1,500	73.3%
2/20/2007	Trout R Us 1 off Perrets Dairy	477	16.1%
2/20/2007	Trout River at Old Kings Rd	1,100	63.6%
3/12/2007	Trout River at U.S. 1 at Boat Ramp Pier	800	50.0%
3/12/2007	Trout River at Old Kings Road	800	50.0%
	MEDIAN:	**1,183.5**	**66.2%**

* Observed values are #/100mL.

5.1.3 Critical Conditions/Seasonality

Appendices B and **C** provide historical fecal coliform observations collected in WBIDs 2203A and 2203, respectively. Coliform data are presented by month, season, and year to determine whether certain patterns are evident in the dataset.

WBID 2203A

A nonparametric test (Kruskal-Wallis) was applied to the fecal coliform dataset to determine whether there were significant differences among months or seasons. At an alpha (α) level of 0.05, there are no significant differences among seasons or months (**Appendices D** and **E**). Grouping observations by season increased sample sizes for statistical comparison, as seen in **Table 2.2**. The greatest percentage of exceedances occurred in the fall (October–December) and summer (June–August). **Appendix F** presents comparisons of stations and seasons for each WBID.

Rainfall records for JIA (**Appendix G** illustrates rainfall from 1990 to 2008) were used to determine the rainfall amounts associated with individual sampling dates. Rainfall recorded on the day of sampling (1D), the cumulative total for the day of and the previous 2 days (3D), the cumulative total for the day of and the previous 6 days (7D), and the cumulative total for the day of and the previous 29 days (30D) were all paired with the respective coliform observation. A

Spearman correlation matrix was generated that summarized the simple correlation coefficients between the rainfall and coliform values (**Appendix H**). The simple correlations (r values in the Spearman correlation table) between both fecal coliform and the various rainfall totals were positive, suggesting that as rainfall (and possible runoff) increased, so did the number of coliform.

Simple linear regressions were performed between coliform observations and rainfall totals to determine whether any of the relationships were significant at an α level of 0.05. The r^2 values between fecal coliform and precipitation regimes showed no significance (**Appendix I**). A table of historical monthly average rainfall (**Appendix J**) indicates that monthly rainfall totals increase in June, peak in September, and by October return to the levels observed in February and March. The highest percentage of exceedances occurred in the fall (October–December; see **Table 2.2**). **Appendix K** includes a table of annual rainfall at JIA from 1955 to 2008; the long-term average was 52.47 inches over this period.

When considering all the data, the greatest percentage of exceedances occurred in 2004 (a 55.6 percent exceedance rate), which was an unusually wet year (69.47 inches), in part due to hurricane activity. The other two above-average years, 2005 (64.4 inches) and 2002 (54.72 inches), had a 12.5 and 0.0 percent exceedance rate, respectively. There does not appear to be an obvious correlation between total annual precipitation and percent exceedance of fecal coliform.

WBID 2203A is tidally influenced and discharges into WBID 2213C (St Johns River above Dames Point), which is not impaired for coliform.

WBID 2203

The same analyses used in WBID 2203A were also applied to WBID 2203. The nonparametric test (Kruskal-Wallis) indicated that at an alpha (α) level of 0.05, there are no significant differences among seasons or months (0.247 and 0.843, respectively; **Appendices D** and **E**). **Appendix F** presents comparisons of stations and seasons.

The precipitation and fecal coliform Spearman correlation matrices were also generated (**Appendix H**). The simple correlations (r values in the Spearman correlation table) between both fecal coliform and the various rainfall totals were positive, suggesting that as rainfall (and possible runoff) increased, so did the number of coliform.

The simple linear regressions performed between coliform observations and rainfall totals (again significant at an α level of 0.05) indicated there was no significance between fecal coliform and the 1D, 3D, 7D, and 30D prior precipitation (**Appendix I**). Again, the long-term average at JIA was 52.47 inches from 1955 to 2008.

When considering all the data, the greatest percentage of exceedances occurred in 2001 (an 80.0 percent exceedance rate), which was a below-average precipitation year (49.14 inches). The lowest percentage of exceedances occurred in 2004 (15.4 percent), which was an unusually wet year (69.47 inches). As with WBID 2203A, there does not appear to be an obvious link between total annual precipitation and percent exceedance.

Assessment of Hydrologic Conditions

As no 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 JIA from 1990 to 2004 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.

Data show that fecal coliform exceedances occurred over all hydrologic conditions for which data exist, and all have at least a 50 percent exceedance rate. However, the lowest percentage of exceedances (50 percent) occurred after medium precipitation events (0.18 to 1.33 inches). There were no data collected within 3 days of an extreme precipitation event.

The highest percentage of exceedances (100 percent) occurred after large precipitation events. If a large percentage of exceedances occur during no measurable precipitation days, it is suspected that point sources are contributing. Likewise, if a large percentage of exceedances occur after large and extreme precipitation events, this may indicate that exceedances are nonpoint source driven, perhaps from stormwater conveyance systems or various land uses.

It is difficult to draw conclusions without data from extreme event ranges; however, with exceedances spread throughout the ranges in which data exist, it is most likely that they stem from a variety of both point and nonpoint sources. **Tables 5.7** and **5.8** contain summaries of data and hydrologic conditions for each WBID. **Figures 5.5** and **5.6** show the same data visually.

Table 5.7. Summary of Fecal Coliform Data by Hydrologic Condition for the Trout River, WBID 2203A

Precipitation Event	Event Range (inches)	Total Samples	Number of Exceedances	% Exceedance	Number of Nonexceedances	% Nonexceedances
Extreme	>2.1"	2	1	50.0	1	50.0
Large	1.33" – 2.1"	1	0	0.0	1	100.0
Medium	0.18" – 1.33"	12	4	33.3	8	66.6
Small	0.01" – 0.18"	9	3	33.3	6	66.6
None/Not Measurable	<0.01"	29	2	6.9	27	93.1

Table 5.8. Summary of Fecal Coliform Data by Hydrologic Condition for the Trout River, WBID 2203

Precipitation Event	Event Range (inches)	Total Samples	Number of Exceedances	% Exceedance	Number of Nonexceedances	% Nonexceedances
Extreme	>2.1"	4	4	100.0	0	0.0
Large	1.33" – 2.1"	2	1	50.0	1	50.0
Medium	0.18" – 1.33"	20	13	65.0	7	35.0
Small	0.01" – 0.18"	16	9	56.3	7	43.8
None/Not Measurable	<0.01"	30	13	43.3	17	56.6

Figure 5.5. Fecal Coliform by Hydrologic Flow Condition for the Trout River, WBID 2203A

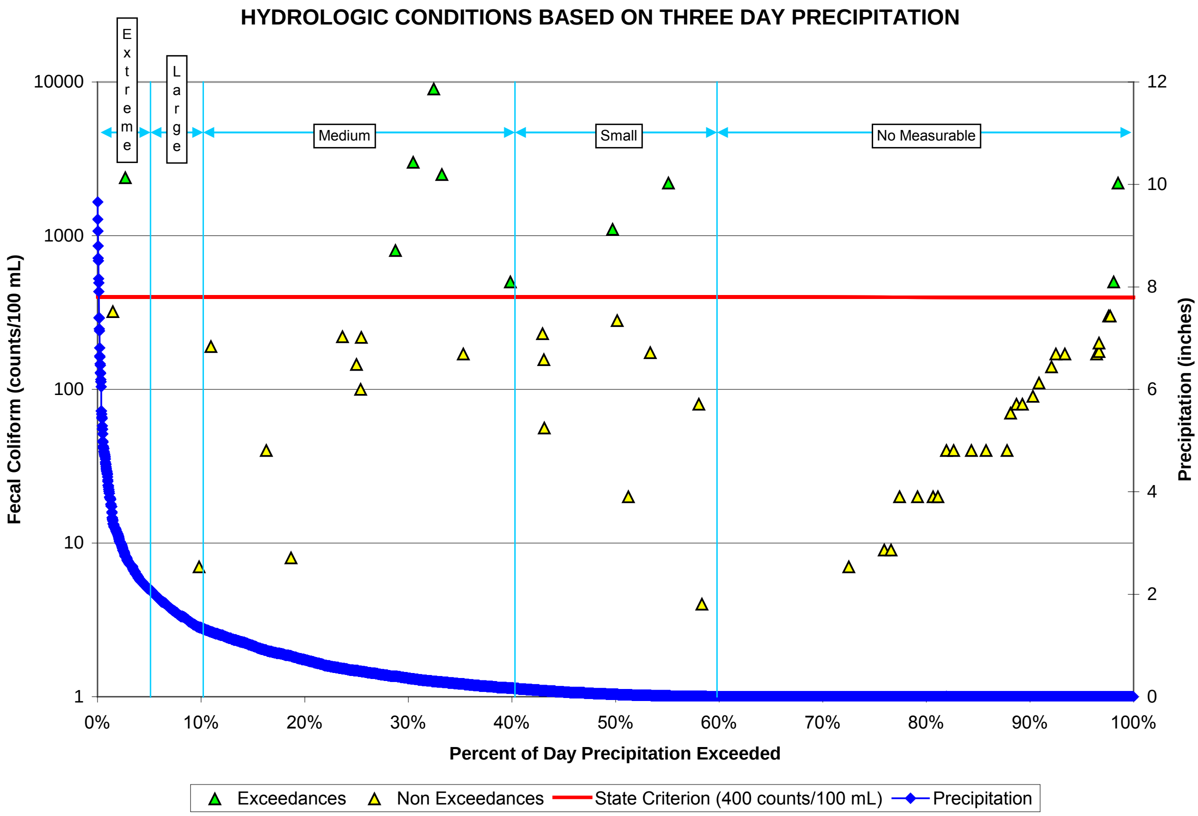
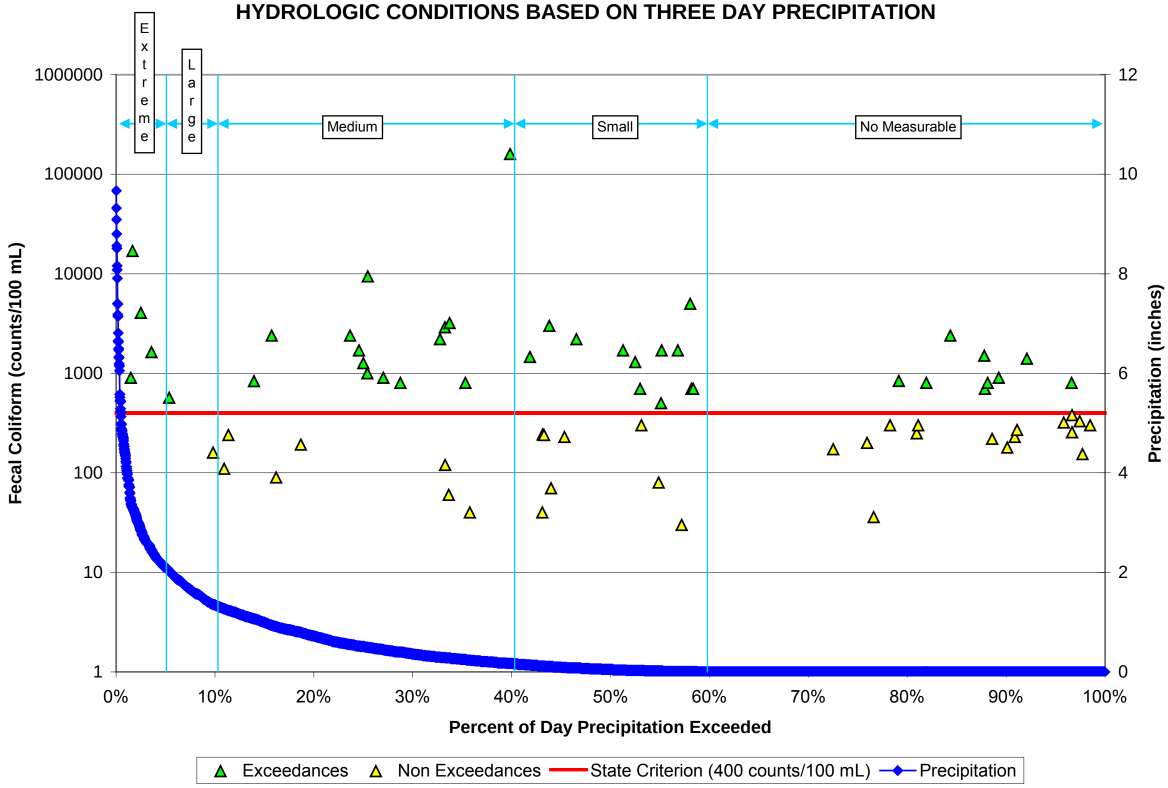


