FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Environmental Assessment and Restoration, Bureau of Watershed Restoration

NORTHEAST DISTRICT • LOWER ST. JOHNS BASIN

Final TMDL Report

Fecal Coliform TMDL for McCoy Creek, WBID 2257

Jessica Rich-Zeisler
Kelly Kingon

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For additional information on the watershed management approach and impaired waters in the Lower St. Johns Basin, contact

Amy Tracy
Florida Department of Environmental Protection
Bureau of Watershed Management
Watershed Planning and Coordination Section
2600 Blair Stone Road, Mail Station 3565
Tallahassee, FL 32399-2400
amy.tracy@dep.state.fl.us
Phone: (850) 245–8506
Fax: (850) 245–8434

Access to all data used in the development of this report can be obtained by contacting

Jessica Rich-Zeisler
Florida Department of Environmental Protection
Bureau of Watershed Management
Watershed Assessment Section
2600 Blair Stone Road, Mail Station 3555
Tallahassee, FL 32399-2400
jessica.rich-zeisler@dep.state.fl.us
Phone: (850) 245–8441
Fax: (850) 245–8536

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TMDL Program

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Identification of Impaired Surface Waters Rule

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

STORET Program

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

2000 305(b) Report

http://www.dep.state.fl.us/water/305b/index.htm

Criteria for Surface Water Quality Classifications

http://www/dep.state.fl.us/legal/legaldocuments/rules/ruleslistnum.htm

Basin Status Report for the Lower St. Johns River Basin

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

Water Quality Assessment Report for the Lower St. Johns River Basin

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Allocation Technical Advisory Committee (ATAC) Report

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

U.S. Environmental Protection Agency, 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 coliforms for McCoy Creek in the North Mainstem Planning Unit of the Lower St. Johns River basin. The creek 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 McCoy Creek that would restore the waterbody and re-establish its applicable water quality criterion for fecal coliform.

1.2 Identification of Waterbody

McCoy Creek, located in Duval County in northeast Florida, drains an area of approximately 5.34 square miles (mi^2). The creek flows directly into the St. Johns River (**Figures 1.1** and **1.2**). McCoy Creek is approximately 3.48 miles long and is a second-order stream. The McCoy Creek watershed is centrally located in Duval County, on the west side of the St. Johns River where Interstate 95 and Interstate 10 meet. Both interstates cross McCoy Creek. The watershed encompasses most of downtown Jacksonville. Additional information about the creek's hydrology and geology are available in the Basin Status Report for the Lower St. Johns Basin (Florida Department of Environmental Protection [Department], 2004).

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. McCoy Creek consists of one segment, WBID 2257 (**Figure 1.2**), which this TMDL addresses.

McCoy Creek is part of the North Mainstem 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 North Mainstem Planning Unit consists of 51 WBIDs. **Figure 1.3** shows the location of these WBIDs, McCoy Creek's location in the planning unit, and a list of the other WBIDs in the planning unit.

Figure 1.1. Location of McCoy Creek, WBID 2257, and Major Geopolitical Features in the Lower St. Johns Basin

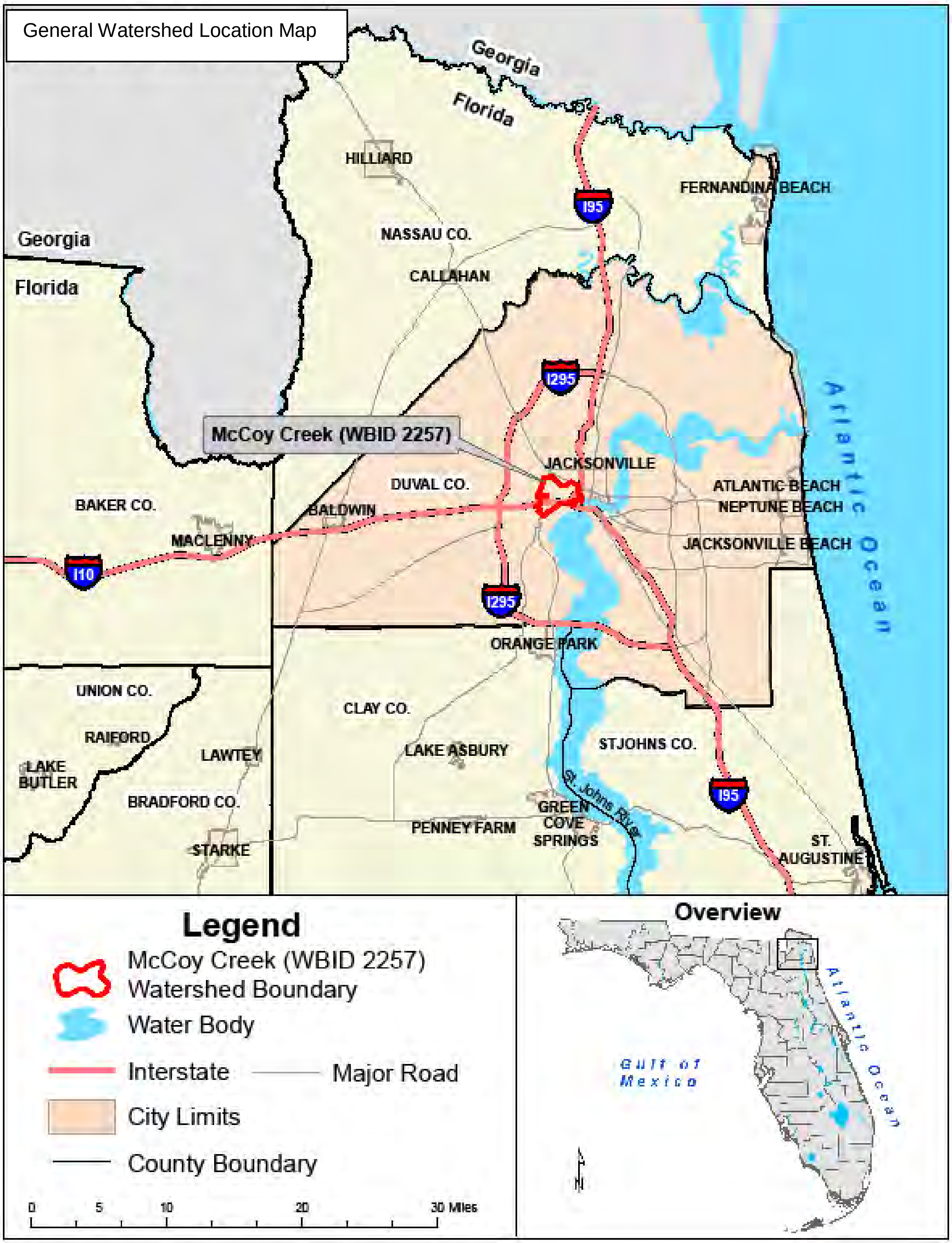


Figure 1.2. Overview of McCoy Creek, WBID 2257