Figure 5.6. Fecal Coliform by Hydrologic Flow Condition for the Trout River, WBID 2203



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:

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

wastewater **NPDES Stormwater**

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 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 Trout River is expressed in terms of both counts/100mL and percent reduction, and represents the maximum daily fecal coliform load the creek can assimilate and maintain the fecal coliform criterion (**Table 6.1**). Since the TMDL is a percent reduction, the reduction can be applied on a daily basis.

Table 6.1. TMDL Components for the Trout River, WBIDs 2203A and 2203

WBID	Parameter	TMDL (counts/100mL)	WLA		LA (% reduction)	MOS
			Wastewater (counts/day)	NPDES Stormwater		
2203A	Fecal Coliform	400	N/A	60%	60%	Implicit
2203	Fecal Coliform	400	N/A	66%	66%	Implicit

6.2 Load Allocation

A fecal coliform reduction of 60 percent is required in WBID 2203A and a reduction of 66 percent is required in WBID 2203 from nonpoint sources. It should be noted that the load allocation includes loading from stormwater discharges that are not part of the NPDES Stormwater Program.

6.3 Wasteload Allocation

6.3.1 NPDES Wastewater Discharges

While there are currently no permitted facilities in either of these Trout River WBIDs that require fecal coliform monitoring, any facilities seeking an NPDES permit to discharge to the Trout River in the future will be required to meet the limits set forth in their perspective permit. For fecal coliform, discharge concentrations must not exceed 200 counts/100mL as a monthly average, 400 counts/100mL in more than 10 percent of the samples, or 800 counts/100mL at any given time. Permitted limits must meet TMDL requirements and will therefore protect water quality.

6.3.2 NPDES Stormwater Discharges

The WLA for the city of Jacksonville and FDOT’s MS4 permit is a 60 percent reduction in current anthropogenic fecal coliform loading in WBID 2203A, and a 66 percent reduction in WBID 2203. 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 are expressed as the percent reductions 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 and total coliform concentrations. However, it is not the intent of this TMDL to abate natural background conditions.

6.4 Margin of Safety

Consistent with the recommendations of the Allocation Technical Advisory Committee (Department, 2001), an implicit MOS was assumed in the development of this TMDL by not allowing any exceedances of the state criterion, even though the actual criterion allows for 10 percent exceedances over the fecal coliform criterion of 400 counts/100mL. In addition, a fecal coliform TMDL for Block House Creek, a tributary to Trout River requires an 82 percent reduction has been adopted concurrent with the Trout River TMDL.

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, or BMAP, for the TMDL. The first BMAP for the tributaries to the Lower St. Johns River will address the 10 worst-case impairments in the 55 tributaries impaired for fecal coliform. Any future BMAPs will address additional subsets of the tributaries listed for fecal coliform.

In addition to addressing failing septic tanks, the BMAP may include some sort of public education program about pet waste cleanup. As **Table 4.4** shows, potential impacts from dogs in the watershed could be significant. If pet owners are educated on the potential impacts their pets are having on the Trout River, and they are inclined to take action, this could potentially decrease a source load. When considering the significance of seven-day rainfall, this could be a potentially significant load to the stream.

Through the implementation of projects, activities, and additional source assessments in the BMAP, stakeholders expect the following outcomes:

Improved water quality trends in the tributaries of the Lower St. Johns River, which will also help improve water quality in the main stem of the river;

Decreased loading of the target pollutant (fecal coliform);

Enhanced public awareness of pollutant sources, pollutant impacts on water quality, and corresponding corrective actions;

Enhanced understanding of basin hydrology, water quality, and pollutant sources; and

The ability to evaluate management actions, estimate their benefits, and identify additional pollutant sources.

7.1.1 Determination of Worst-Case WBIDs

The initial determination of the worst-case WBIDs uses a ranking method that establishes the severity of bacterial contamination based on the number of exceedances of fecal coliform colony counts—i.e., the number of total fecal coliform samples in a waterbody during the period of record to indicate how many samples are over 800, 5,000, and 10,000 colony counts. A combined rank is then created based on the number of exceedances in each category. The WBIDs are sorted from worst to best to provide a guideline for assessment priorities, with the worst-case waterbody ranked first. Future BMAPs will continue to address the worst-case waters first, using the ranking method.

7.1.2 Identification of Probable Sources

Tributary Pollutant Assessment Project

Initial sampling for the study on the six initial WBIDs of highest concern began July 26, 2005, and was completed on February 1, 2006. The final deliverable (the *Tributary Pollutant Assessment Project Manual*) was submitted to JEA on June 1, 2006, and became available for public review and comment on June 16, 2006. Four types of fecal indicators (fecal coliform, *E. coli*., *Enterococci*, and coliphages) were studied. *Enterococcus faecalis* was also studied in an attempt to further identify potential sources of sewage, and samples were checked for human/ruminant primers.

The executive summary submitted to the Department by JEA and PBS&J is attached as **Appendix L**. The results of the study will be used to help guide the identification of restoration projects during BMAP development.

Technical Reports

In an effort to address the known impairments in the Lower St. Johns tributaries, the Department contracted with PBS&J to develop technical reports that describe and interpret the water quality, spatial, and geographic data from the Department, Duval County Health Department, city of Jacksonville, and JEA. The reports analyze the available data to identify the most probable sources of fecal coliform, which fall into five main categories, as follows: (1) stormwater, (2) onsite sewage treatment and disposal systems (OSTDS), (3) sewer infrastructure, (4) nonpoint sources such as pet waste, and (5) natural background such as wildlife. These reports were peer reviewed by technical stakeholders in the basin, who also provided additional input based on their knowledge of the tributaries.

7.1.3 Issues To Be Addressed in Future Watershed Management Cycles

The BMAP process identified the following items that should be addressed in future watershed management cycles to ensure that future BMAPs use the most accurate information:

> ***Source Identification—****Sources of fecal coliform impairment are particularly difficult to trace. For this reason, the BMAP includes source identification studies as management actions.*
>
> ***Septic Tanks—****The Department is implementing a study,* Evaluation of Septic Tank Influences on Nutrient Loading to the Lower St. Johns River Basin and Its Tributaries, *to better understand the nutrient and bacteria loading from septic tanks via ground water by monitoring conditions at representative sites. The study seeks to answer questions on potential OSTDS impacts and the attenuation of nitrogen, phosphorus, and bacteria (fecal coliform) by soil, under the range of conditions that represent typical OSTDS sites near impaired surface waters. It will also document the nutrients and bacteria in the receiving Lower St. Johns tributaries at each site. The results will provide information about the relative contribution of fecal coliform from septic tanks located near the impaired tributaries.*
>
> ***GIS Information—****During the BMAP process, the available GIS data, which provide a basis for some of the source analyses, have improved. As more information becomes available, the updated GIS database for the tributaries will be utilized to aid in source identification. This information will include determining the spatial locations for private wastewater systems and*

infrastructure, collecting jurisdictional or systemwide programs and activities on a WBID scale for future reporting and assessment, and systematically updating all GIS information databases used to compile the BMAP.