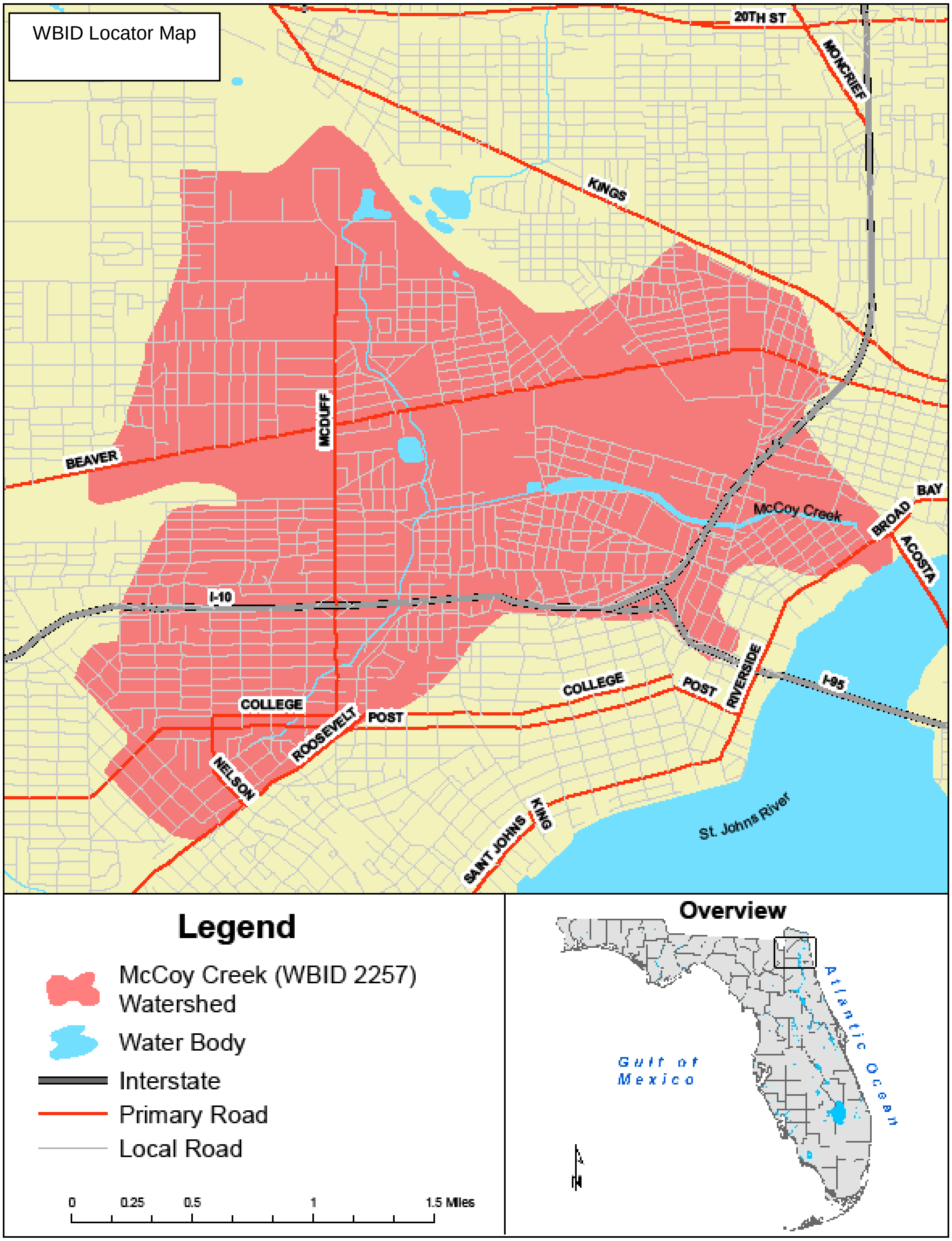
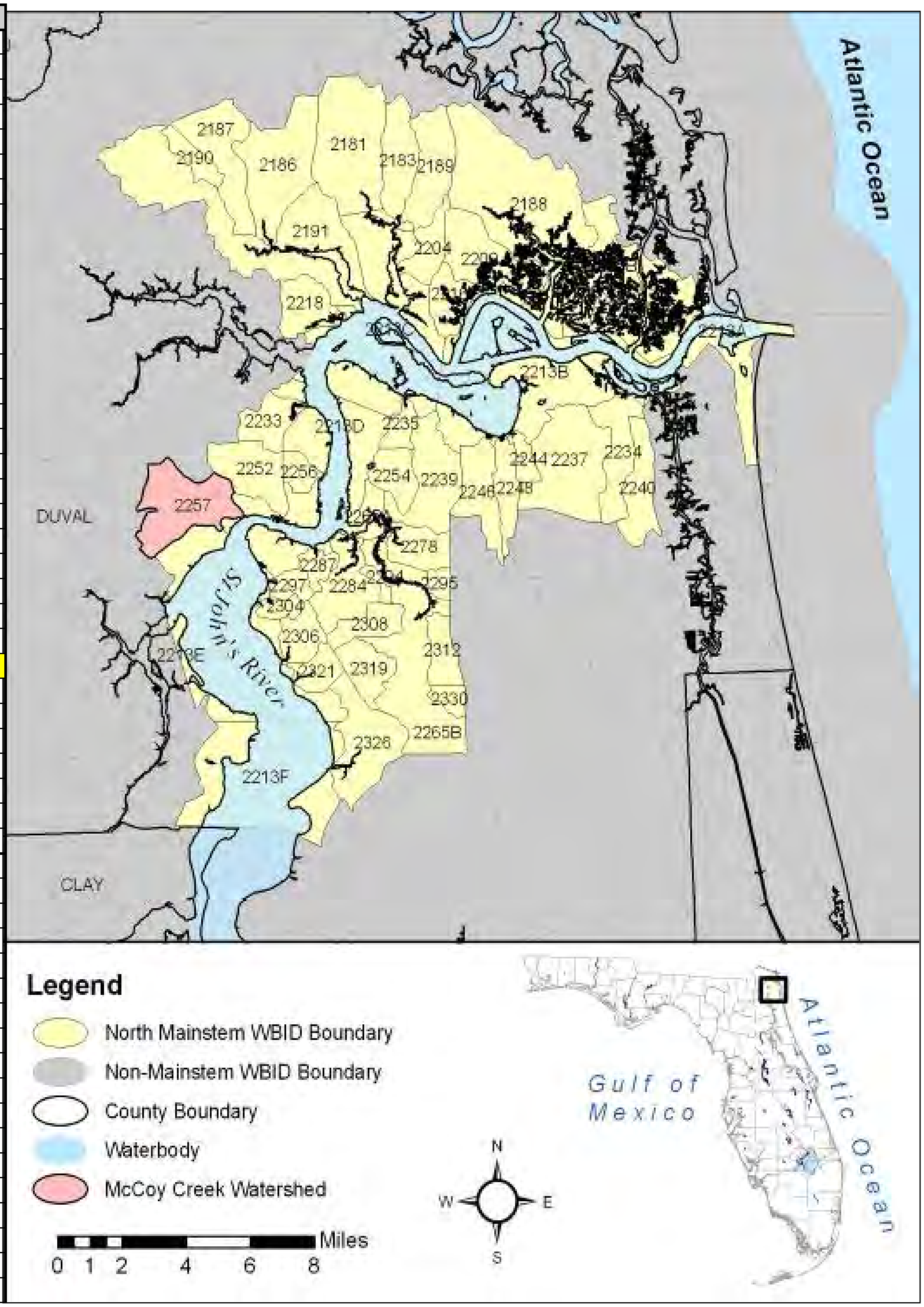