7.1.4 BMAP Implementation

The BMAP requires that all stakeholders implement their projects to achieve reductions as soon as practicable. However, the full implementation of the BMAP will be a long-term process. Some of the projects and activities in the BMAP are recently completed or currently ongoing, but several projects will require more time to design, secure funding, and construct. While funding the projects could be an issue, funding limitations do not affect the requirement that every entity must implement the activities listed in the BMAP.

Since BMAP implementation is a long-term process, the TMDL targets established for the Lower St. Johns Basin will not be achieved in the next five years. It may take even longer for the tributaries to respond to reduced loadings and fully meet applicable water quality standards. Regular follow-up and continued coordination and communication among the stakeholders will be essential to ensure the implementation of management strategies and the assessment of their incremental effects. Any additional management actions required to achieve TMDLs, if necessary, will be developed as part of BMAP follow-up.

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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 Chapter 62-40, F.A.C. In 1994, the Department's stormwater treatment requirements were integrated with the stormwater flood control requirements of the state's water management districts, along with wetland protection requirements, into the Environmental Resource Permit regulations

Chapter 62-40, F.A.C., also requires the water management districts to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a Surface Water Improvement and Management (SWIM) plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL.

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 Stormwater Permitting Program to designate certain stormwater discharges as "point sources" of pollution. The EPA promulgated regulations and began implementing the Phase I NPDES Stormwater Program in 1990. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific standard industrial classification (SIC) codes, construction sites disturbing 5 or more acres of land, and master drainage systems of local governments with a population above 100,000, which are better known as MS4s. However, because the master drainage systems of most local governments in Florida are interconnected, the EPA has implemented Phase 1 of the MS4 permitting program on a countywide basis, which brings in all cities (incorporated areas), Chapter 298 urban water control districts, and the FDOT throughout the 15 counties meeting the population criteria. The EPA authorized the Department to implement the NPDES Stormwater Program (except for tribal lands) in October 2000.

An important difference between the federal and state stormwater/environmental resource permitting programs is that the NPDES Program covers both new and existing discharges, while the state's program focuses on new discharges only. Additionally, Phase II of the NPDES Program, implemented in 2003, expands the need for these permits to construction sites between 1 and 5 acres, and to local governments with as few as 10,000 people. The revised rules require that these additional activities obtain permits by 2003. While these urban stormwater discharges are now technically referred to as "point sources" for the purpose of regulation, they are still diffuse sources of pollution that cannot be easily collected and treated by a central treatment facility, as are other point sources of pollution, such as domestic and industrial wastewater discharges. It should be noted that all MS4 permits issued in Florida include a reopener clause that allows permit revisions to implement TMDLs when the implementation plan is formally adopted.

Appendix B: Historical Fecal Coliform Observations in the Trout River, WBID 2203A

Sample Date	Station	Location	Value (#/100mL)	Remark Code
11/12/1996	21FLJXWQTR113	Trout River at Lem Turner Rd	0	
11/12/1996	21FLJXWQTR113	Trout River at Lem Turner Rd	80	
5/27/1998	21FLJXWQTR113	Trout River at Lem Turner Rd	220	
5/27/1998	21FLJXWQTR113	Trout River at Lem Turner Rd	220	
6/1/1998	21FLJXWQTR34	Highlands Creek at Broward Rd	300	
6/1/1998	21FLJXWQTR34	Highlands Creek at Broward Rd	300	
7/27/1998	21FLJXWQTR113	Trout River at Lem Turner Rd	500	
7/27/1998	21FLJXWQTR113	Trout River at Lem Turner Rd	500	
7/27/1998	21FLJXWQTR34	Highlands Creek at Broward Rd	40	
7/27/1998	21FLJXWQTR34	Highlands Creek at Broward Rd	40	
10/14/1998	21FLJXWQTR34	Highlands Creek at Broward Rd	9,000	
10/14/1998	21FLJXWQTR34	Highlands Creek at Broward Rd	9,000	
10/21/1998	21FLJXWQTR113	Trout River at Lem Turner Rd	170	
10/21/1998	21FLJXWQTR113	Trout River at Lem Turner Rd	170	
1/13/1999	21FLJXWQTR113	Trout River at Lem Turner Rd	20	U
1/13/1999	21FLJXWQTR113	Trout River at Lem Turner Rd	20	K
1/13/1999	21FLJXWQTR34	Highlands Creek at Broward Rd	500	
1/13/1999	21FLJXWQTR34	Highlands Creek at Broward Rd	500	
4/28/1999	21FLJXWQTR113	Trout River at Lem Turner Rd	230	
4/28/1999	21FLJXWQTR34	Highlands Creek at Broward Rd	2,400	
4/28/1999	21FLJXWQTR34	Highlands Creek at Broward Rd	2,400	
4/28/1999	21FLJXWQTR113	Trout River at Lem Turner Rd	230	
8/23/1999	21FLJXWQTR34	Highlands Creek at Broward Rd	1,100	
8/23/1999	21FLJXWQTR34	Highlands Creek at Broward Rd	1,100	
8/23/1999	21FLJXWQTR113	Trout River at Lem Turner Rd	130	
8/23/1999	21FLJXWQTR113	Trout River at Lem Turner Rd	130	
10/11/1999	21FLJXWQTR34	Highlands Creek at Broward Rd	300	
10/11/1999	21FLJXWQTR113	Trout River at Lem Turner Rd	70	
10/11/1999	21FLJXWQTR113	Trout River at Lem Turner Rd	70	
10/11/1999	21FLJXWQTR34	Highlands Creek at Broward Rd	300	
1/26/2000	21FLJXWQTR34	Highlands Creek at Broward Rd	3,000	
1/26/2000	21FLJXWQTR113	Trout River at Lem Turner Rd	1,700	
1/26/2000	21FLJXWQTR113	Trout River at Lem Turner Rd	1,700	
1/26/2000	21FLJXWQTR34	Highlands Creek at Broward Rd	3,000	
4/18/2000	21FLJXWQTR113	Trout River at Lem Turner Rd	40	
4/18/2000	21FLJXWQTR34	Highlands Creek at Broward Rd	170	
4/18/2000	21FLJXWQTR34	Highlands Creek at Broward Rd	170	
4/18/2000	21FLJXWQTR113	Trout River at Lem Turner Rd	40	
7/5/2000	21FLJXWQTR113	Trout River at Lem Turner Rd	170	
7/5/2000	21FLJXWQTR113	Trout River at Lem Turner Rd	170	
9/21/2000	21FLJXWQTR34	Highlands Creek at Broward Rd	100	
9/21/2000	21FLJXWQTR34	Highlands Creek at Broward Rd	100	

Sample Date	Station	Location	Value (#/100mL)	Remark Code
12/6/2000	21FLJXWQTR34	Highlands Creek at Broward Rd	500	
12/6/2000	21FLJXWQTR34	Highlands Creek at Broward Rd	500	
3/7/2001	21FLJXWQTR113	Trout River at Lem Turner Rd	70	
3/7/2001	21FLJXWQTR113	Trout River at Lem Turner Rd	70	
3/7/2001	21FLJXWQTR34	Highlands Creek at Broward Rd	170	
3/7/2001	21FLJXWQTR34	Highlands Creek at Broward Rd	170	
6/20/2001	21FLJXWQTR34	Highlands Creek at Broward Rd	800	
6/20/2001	21FLJXWQTR34	Highlands Creek at Broward Rd	800	P
6/20/2001	21FLJXWQTR113	Trout River at Lem Turner Rd	20	
6/20/2001	21FLJXWQTR113	Trout River at Lem Turner Rd	20	P
8/28/2001	21FLJXWQTR113	Trout River at Lem Turner Rd	20	
8/28/2001	21FLJXWQTR34	Highlands Creek at Broward Rd	170	
8/28/2001	21FLJXWQTR113	Trout River at Lem Turner Rd	20	
8/28/2001	21FLJXWQTR34	Highlands Creek at Broward Rd	170	
12/17/2001	21FLJXWQTR113	Trout River at Lem Turner Rd	140	
12/17/2001	21FLJXWQTR34	Highlands Creek at Broward Rd	440	
12/17/2001	21FLJXWQTR113	Trout River at Lem Turner Rd	140	
12/17/2001	21FLJXWQTR34	Highlands Creek at Broward Rd	440	
3/27/2002	21FLJXWQTR34	Highlands Creek at Broward Rd	156	
5/30/2002	21FLJXWQTR34	Highlands Creek at Broward Rd	176	
8/12/2002	21FLJXWQTR34	Highlands Creek at Broward Rd	56	
12/5/2002	21FLA 20030121	Trout R @ I 95 Burt Maxwell Park Dock	145	
12/5/2002	21FLJXWQTR34	Highlands Creek at Broward Rd	177	
3/13/2003	21FLJXWQTR34	Highlands Creek at Broward Rd	190	
3/13/2003	21FLJXWQTR113	Trout River at Lem Turner Rd	180	
6/25/2003	21FLJXWQTR113	Trout River at Lem Turner Rd	200	
6/25/2003	21FLJXWQTR34	Highlands Creek at Broward Rd	70	
9/29/2003	21FLJXWQTR113	Trout River at Lem Turner Rd	40	
9/29/2003	21FLJXWQTR34	Highlands Creek at Broward Rd	600	
12/2/2003	21FLJXWQTR113	Trout River at Lem Turner Rd	80	
12/2/2003	21FLJXWQTR34	Highlands Creek at Broward Rd	40	
3/3/2004	21FLJXWQTR113A	Trout River at Bert Maxwell Boat Ramp	110	
3/3/2004	21FLJXWQTR34	Highlands Creek at Broward Rd	500	
6/23/2004	21FLJXWQTR113	Trout River at Lem Turner Rd	320	
6/23/2004	21FLJXWQTR34	Highlands Creek at Broward Rd	1,000	
7/28/2004	21FLA 20030121	Trout R @ I 95 Burt Maxwell Park Dock	2,200	
9/23/2004	21FLJXWQTR113A	Trout River at Bert Maxwell Boat Ramp	2,500	Q
9/23/2004	21FLJXWQTR34	Highlands Creek at Broward Rd	1,500	Q
12/1/2004	21FLJXWQTR113A	Trout River at Bert Maxwell Boat Ramp	170	
12/1/2004	21FLJXWQTR34	Highlands Creek at Broward Rd	170	
3/21/2005	21FLJXWQTR113A	Trout River at Bert Maxwell Boat Ramp	40	Q
3/21/2005	21FLJXWQTR34	Highlands Creek at Broward Rd	1,700	Q
6/21/2005	21FLJXWQTR113A	Trout River at Bert Maxwell Boat Ramp	90	
6/21/2005	21FLJXWQTR34	Highlands Creek at Broward Rd	80	
9/20/2005	21FLJXWQTR113A	Trout River at Bert Maxwell Boat Ramp	20	U
9/20/2005	21FLJXWQTR34	Highlands Creek at Broward Rd	120	

Sample Date	Station	Location	Value (#/100mL)	Remark Code
12/5/2005	21FLJXWQTR34	Highlands Creek at Broward Rd	170	
12/5/2005	21FLJXWQTR113A	Trout River at Bert Maxwell Boat Ramp	40	
1/10/2006	21FLJXWQTR113A	Trout River at Bert Maxwell Boat Ramp	40	Q
1/10/2006	21FLJXWQTR34	Highlands Creek at Broward Rd	330	Q
6/13/2006	21FLJXWQTR113A	Trout River at Bert Maxwell Boat Ramp	2,400	
6/13/2006	21FLJXWQTR34	Highlands Creek at Broward Rd	1,700	
7/17/2006	21FLJXWQTR34	Highlands Creek at Broward Rd	2,200	
7/17/2006	21FLJXWQTR113A	Trout River at Bert Maxwell Boat Ramp	80	
11/8/2006	21FLJXWQTR34	Highlands Creek at Broward Rd	280	B
11/8/2006	21FLJXWQTR113A	Trout River at Bert Maxwell Boat Ramp	20	B
11/14/2006	21FLA 20030116	Trout River at US 17	4	B
11/14/2006	21FLA 20030121	Trout R @ I 95 Burt Maxwell Park Dock	12	B
2/20/2007	21FLA 20030121	Trout R @ I 95 Burt Maxwell Park Dock	40	B
2/20/2007	21FLA 20030113	Trout R @ Lem Turner Rd	15	B
3/19/2007	21FLJXWQTR113A	Trout River at Bert Maxwell Boat Ramp	20	K
3/19/2007	21FLJXWQTR34	Highlands Creek at Broward Rd	300	
3/20/2007	21FLA 20030121	Trout R @ I 95 Burt Maxwell Park Dock	7	U
3/20/2007	21FLA 20030116	Trout River at US 17	7	B
4/16/2007	21FLJXWQTR113A	Trout River at Bert Maxwell Boat Ramp	40	
4/16/2007	21FLJXWQTR34	Highlands Creek at Broward Rd	500	
4/17/2007	21FLA 20030116	Trout River at US 17	8	U
4/17/2007	21FLA 20030121	Trout R @ I 95 Burt Maxwell Park Dock	8	U
7/17/2007	21FLA 20030116	Trout River at US 17	7	A
7/18/2007	21FLA 20030121	Trout R @ I 95 Burt Maxwell Park Dock	173	A
8/13/2007	21FLJXWQTR113A	Trout River at Bert Maxwell Boat Ramp	80	
8/13/2007	21FLJXWQTR34	Highlands Creek at Broward Rd	40	
8/22/2007	21FLA 20030116	Trout River at US 17	9	A
8/22/2007	21FLA 20030121	Trout R @ I 95 Burt Maxwell Park Dock	9	A
9/18/2007	21FLA 20030116	Trout River at US 17	218	A
9/18/2007	21FLA 20030121	Trout R @ I 95 Burt Maxwell Park Dock	200	A
11/6/2007	21FLA 20030116	Trout River at US 17	9	A
11/6/2007	21FLA 20030121	Trout R @ I 95 Burt Maxwell Park Dock	673	A
12/11/2007	21FLJXWQTR113A	Trout River at Bert Maxwell Boat Ramp	20	L
12/11/2007	21FLJXWQTR34	Highlands Creek at Broward Rd	80	Q

Shaded cells represent values that exceed 400 counts/100mL.

Remark Code:

A	Value reported is the mean of two or more determinations.
B	Results based on colony counts outside the acceptable range.
K	Off-scale low. Actual value not known, but known to be less than value shown.
L	Off-scale high. Actual value not known, but known to be greater than value shown.
P	Too numerous to count.
Q	Sample held beyond normal holding time.
U	Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use. In the case of species, undetermined sex.

Appendix C: Historical Fecal Coliform Observations in the Trout River, WBID 2203

Sample Date	Station	Location	Value (#/100mL)	Remark Code
11/12/1996	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	5,000	
5/27/1998	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	2,400	
7/27/1998	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	160,000	L
10/19/1998	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	1,700	
1/20/1999	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	3,000	
4/21/1999	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	300	
8/25/1999	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	1,300	
10/19/1999	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	230	
1/31/2000	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	1,700	
4/26/2000	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	90	
5/25/2000	21FLA 20030123	Trout R US 1 off Perrets Dairy	250	
9/12/2000	21FLA 20030123	Trout R US 1 off Perrets Dairy	30	
9/21/2000	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	1,000	
12/5/2000	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	800	
1/31/2001	21FLA 20030123	Trout R US 1 off Perrets Dairy	60	
3/7/2001	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	800	
6/19/2001	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	800	
8/29/2001	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	1,700	
12/20/2001	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	2,200	
3/27/2002	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	40	
5/30/2002	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	256	
8/12/2002	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	244	
12/5/2002	21FLA 20030123	Trout R US 1 off Perrets Dairy	1,267	
12/5/2002	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	1,267	
3/13/2003	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	110	
4/22/2003	21FLJXWQTREE10	Trout River at Old Kings Road	700	
4/22/2003	21FLJXWQTREE10	Trout River at Old Kings Road	700	
6/25/2003	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	380	
7/8/2003	21FLJXWQTREE10	Trout River at Old Kings Road	700	
7/8/2003	21FLJXWQTREE10	Trout River at Old Kings Road	700	Q
8/5/2003	21FLJXWQTREE10	Trout River at Old Kings Road	3,200	
8/5/2003	21FLJXWQTREE10	Trout River at Old Kings Road	3,200	Q
9/10/2003	21FLJXWQTREE10	Trout River at Old Kings Road	80	Q
9/10/2003	21FLJXWQTREE10	Trout River at Old Kings Road	80	
9/29/2003	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	2,400	
11/18/2003	21FLJXWQTREE10	Trout River at Old Kings Road	220	
11/18/2003	21FLJXWQTREE10	Trout River at Old Kings Road	220	
12/15/2003	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	900	
2/18/2004	21FLJXWQTREE10	Trout River at Old Kings Road	300	
3/3/2004	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	230	
5/25/2004	21FLJXWQTREE10	Trout River at Old Kings Road	180	

Sample Date	Station	Location	Value (#/100mL)	Remark Code
5/25/2004	21FLJXWQTREE10	Trout River at Old Kings Road	180	Q
6/23/2004	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	900	
7/28/2004	21FLA 20030753	Trout River at Old Kings Road	300	B
8/3/2004	21FLJXWQTREE10	Trout River at Old Kings Road	240	
8/3/2004	21FLJXWQTREE10	Trout River at Old Kings Road	240	Q
8/24/2004	21FLJXWQTREE10	Trout River at Old Kings Road	240	
9/23/2004	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	2,900	Q
9/29/2004	21FLJXWQTREE10	Trout River at Old Kings Road	70	
12/29/2004	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	270	
12/29/2004	21FLJXWQTREE10	Trout River at Old Kings Road	270	
3/23/2005	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	2,400	
3/23/2005	21FLJXWQTREE10	Trout River at Old Kings Road	700	
4/26/2005	21FLJXWQTREE10	Trout River at Old Kings Road	120	
6/2/2005	21FLJXWQTREE10	Trout River at Old Kings Road	40	
6/22/2005	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	1,400	
6/22/2005	21FLJXWQTREE10	Trout River at Old Kings Road	1,100	
7/12/2005	21FLJXWQTREE10	Trout River at Old Kings Road	1,635	
8/23/2005	21FLJXWQTREE10	Trout River at Old Kings Road	1,460	
9/6/2005	21FLJXWQTREE10	Trout River at Old Kings Road	570	
9/20/2005	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	840	
9/20/2005	21FLJXWQTREE10	Trout River at Old Kings Road	640	
9/21/2005	21FLGW 27947	SJ2-SS-2046 Trout River	836	B
12/5/2005	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	800	
12/5/2005	21FLJXWQTREE10	Trout River at Old Kings Road	90	
1/24/2006	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	700	
1/24/2006	21FLJXWQTREE10	Trout River at Old Kings Road	700	
6/14/2006	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	17,000	
6/14/2006	21FLJXWQTREE10	Trout River at Old Kings Road	1,300	
7/17/2006	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	500	
7/17/2006	21FLJXWQTREE10	Trout River at Old Kings Road	110	
11/14/2006	21FLA 20030123	Trout R US 1 off Perrets Dairy	700	
12/7/2006	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	320	
12/7/2006	21FLJXWQTREE10	Trout River at Old Kings Road	364	
2/20/2007	21FLA 20030047	Trout R @ End of Colorado Springs Rd	1,500	
2/20/2007	21FLA 20030123	Trout R US 1 off Perrets Dairy	477	A
2/20/2007	21FLA 20030753	Trout River at Old Kings Road	1,100	
3/12/2007	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	800	
3/12/2007	21FLJXWQTREE10	Trout River at Old Kings Road	800	
3/20/2007	21FLA 20030047	Trout R @ End of Colorado Springs Rd	173	
3/20/2007	21FLA 20030123	Trout R US 1 off Perrets Dairy	756	A
3/20/2007	21FLA 20030753	Trout River at Old Kings Road	100	B
4/17/2007	21FLA 20030047	Trout R @ End of Colorado Springs Rd	192	
4/17/2007	21FLA 20030123	Trout R US 1 off Perrets Dairy	511	A
4/17/2007	21FLA 20030753	Trout River at Old Kings Road	216	
6/11/2007	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	1,700	