Figure 1.3. WBIDs in the North Mainstem Planning Unit

WBID	Waterbody Name
2181	Dunn Creek
2191	Broward River
2203	Trout River
2204	Terrapin Creek
2207	Blockhouse Creek
2210	West Branch
2213P	Ortega River
2220	Nine Mile Creek
2224	Ribault River
2227	Sherman Creek
2228	Moncrief Creek
2232	Sixmile Reach
2233	Long Branch
2235	New Castle Creek
2238	Little Sixmile Creek
2239	Strawberry Creek
2240	Greenfield Creek
2244	Cow Head Creek
2246	Jones Creek
2248	Gin House Creek
2249B	McGrits Creek
2249A	Ortega River
2252	Hogan Creek
2254	Red Bay Branch
2256	Deer Creek
2257	McCoy Creek
2262	Cedar River
2265B	Potsburg Creek
2266	Hopkins Creek
2270	Hogpen Creek
2278	Silversmith Creek
2280	Big Fishwier Creek
2282	Wills Branch
2284	Little Potsburg Creek
2287	Miller Creek
2297	Craig Creek
2299	Open Creek
2304	Miramar Creek
2306	New Rose Creek
2316	Williamson Creek
2321	Christopher Branch
2322	Butcher Pen Creek
2324	Fishing Creek
2326	Goody's Creek
2351	Julington Creek
2356	Big Davis Creek
2361	Deep Bottom Creek
2365	Durbin Creek
2370	Oldfield Creek
2381	Cormorant Branch
2385	Mandarin Drain



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 coliforms that caused the verified impairment of McCoy Creek. These activities will depend heavily on the active participation of the St. Johns River Water Management District (SJRWMD), the 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 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 2007.

2.2 Information on Verified Impairment

The Department used the IWR to assess water quality impairments in McCoy Creek and has verified that the creek is 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 waters was January 1, 1996, to June 30, 2003), by month, season, and year, respectively. There is a 68.51 percent overall exceedance rate for fecal coliforms in McCoy Creek during the verified period. There are a total of 54 samples, ranging from 78 counts/100mL to 200,000 counts/100mL, with 37 samples exceeding the criteria for fecal coliform.

Exceedances occur in all months in which samples have been collected with 100 percent exceedance rates occurring in January, July, August, and October (**Table 2.1**). All months had exceedance rates greater than or equal to 50 percent except December (33.33 percent) and April (40 percent). Sample size for each month is small, with all months having ten or less samples, making interpretation difficult.

When aggregating data by season, summer demonstrates the highest percentage of exceedances (93 percent) and also has the largest amount of rainfall (**Table 2.2**). It is likely that exceedances are associated with rainfall events and nonpoint sources, as well as seasonal variation.

After examining the yearly data, exceedance rates appear to be decreasing over time. Starting at 100 percent in 1996 and 1998, by 2003 the exceedance rate was only 40 percent (**Table 2.3**). Sample size is small, ranging from 1 to 16 samples per year, making it difficult to verify potential trends. However, from the data that are available, exceedances may be decreasing with time;

potentially due to improved stormwater systems, decreased precipitation amounts, and/or advanced wastewater treatment systems (changeover from septic to sewer).

There are three sampling sites where historical data was collected during the verified period (January 1, 1996, to June 30, 2003). Most of the samples were taken by the city of Jacksonville and a few were gathered by the Department. **Section 5.1** discusses sampling stations further.

Table 2.1. Summary of Fecal Coliform Data by Month for the Verified Period (January 1, 1996–June 30, 2003), WBID 2257

Month	N	Minimum	Maximum	Median	Mean	Number of Exceedances	% Exceedances	Mean Precipitation
January	2	5,000	17,000	11,000	11,000	2	100.00	2.55
February	5	276	2,400	800	1,103	3	60.00	2.82
March	7	220	7,800	1,620	2,685	5	71.43	4.26
April	5	140	9,000	340	2,082	2	40.00	2.79
May	10	78	2,400	470	937	5	50.00	1.61
June	-	-	-	-	-	-	-	6.18
July	3	2,200	24,000	24,000	16,733	3	100.00	6.36
August	3	1,100	3,000	2,200	2,100	3	100.00	6.97
September	8	300	200,000	7,250	59,275	7	87.50	10.01
October	5	500	50,000	5,000	15,500	5	100.00	3.74
November	-	-	-	-	-	-	-	1.81
December	6	80	9,500	235	2,648	2	33.33	3.46

- = There are no data for June and November.

Coliform counts are #/100 mL

Exceedances represent values above 400 counts/100 mL

Mean precipitation is for Jacksonville International Airport (JIA) in inches

Table 2.2. Summary of Fecal Coliform Data by Season for the Verified Period (January 1, 1996–June 30, 2003), WBID 2257

Season	N	Minimum	Maximum	Median	Mean	Number of Exceedances	% Exceedances	Mean Precipitation*
Winter	14	220	17,000	1,660	3,308	10	71.43	3.21
Spring	15	78	9,000	340	1,319	7	46.67	3.53
Summer	14	300	200,000	4,050	37,907	13	92.86	7.78
Fall	11	80	50,000	5,000	8,490	7	63.64	3.00

Coliform counts are #/100mL.

Exceedances represent values above 400 counts/100mL.

Mean precipitation is for JIA.

*Represents a monthly average for that season.

Table 2.3. Summary of Fecal Coliform Data by Year for the Verified Period (January 1, 1996–June 30, 2003), WBID 2257

Year	N	Minimum	Maximum	Median	Mean	Number of Exceedances	% Exceedances	Mean Precipitation
1996	1	500	500	500	500	1	100.00	5.05
1997	-	-	-	-	-	-	-	4.77
1998	6	1,700	24,000	5,000	10,350	6	100.00	4.73
1999	8	140	50,000	7,000	12,680	7	87.50	3.54
2000	10	80	9,500	650	1,975	6	60.00	3.31
2001	8	310	200,000	5,350	53,064	7	87.50	4.1
2002	16	78	53,800	576	4,797	8	50.00	4.56
2003	5	340	2,400	340	1,024	2	40.00	3.71

- = There are no data for 1997.