Sample Date	Station	Location	Value (#/100mL)	Remark Code
6/11/2007	21FLJXWQTREE10	Trout River at Old Kings Road	80	
6/25/2007	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	330	
6/25/2007	21FLJXWQTREE10	Trout River at Old Kings Road	20	
7/17/2007	21FLA 20030047	Trout R @ End of Colorado Springs Rd	160	
7/17/2007	21FLA 20030123	Trout R US 1 off Perrets Dairy	1,000	B
7/17/2007	21FLA 20030753	Trout River at Old Kings Road	118	A
7/17/2007	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	900	
7/17/2007	21FLJXWQTREE10	Trout River at Old Kings Road	40	
7/24/2007	21FLJXWQTREE10	Trout River at Old Kings Road	4,050	Q
8/13/2007	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	900	
8/21/2007	21FLA 20030047	Trout R @ End of Colorado Springs Rd	154	A
8/21/2007	21FLA 20030123	Trout R US 1 off Perrets Dairy	300	
8/21/2007	21FLJXWQTREE10	Trout River at Old Kings Road	100	Q
8/22/2007	21FLA 20030753	Trout River at Old Kings Road	200	
8/27/2007	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	2,200	
9/18/2007	21FLA 20030047	Trout R @ End of Colorado Springs Rd	9,400	
9/18/2007	21FLA 20030123	Trout R US 1 off Perrets Dairy	345	A
9/18/2007	21FLA 20030753	Trout River at Old Kings Road	8,800	
11/6/2007	21FLA 20030047	Trout R @ End of Colorado Springs Rd	36	A
11/6/2007	21FLA 20030123	Trout R US 1 off Perrets Dairy	550	
11/6/2007	21FLA 20030753	Trout River at Old Kings Road	91	A
12/11/2007	21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier	300	Q
12/11/2007	21FLJXWQTREE10	Trout River at Old Kings Road	230	Q

	Shaded cells represent values that exceed 400 counts/100mL.

Remark Code:

A	Value reported is the mean of two or more determinations.
B	Results based on colony counts outside the acceptable range.
C	Calculated. Value stored was not measured directly, but was calculated from other data available.
L	Off-scale high. Actual value not known, but known to be greater than value shown.
Q	Sample held beyond normal holding time.

Appendix D: Kruskal–Wallis Analysis of Fecal Coliform Observations versus Season in the Trout River, WBIDs 2203A and 2203

WBID 2203A

Group	Count	Rank Sum
Fall	26	1563.500
Spring	30	1756.000
Summer	38	2369.000
Winter	28	1814.500

Kruskal-Wallis Test Statistic = 0.518
Probability is 0.915 assuming Chi-square distribution with 3 df

WBID 2203

Group	Count	Rank Sum
Fall	23	1251.500
Spring	24	1058.500
Summer	40	2350.500
Winter	22	1334.500

Kruskal-Wallis Test Statistic = 4.135
Probability is 0.247 assuming Chi-square distribution with 3 df

Appendix E: Kruskal–Wallis Analysis of Fecal Coliform Observations versus Month in the Trout River, WBIDs 2203A and 2203

WBID 2203A

Group	Count	Rank Sum
January	10	806.5
February	2	40.5
March	15	807
April	12	718
May	3	231
June	14	1039.5
July	11	723.5
August	13	606
September	10	675.5
October	8	619
November	8	269
December	16	967.5

Kruskal-Wallis Test Statistic = 18.202

Probability is 0.077 assuming Chi-square distribution with 11 df

WBID 2203

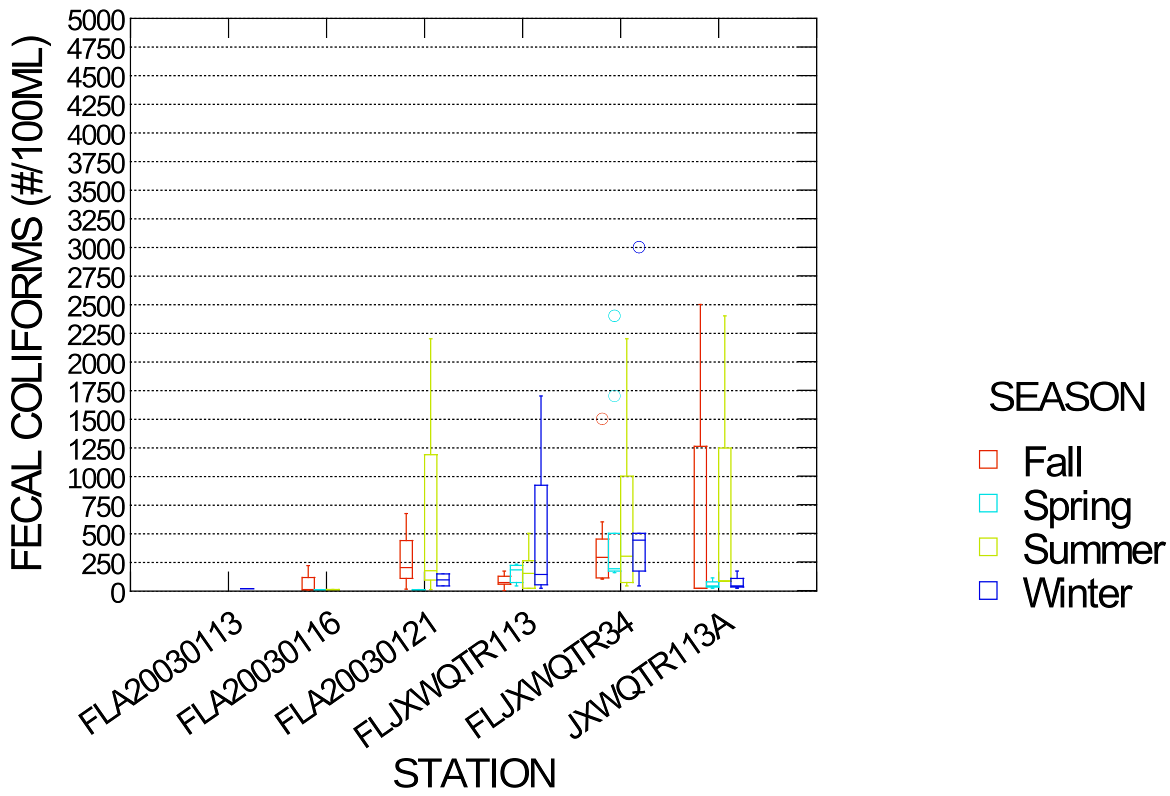
Group	Count	Rank Sum
January	5	323.5
February	4	266.5
March	11	527
April	8	307.5
May	5	224
June	12	715.5
July	13	742.5
August	15	892.5
September	14	829.5
October	2	124.5
November	7	297.5
December	13	744.5

Kruskal-Wallis Test Statistic = 6.427

Probability is 0.843 assuming Chi-square distribution with 11 df

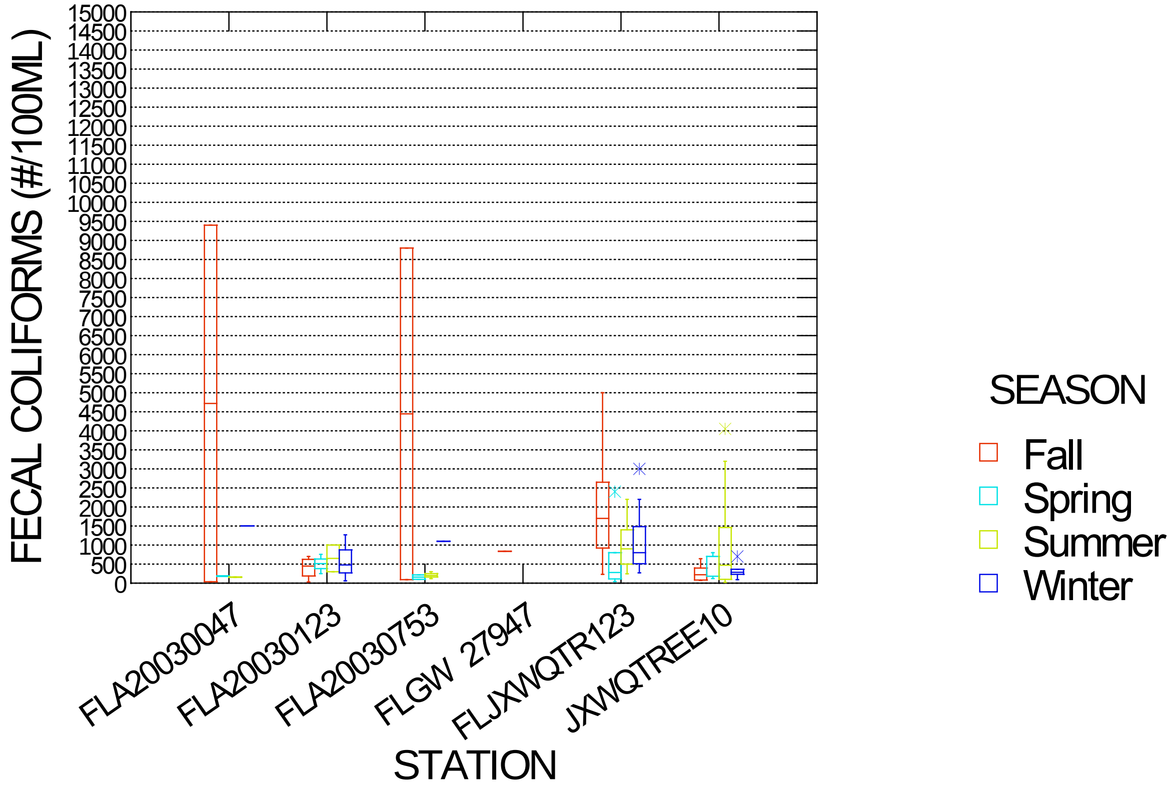
Appendix F: Chart of Fecal Coliform Observations by Season and Station in the Trout River, WBIDs 2203A and 2203

WBID 2203A



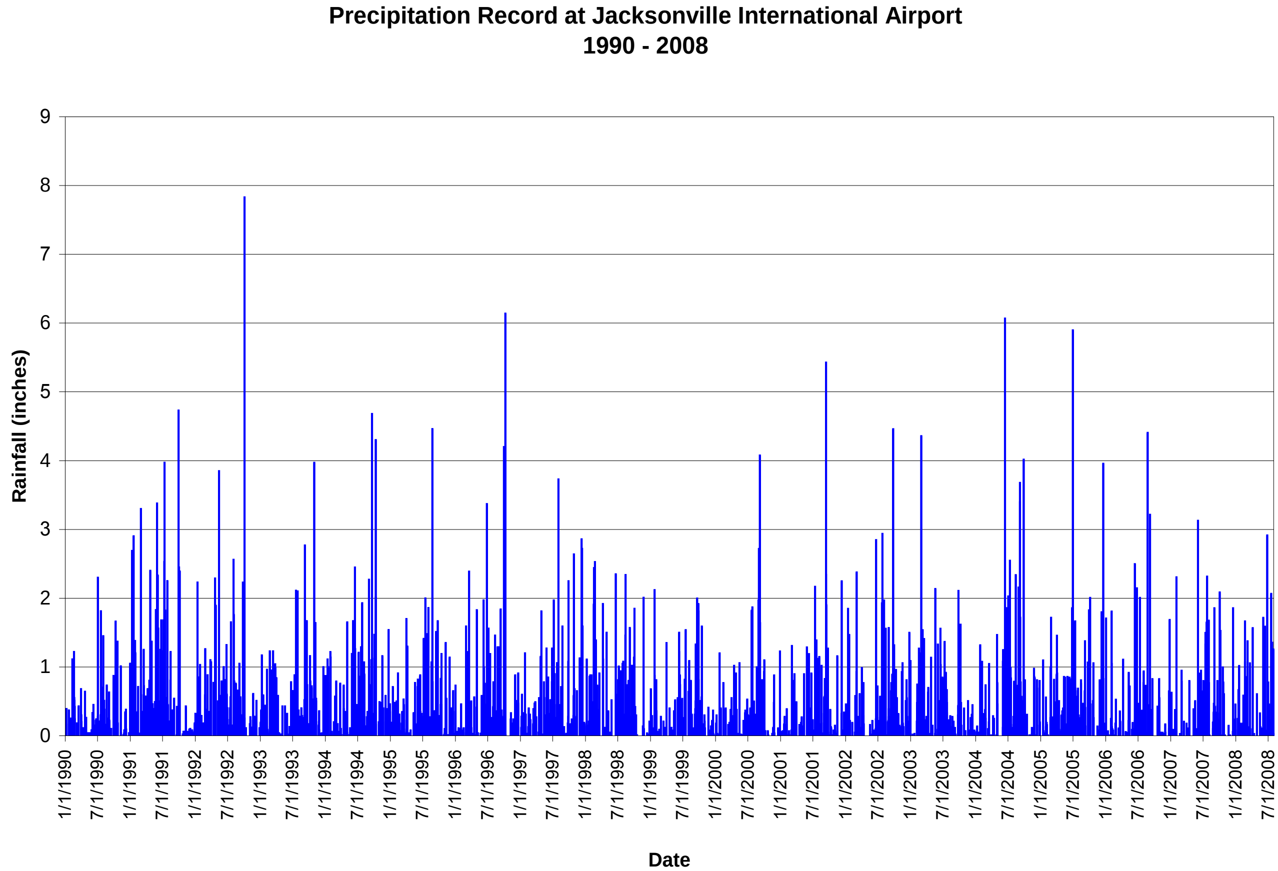
STORET ID	Station
21FLA 20030113	Trout R @ Lem Turner Rd
21FLA 20030116	Trout River at US 17
21FLA 20030121	Trout R @ I 95 Burt Maxwell Park Dock
21FLJXWQTR113	Trout River at Lem Turner Rd
21FLJXWQTR113A	Trout River at Bert Maxwell Boat Ramp
21FLJXWQTR34	Highlands Creek at Broward Rd

WBID 2203



STORET ID	Station
21FLA 20030047	Trout R US 1 off Perrets Dairy
21FLA 20030123	Trout R US 1 off Perrets Dairy
21FLA 20030753	Trout River at Old Kings Rd
21FLGW 27947	SJ2-SS-2046 Trout River
21FLJXWQTR123	Trout River at U.S. 1 at Boat Ramp Pier
21FLJXWQTREE10	Trout River at Old Kings Road

Appendix G: Chart of Rainfall for JIA, 1990–2008



Appendix H: Spearman Correlation Matrix Analysis for Precipitation and Fecal Coliform in the Trout River, WBIDs 2203A and 2203

WBID 2203A

	YEAR	MONTH	FECALS	V1DAYPRECIP	V3DAYPRECIP	V7DAYPRECIP	CUMULATIVET
YEAR	1						
MONTH	0.001	1					
FECALS	-0.306	-0.074	1				
V1DAYPRECIP	0.102	-0.01	0.166	1			
V3DAYPRECIP	0.01	-0.037	0.289	0.533	1		
V7DAYPRECIP	0.068	-0.34	0.194	0.169	0.401	1	
CUMULATIVET	-0.042	-0.021	0.111	0.199	0.247	0.285	1

WBID 2203

	YEAR	MONTH	FECALS	V1DAYPRECIP	V3DAYPRECIP	V7DAYPRECIP	CUMULATIVET
YEAR	1						
MONTH	-0.079	1					
FECALS	-0.154	0.033	1				
V1DAYPRECIP	-0.008	0.048	0.139	1			
V3DAYPRECIP	-0.059	-0.063	0.215	0.585	1		
V7DAYPRECIP	-0.053	-0.058	0.046	0.401	0.656	1	
CUMULATIVET	0.012	0.072	0.084	0.327	0.406	0.528	1

Appendix I: Analysis of Fecal Coliform Observations and Precipitation in the Trout River, WBIDs 2203A and 2203

FECAL COLIFORM DATA VERSUS DAY OF SAMPLING PRECIPITATION

WBID 2203A

Multiple R: 0.096 Squared multiple R: 0.009
Adjusted squared multiple R: 0.000 Standard error of estimate: 1348.421

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	569.041	133.996	0	.	4.247	0
V1DAYPRECIP	335.717	336.823	0.096	1	0.997	0.321

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	1806319.8	1	1806319.8	0.993	0.321
Residual	1.95E+08	107	1818240.3		

Durbin-Watson D Statistic 1.091
First Order Autocorrelation 0.453

WBID 2203

Durbin-Watson D Statistic 2.189
First Order Autocorrelation -0.099

Multiple R: 0.005 Squared multiple R: 0.000
Adjusted squared multiple R: 0.000 Standard error of estimate: 15435.477

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	2593.168	1574.573	0	.	1.647	0.103
V1DAYPRECIP	-235.604	4143.705	-0.005	1	-0.057	0.955

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	770244.01	1	770244.01	0.003	0.955
Residual	2.55E+10	107	2.38E+08		

Durbin-Watson D Statistic 1.993
First Order Autocorrelation 0.003

FECAL COLIFORM DATA VERSUS DAY OF SAMPLING AND 2 DAYS PRIOR PRECIPITATION

WBID 2203A

Multiple R: 0.138 Squared multiple R: 0.019
Adjusted squared multiple R: 0.010 Standard error of estimate: 1341.616

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	528.616	138.832	0	.	3.808	0
V3DAYPRECIP	304.106	210.264	0.138	1	1.446	0.151

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	3765111.2	1	3765111.2	2.092	0.151
Residual	1.93E+08	107	1799933.8		

Durbin-Watson D Statistic 1.107
First Order Autocorrelation 0.444

WBID 2203

Multiple R: 0.022 Squared multiple R: 0.001
Adjusted squared multiple R: 0.000 Standard error of estimate: 15431.841

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	2380.857	1672.924	0	.	1.423	0.158
V3DAYPRECIP	472.525	2039.71	0.022	1	0.232	0.817

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	1.28E+07	1	1.28E+07	0.054	0.817
Residual	2.55E+10	107	2.38E+08		

Durbin-Watson D Statistic 1.994
First Order Autocorrelation 0.003

FECAL COLIFORM DATA VERSUS DAY OF SAMPLING AND 6 DAYS PRIOR PRECIPITATION

WBID 2203A

Multiple R: 0.060   Squared multiple R: 0.004
Adjusted squared multiple R: 0.000   Standard error of estimate: 1352.225

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	541.219	164.82	0	.	3.284	0.001
V7DAYPRECIP	84.673	136.144	0.06	1	0.622	0.535

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	707280.38	1	707280.38	0.387	0.535
Residual	1.96E+08	107	1828511.7		

Durbin-Watson D Statistic 1.085
First Order Autocorrelation 0.456

WBID 2203

Dep Var: FECALS   N: 109   Multiple R: 0.028   Squared multiple R: 0.001
Adjusted squared multiple R: 0.000   Standard error of estimate: 15429.757

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	2869.373	1823.573	0	.	1.573	0.119
V7DAYPRECIP	-341.049	1186.736	-0.028	1	-0.287	0.774

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	1.97E+07	1	1.97E+07	0.083	0.774
Residual	2.55E+10	107	2.38E+08		