Table represents years for which data exist.

Coliform counts are #/100mL.

Exceedances represent values above 400 counts/100mL.

Total precipitation is for JIA in inches.

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)**

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

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 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 are insufficient data (fewer than 10 samples in a given month) available to evaluate the geometric mean criterion for fecal coliform bacteria. Therefore, the criterion selected for the TMDL is that samples shall not 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 sources” has meant discharges to surface waters that typically have a continuous flow via a discernable, confined, and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) are examples of traditional point sources. In contrast, the term “nonpoint sources” was used to describe intermittent, rainfall driven, diffuse sources of pollution associated with everyday human activities, including runoff from urban land uses, agriculture, silviculture, and mining; discharges from failing septic systems; and atmospheric deposition.

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

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

4.2 Potential Sources of Coliforms in McCoy Creek Watershed

4.2.1 Point Sources

There are five permitted facilities located within the watershed and several others just outside the WBID boundary that may have an impact on McCoy Creek. **Table 4.1** lists these facilities, and **Figure 4.1** shows the location of the facilities within the watershed, as well as in the immediate surrounding areas.

Within the watershed, there are two facilities that have been issued multi-sector stormwater general permits authorizing discharges of stormwater. One of the facilities is Conrad Yelvington Distributors Inc. (permit #FLR05F356) and the other is Load King Mfg. (permit #FLR05C230). Conrad Yelvington Distributors Inc. has one outfall that drains into McCoy Creek while Load King Mfg. has two outfalls under their permit; one empties into the City of Jacksonville MS4 and the other into the St. Johns River. Since both outfalls of the Load King Mfg. facility empty into other waterbodies it is highly unlikely that it is having an effect on McCoy Creek. There are two other multi-sector stormwater facilities that are outside the WBID boundary, but that do have outfalls into McCoy Creek. First Student, Inc. (Permit #FLR05F474) with two outfalls into McCoy Creek; and CSX Transportation Inc. (Permit #FLR05D027) with its outfall into a drainage ditch that runs into McCoy Creek. In July 2006 the First Student, Inc. facility ceased operation and terminated the permit. The CSX Tranfser Station – Moncrief Yard facility is primarily engaged in line-haul railroad passenger and freight operations and rainfall related discharge events from this site are not considered a source of fecal coliforms. CSX Transportation, Inc., a ground water remediation system for chlorinated organic contaminants, PAHs, and volatile organics, has an industrial wastewater permit (Permit # FL0176877) as well. Under this permit, it is allowed to discharge up to 0.138 million gallons per day (MGD) into McCoy Creek. Over the January 2000 thru August 2004 period, the daily average discharge was 0.069 MGD. The ground water remediation discharge was not considered a source for fecal coliforms. There are three CSX Transportation, Inc. locations indicated on **Figure 4.1**. Two are outside the McCoy Creek WBID boundary and represent the location of the actual facility and the multisector stormwater outfall discussed earlier. The Stockton Street Transfer station had a discharge to the City of Jacksonville MS4 but was inactive in 2007 and the permit was terminated. The point within the WBID boundary demarks the ground water remediation system outfall location.