Durbin-Watson D Statistic 1.998
First Order Autocorrelation 0.001

FECAL COLIFORM DATA VERSUS DAY OF SAMPLING AND 29 DAYS PRIOR PRECIPITATION

WBID 2203A

Dep Var: FECALS N: 122 Multiple R: 0.029 Squared multiple R: 0.001
Adjusted squared multiple R: 0.000 Standard error of estimate: 1288.897

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	506.202	186.063	0	.	2.721	0.007
CUMULATIVET	10.388	32.378	0.029	1	0.321	0.749

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	170989.41	1	170989.41	0.103	0.749
Residual	1.99E+08	120	1661255.9		

Durbin-Watson D Statistic 1.077
First Order Autocorrelation 0.460

WBID 2203

Multiple R: 0.066 Squared multiple R: 0.004
Adjusted squared multiple R: 0.000 Standard error of estimate: 15402.357

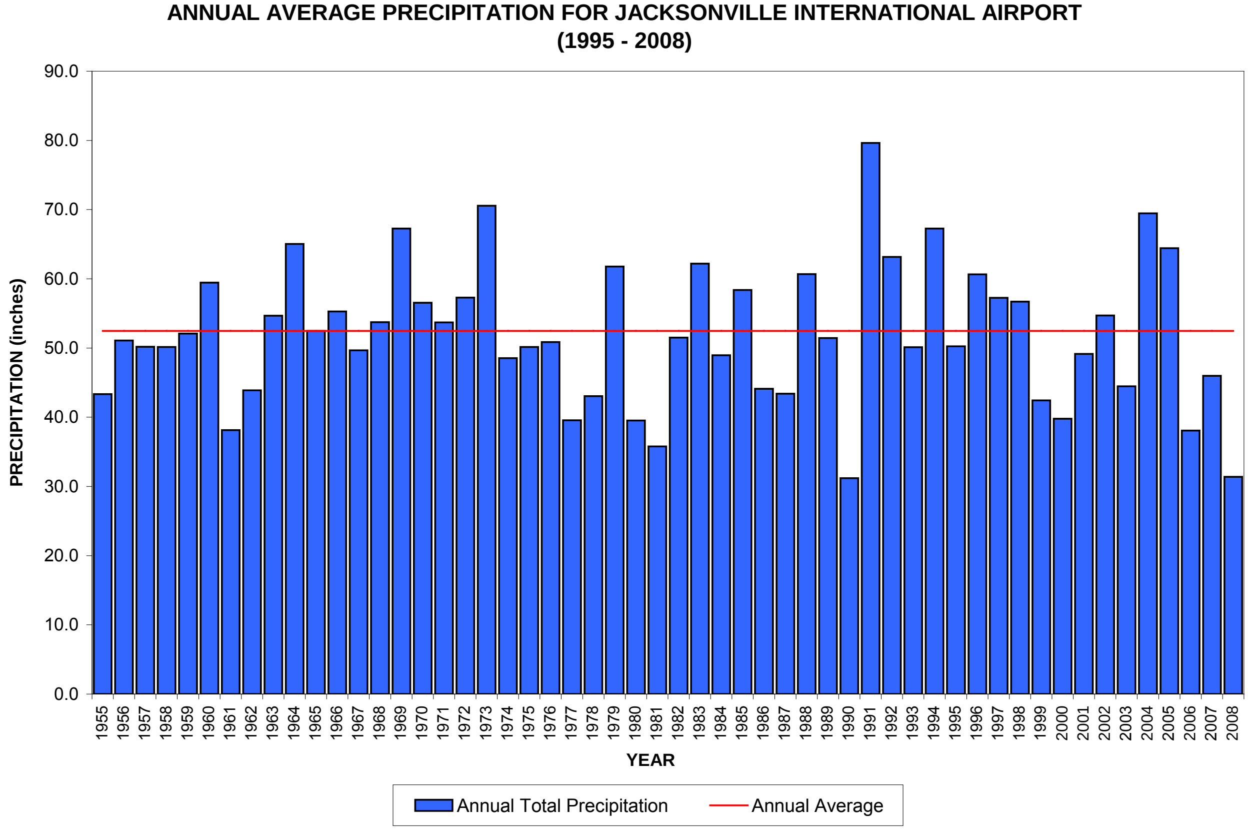
Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	1264.191	2410.222	0	.	0.525	0.601
CUMULATIVET	261.217	383.516	0.066	1	0.681	0.497

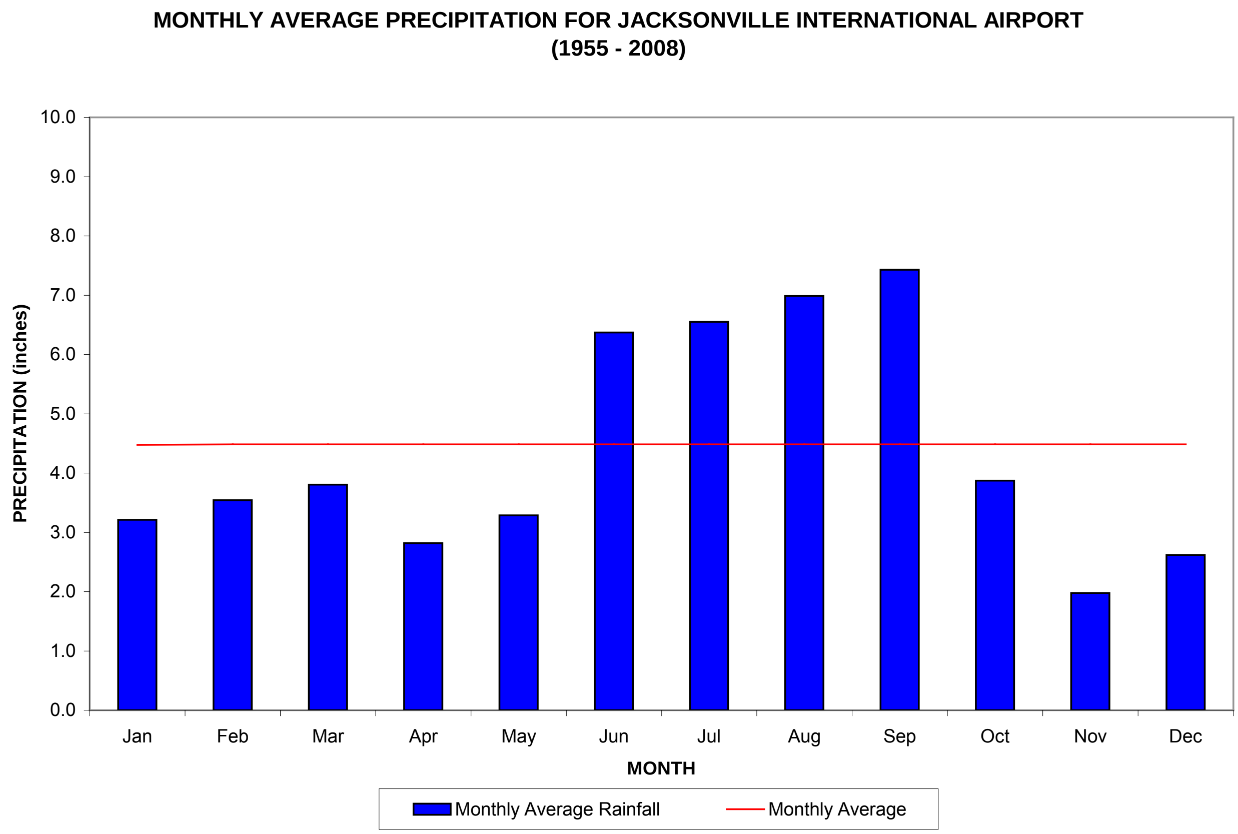
Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	1.10E+08	1	1.10E+08	0.464	0.497
Residual	2.54E+10	107	2.37E+08		

Durbin-Watson D Statistic 1.968
First Order Autocorrelation 0.016

Appendix J: Annual and Monthly Average Precipitation at JIA




MONTHLY AVERAGE PRECIPITATION FOR JACKSONVILLE INTERNATIONAL AIRPORT
(1955 - 2008)
PRECIPITATION (inches)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
MONTH
Monthly Average Rainfall
Monthly Average