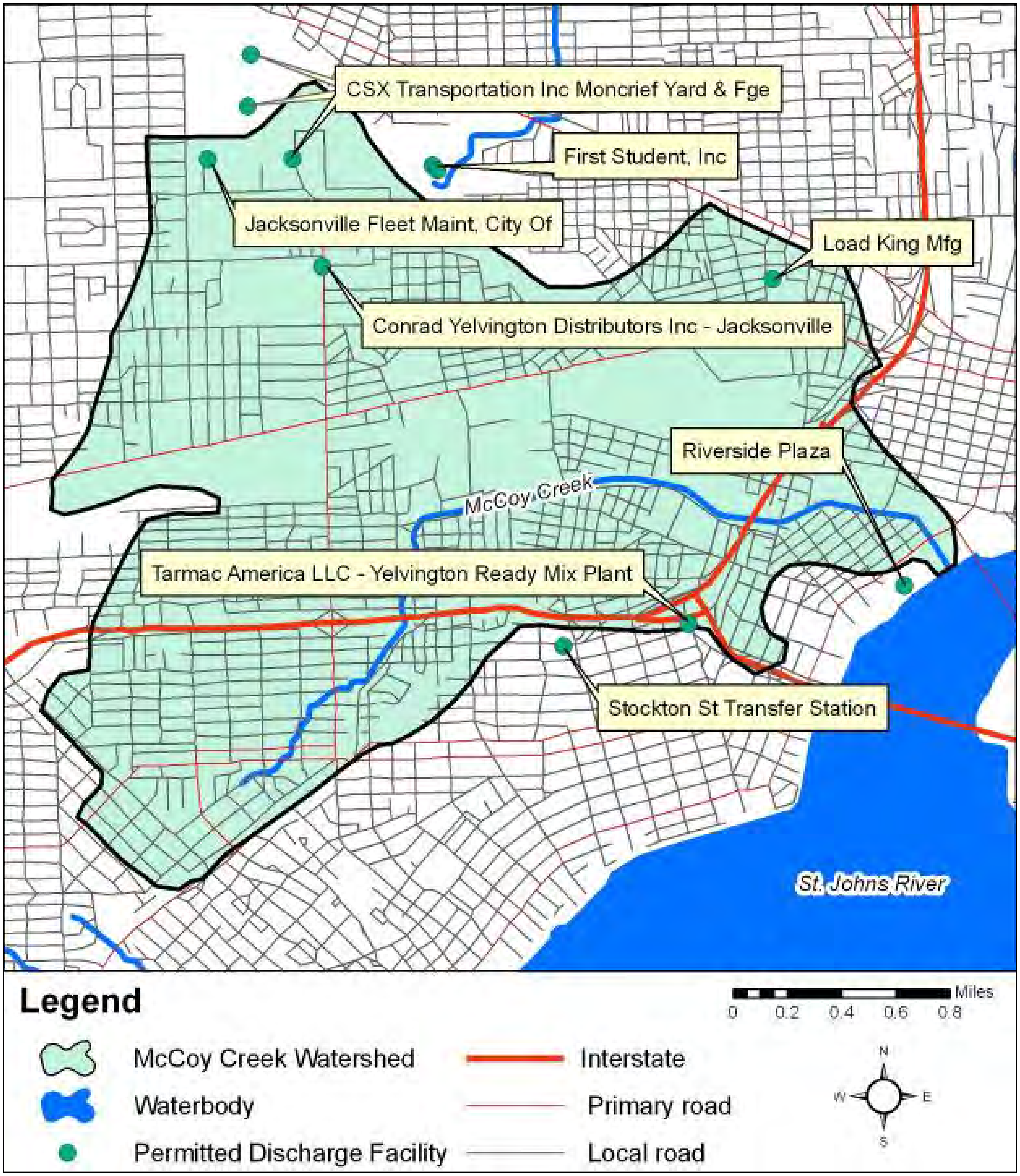
Three other facilities are located within or near the watershed, but they should not affect surface waters because they are not authorized to discharge to surface waters or do not discharge to McCoy Creek. Jacksonville Fleet Management (Permit #FLA011447) is a 100 percent recycle vehicle and equipment wash facility. Tarmac America LLC (Permit #FLG110707) has a concrete batch general permit and has zero discharge into surface waters. Riverside Plaza (Permit #FL0039691) is a noncontact cooling water system for a water-cooled air-conditioning system. The outfall and discharge for this facility flow directly into the St. Johns River and should not affect surface water quality in the McCoy Creek watershed.

The permitted discharges into McCoy Creek appear negligible in volume and should not alter the water quality of the creek. Most of the facilities mentioned above are not required to perform effluent monitoring under the general permit, and current coliform loadings from these facilities cannot be quantified. The only facility that is required to monitor its effluent is the CSX Transportation ground water remediation system; however, it is not required to monitor for coliform. It is unlikely that high numbers of coliform would be discharged from this type of facility.

Table 4.1. Permitted Discharge Facilities Located Within or Near the McCoy Creek Watershed

Permit #	Facility Name	Permitted Surface Water Discharge (MGD)	Description
FLG110707	Tarmac America LLC	0.0000	Concrete Batch General Permit–No discharge
FLR05D027	CSX Transportation Inc. Moncrief	0.0000	General Stormwater Permit–No monitoring required
FL0176877	CSX Transportation Inc. Moncrief Yard	0.1380	Ground Water Remediation–Discharge to McCoy Creek
FLR05F356	Conrad Yelvington Distributors Inc.	0.0000	General Stormwater Permit–No monitoring required
FLR05C230	Load King Mfg.	0.0000	General Stormwater Permit–No monitoring required
FL0039691	Riverside Plaza	2.1000	Discharge to St. Johns River
FLR05E238	Stockton St. Transfer Station	0.0000	General Stormwater Permit–No monitoring required
FLA011447	Jacksonville Fleet Management	0.0000	100% Recycle Facility–No discharge
FLR05F474	First Student, Inc.	0.0000	General Stormwater Permit–No monitoring required

Figure 4.1. Permitted Discharge Facilities in the McCoy Creek Watershed, WBID 2257



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 (FLS000012) that covers the McCoy Creek watershed. Responsibility for the permit is shared among FDOT and the cities of Jacksonville, Neptune Beach, and Atlantic Beach. **Figure 4.2** shows the stormwater infrastructure of the watershed.

Outfalls represent points where a conveyance of stormwater 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 (Grable, K., personal communication, October 16, 2008). In the McCoy Creek watershed, there are 86 outfalls and 1717 inlets.

4.2.2 Land Uses and Nonpoint Sources

Additional coliform loadings to McCoy Creek 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 4.2. Figure 4.3** shows the principal land uses in the watershed.