Appendix K: Monthly and Annual Precipitation at JIA, 1955–2008

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
1955	3.1	2.46	1.66	1.5	4.51	2.7	5.53	3.85	10.6	5.36	1.9	0.2	**43.33**
1956	2.9	2.94	0.81	2.33	3.98	7.87	8.25	5.24	2.89	13.4	0.4	0	**51.08**
1957	0.3	1.69	3.87	1.61	5.25	7.1	12.3	3.3	8.33	3.5	1.6	1.3	**50.18**
1958	3.4	3.74	3.38	8.24	3.79	3.96	4.37	4.67	4.75	5.07	2	2.8	**50.14**
1959	3	5.22	9.75	2.65	9.2	2.94	4.51	2.86	5.67	3.12	2.2	1	**52.08**
1960	2.1	5.17	6.94	3.54	1.18	4.7	16.2	6.5	8.57	2.95	0.1	1.5	**59.45**
1961	2.9	4.85	1.17	4.16	3.06	5.27	3.48	10.6	1.02	0.27	0.9	0.5	**38.15**
1962	2.2	0.52	3.1	2.36	1.12	8.22	6.31	10.1	4.37	1.13	2.1	2.5	**43.9**
1963	5.4	6.93	2.23	1.75	1.74	12.5	6.47	4.95	4.88	1.53	2.7	3.6	**54.66**
1964	7.3	6.55	1.76	4.65	4.8	4.67	6.12	5.63	10.3	5.09	3.3	4.8	**65.03**
1965	0.7	5.5	3.91	0.95	0.94	9.79	2.71	9.58	11	1.75	1.9	3.8	**52.47**
1966	4.6	5.97	0.71	2.25	10.4	7.74	11.1	3.88	5.94	1.38	0.2	1.1	**55.3**
1967	3.1	4.35	0.81	2	1.18	12.9	5.22	12.3	1.8	1.13	0.2	4.7	**49.68**
1968	0.8	3.05	1.2	0.99	2.17	12.3	6.84	16.2	2.68	5.09	1.3	1.1	**53.72**
1969	0.8	3.39	4.23	0.34	3.78	5.12	5.89	15.1	10.3	9.81	4.6	3.9	**67.26**
1970	4.2	8.85	9.98	1.77	1.84	2.65	7.6	11	3.2	3.95	0	1.6	**56.55**
1971	2	2.55	2.41	4.07	1.9	5.52	5.07	12.8	4.17	6.46	0.8	5.9	**53.69**
1972	5.8	3.48	4.43	2.98	8.26	6.75	3.15	9.76	2.6	4.46	4.2	1.4	**57.29**
1973	4.6	5.07	10.2	11.6	5.33	4.1	5.45	7.49	7.86	4.08	0.4	4.3	**70.57**
1974	0.3	1.28	3.47	1.53	4.14	5.53	9.83	11.2	8.13	0.34	1	1.7	**48.52**
1975	3.5	2.58	2.46	5.78	7	5.21	6.36	6.23	5.24	3.63	0.4	1.8	**50.15**
1976	2.3	1.05	3.41	0.63	10	4.26	5.41	6.37	8.56	1.63	2.4	4.8	**50.87**
1977	3	3.24	1.03	1.76	3.07	2.65	1.97	7.26	7.45	1.68	3.1	3.4	**39.56**
1978	4.6	4.17	2.83	2.24	9.18	2.62	6.67	2.39	4.4	1.26	0.8	1.8	**43.04**
1979	6.3	3.75	1	4.18	7.54	5.91	4.67	4.78	17.8	0.25	3.6	2	**61.76**
1980	2.6	1.06	6.83	3.91	3.02	4.59	5.29	3.97	3.03	2.69	2.3	0.2	**39.53**
1981	0.9	4.53	5.41	0.32	1.48	3.31	2.46	6.47	1.22	1.35	4.9	3.4	**35.77**
1982	3	1.67	4.26	3.6	3.55	8.06	3.81	6.93	9.32	3.37	1.9	2	**51.52**
1983	7.2	4.27	8.46	4.65	1.38	6.86	6.11	4.63	4.61	4.29	3.3	6.4	**62.19**
1984	2.1	4.67	5.77	3.14	1.46	4.76	6.01	3.78	12.3	1.53	3.3	0.1	**48.96**
1985	1.1	1.45	1.26	2.76	2.08	3.71	6.33	8.93	16.8	8.34	2.1	3.6	**58.39**
1986	4.2	4.72	5.44	0.93	2.13	2.53	3.27	9.6	1.99	1.8	2.9	4.7	**44.1**
1987	4.1	6.47	6.27	0.14	0.75	4.18	4.4	4.48	7.13	0.3	5	0.2	**43.39**
1988	6.4	6.08	2.65	3.44	1.35	3.71	4.5	8.48	16.4	2.35	4.3	1.1	**60.68**
1989	1.7	1.77	2.14	2.79	1.55	3.66	8.98	9.16	14.4	1.39	0.5	3.4	**51.45**
1990	1.8	4.07	1.59	1.34	0.18	1.59	6.53	3.81	2.6	4.54	1.2	1.9	**31.2**
1991	10	1.52	7.33	6.31	9.35	11.7	15.9	3.48	6.2	6.36	0.7	0.6	**79.63**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
1992	5.8	2.64	4.09	5.33	5.97	7.04	3.32	10.8	7.33	8.34	1.9	0.7	**63.18**
1993	3.9	2.89	5.98	0.85	1.6	2.52	7.54	2.96	7.6	8.84	3.6	1.9	**50.12**
1994	6.6	0.92	2.14	1.51	3.15	14	8.26	3.29	9.79	10.2	3.5	3.9	**67.26**
1995	1.9	2.07	3.67	1.77	1.77	5.35	9.45	9.93	5.41	3.53	3.2	2.2	**50.25**
1996	1.1	1.11	6.83	2.85	0.72	11.4	4.2	7.83	8.49	11.5	1.4	3.2	**60.63**
1997	2.9	1.28	1.84	4.56	3.43	6.33	7.69	8.24	3.97	4.84	2.4	9.8	**57.27**
1998	3.5	11.1	2.64	4.71	0.96	2.95	7.29	10.1	7.65	3.01	2.4	0.4	**56.72**
1999	4.6	1.7	0.4	1.92	1.02	7.75	3.56	3.51	13	3.24	0.8	0.9	**42.44**
2000	2.8	1.17	1.79	2.6	1.15	2.43	5.69	7.38	11.6	0.23	1.6	1.4	**39.77**
2001	0.9	0.68	5.48	0.62	2.56	5.59	8.31	3.58	16	0.81	1.4	3.1	**49.14**
2002	4.5	0.82	4.38	2.41	0.47	6.24	7.8	8.14	9.31	2.58	2.7	5.4	**54.72**
2003	0.1	4.66	10.7	2.63	2.54	6.75	7.33	1.83	3.04	2.98	0.7	1.2	**44.47**
2004	1.6	4.47	1.36	2.02	1.24	17.2	8.6	9.85	16.3	1.32	2.9	2.7	**69.47**
2005	1.9	3.56	3.67	4.53	3.51	14.8	7.37	4.43	5.76	6.49	1.1	7.4	**64.44**
2006	2.30	3.91	0.68	1.22	2.01	7.25	3.97	7.08	4.55	1.81	0.39	2.90	**38.07**
2007	2.29	2.40	2.22	1.02	1.12	6.68	9.48	3.57	5.44	8.85	0.17	2.74	**45.98**
2008	2.63	5.22	3.50	2.34	0.66	8.21	8.83						**31.39**
AVG	**3.21**	**3.54**	**3.81**	**2.82**	**3.29**	**6.37**	**6.55**	**6.99**	**7.43**	**3.87**	**1.98**	**2.62**	**52.47**

Rainfall is in inches, and represents data from JIA.

Appendix L: Executive Summary, Tributary Pollution Assessment Project

Note: *This appendix contains the executive summary of the Tributary Pollution Assessment Project (TPAP) submitted to the Department by JEA and PBS&J. The six phases detailed in the methodology development and evaluation section have already been completed as of the date of this TMDL. In place of the public workshop mentioned in the section describing Phase 6, the* Tributary Pollution Assessment Manual *was presented to the Jacksonville Waterways Commission on February 1, 2007.*

The Tributary Pollution Assessment Project involves developing and evaluating a methodology for conducting tributary pollution assessments for listed water bodies in the Duval County area, as referenced in the Reasonable Assurance (RA) Plan. Duval County has approximately 100 tributary Water Body IDs (WBIDs), i.e. small to large tributaries of the St. Johns River, identified by the State. The RA Plan provides reasonable assurance that the fecal coliform levels of the 51 top-ranked WBIDs will be reduced sufficiently to restore them to their designated use for recreation. The 51 WBIDs are grouped into four priority groups in the RA Plan.

PBS&J was contracted by JEA to develop a methodology for conducting tributary pollution assessments for sources of fecal coliform contamination in the listed tributaries. This methodology will be field-verified by conducting sanitary surveys of selected tributary water body segments, and revised based on lessons learned from this process. The final product of this endeavor will be a *Tributary Pollution Assessment Manual* that can be used as a blueprint for conducting sanitary surveys.

The Tributary Pollution Assessment Project is a continuation of the effort started under the RA Plan. The RA Plan participants have been brought together to form the Tributary Assessment Team (TAT). The TAT will serve as an advisory committee to the PBS&J Project Team throughout the development of the *Tributary Pollution Assessment Manual*. The TAT is composed of representatives from:

JEA
City of Jacksonville Environmental Quality Division
City of Jacksonville Public Works Department
Duval County Health Department
Florida Department of Environmental Protection
St. Johns Riverkeeper
Water and Sewer Expansion Authority
US Army Corps of Engineers

Other representatives (from these and additional entities) may be included in the TAT activities in varying roles, as relevant.

Our approach for developing and evaluating a methodology for conducting tributary pollution assessments is divided into six major phases including:

1) Pre-planning;
2) Planning;
3) Development of Tributary Pollution Assessment Manual;
4) Evaluation of Methodology/Manual by Conducting Sanitary Surveys;

5) Summary Report; and
6) Public Workshop.

The Pre-Planning phase (Phase I) entailed four main goals:

1) to obtain and review all documents included in the RA Plan;
2) to develop categories for tributary classification and categorize the 51 priority WBIDs;
3) to overlay each WBID onto land use, infrastructure, and historical sampling maps to begin assessing probable sources and migration pathways; and
4) to develop the *Draft Work Plan*.

The Planning phase (Phase II) begins with the organization and initial meeting of the Tributary Assessment Team (TAT) with the ultimate goal of finalizing the *Work Plan*.

The Development of the *Tributary Pollution Assessment Manual* phase (Phase III) primarily involves the formulation of the assessment methodology for each tributary category described in the Pre-Planning phase, the use of a decision tree to determine which assessment methodology corresponds to each of the highest-ranked WBIDs, and the establishment of a model monitoring plan for each tributary category. This phase will be completed upon submitting the *Manual* to the TAT for review.

The next phase, Evaluation of Methodology/Manual by Conducting Sanitary Surveys (Phase IV), entails field-verification of the methodology described in the *Draft Tributary Pollution Assessment Manual* for the highest ranked water bodies for each category (or as determined to ensure adequate geographical representation of the study area) and applying the results to recommend generic corrective actions and revise the methodology, if necessary. The outcome of this phase would be the *Tributary Pollution Assessment Manual.*

The final two phases, Summary Report (Phase V) and Public Workshop (Phase VI), would entail providing a summary of the results of the tributary pollution assessments, including a discussion of lessons learned and site-specific corrective actions, to JEA and presenting the results from the *Tributary Pollution Assessment Manual* to the public. The final phase would also include a written summary of public input received at the workshop.

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