The McCoy Creek watershed is fairly large (5.34 mi^2). As **Table 4.2** shows, almost all of the land in this watershed is impacted (over 3,190 acres or 93 percent), with the largest single land use being high density residential areas (35 percent). Natural areas only cover approximately 7 percent of the watershed (almost 230 acres), and they are composed mostly of open lands. There are no agricultural areas in the watershed.

Table 4.2. Classification of Land Use Categories in the McCoy Creek Watershed, WBID 2257

Level 3 Land Use Code	Attribute	Acres	% of Total
1100	Residential, low density–less than 2 dwelling units/acre	9.15	0.27%
1200	Residential, medium density–2-5 dwelling units/acre	478.53	13.99%
1300	Residential, high densityɤ–6 or more dwelling units/acre	906.81	26.52%
1400	Commercial and services	682.84	19.97%
1490	Commercial & services under construction	3.94	0.12%
1510	Food processing	26.65	0.78%
1550	Other light industrial	296.67	8.67%
1560	Other heavy industrial	106.64	3.12%

Level 3 Land Use Code	Attribute	Acres	% of Total
1660	Holding ponds	4.88	0.14%
1700	Institutional	112.31	3.28%
1800	Recreational	16.22	0.47%
1830	Race tracks	37.19	1.09%
1860	Community recreational facilities	61.79	1.81%
1900	Open land	23.12	0.68%
3100	Herbaceous upland nonforested	81.17	2.37%
3200	Shrub and brushland	31.55	0.92%
4340	Upland mixed coniferous/hardwood	32.94	0.96%
5100	Streams and waterways	7.80	0.23%
5300	Reservoirs - pits, retention ponds, dams	9.57	0.28%
6170	Mixed wetland hardwoods	73.11	2.14%
6210	Cypress	4.57	0.13%
6410	Freshwater marshes	4.13	0.12%
6430	Wet prairies	5.11	0.15%
6460	Mixed scrub-shrub wetland	15.28	0.45%
7400	Disturbed land	3.54	0.10%
7410	Rural land in transition without positive indicators of intended a	10.28	0.30%
7430	Spoil areas	25.80	0.75%
8120	Railroads	190.51	5.57%
8130	Bus and truck terminals	22.99	0.67%
8140	Roads and highways (divided 4-lanes with medians)	127.42	3.73%
8180	Auto parking facilities	0.04	0.00%
8200	Communications	5.16	0.15%
8310	Electrical power facilities	2.15	0.06%
	TOTAL:	**3,419.86**	**100.00%**

Figure 4.2. Stormwater Infrastructure in the McCoy Creek Watershed, WBID 2257

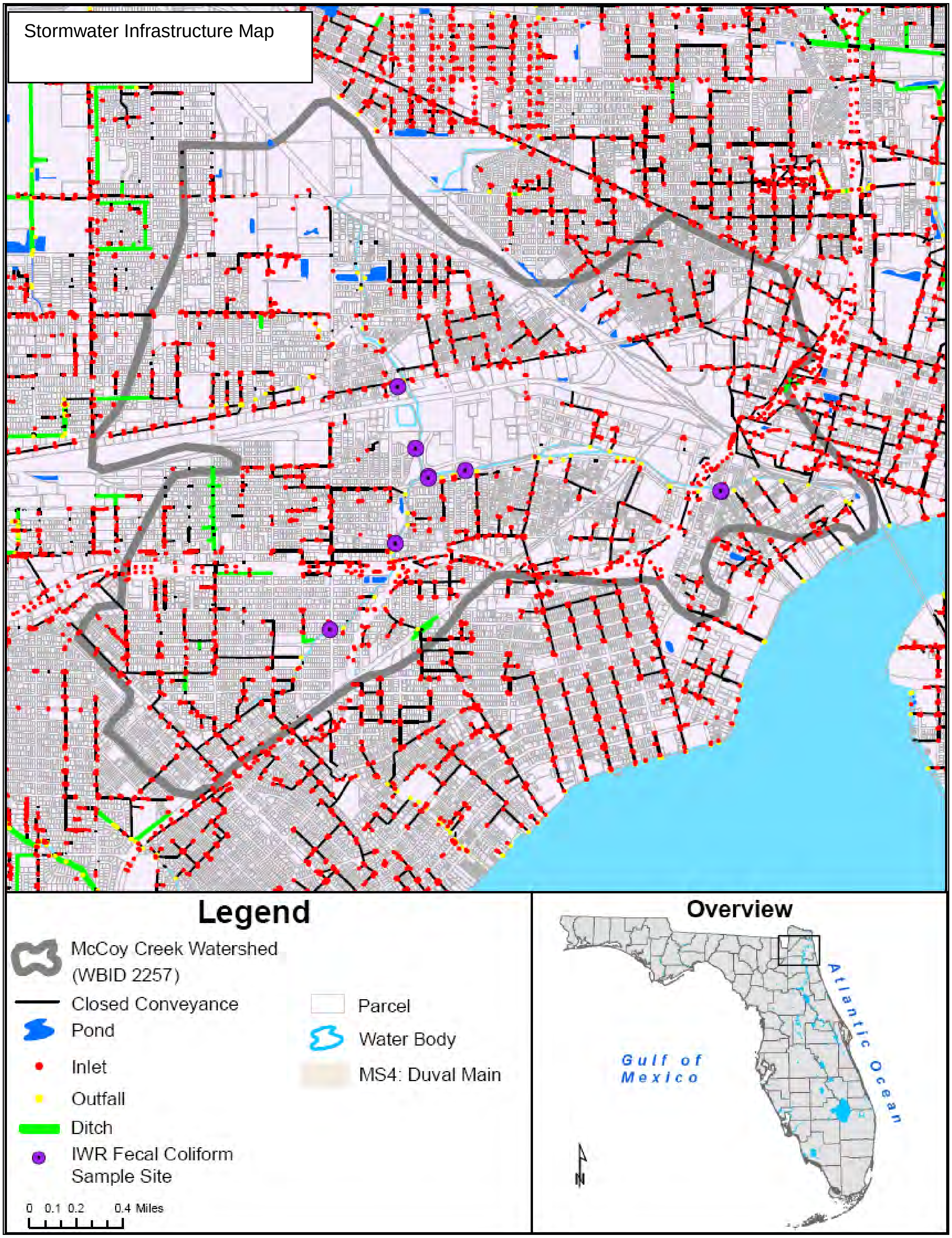
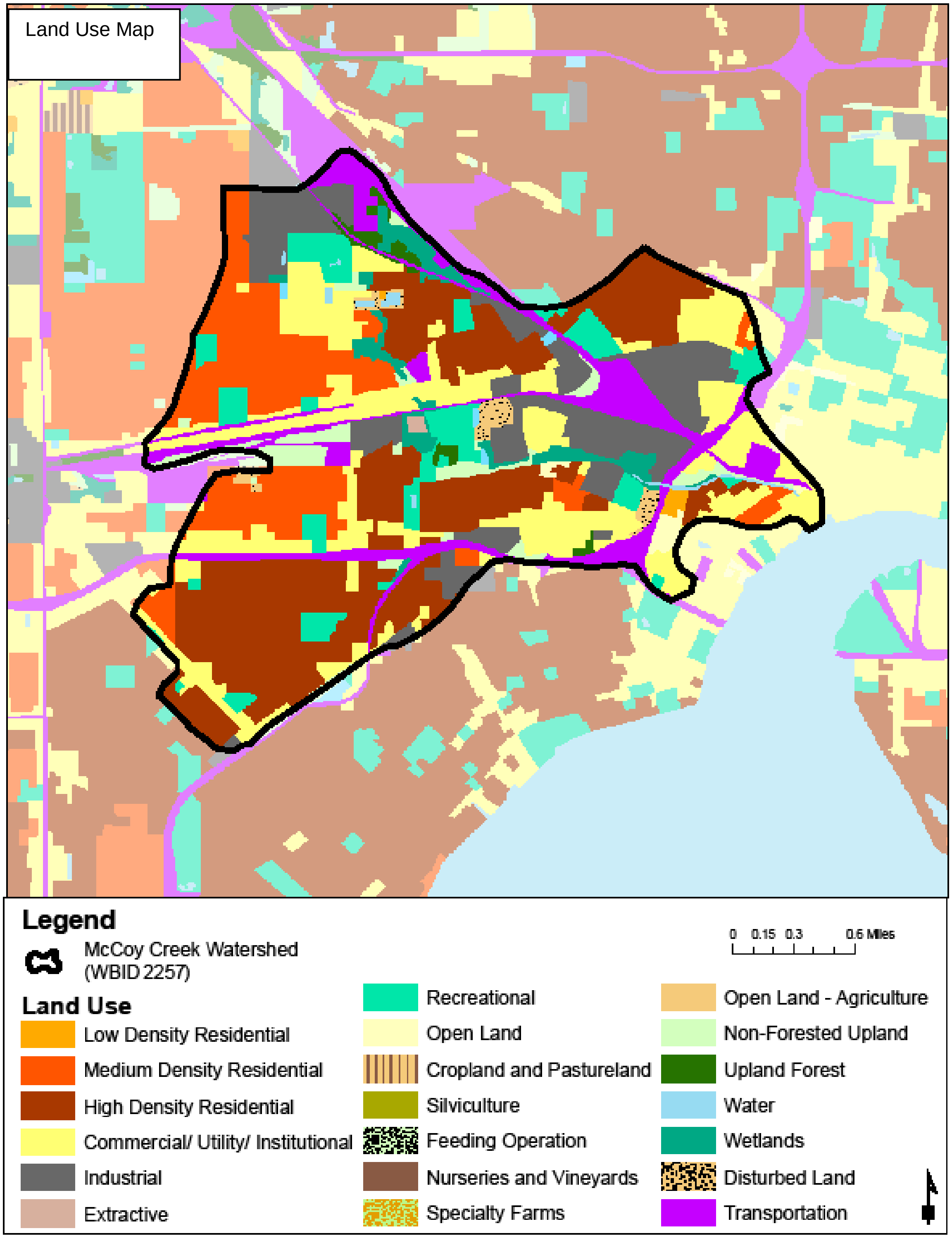


Figure 4.3. Principal Level 2 Land Uses in the McCoy Creek Watershed, WBID 2257, in 2004

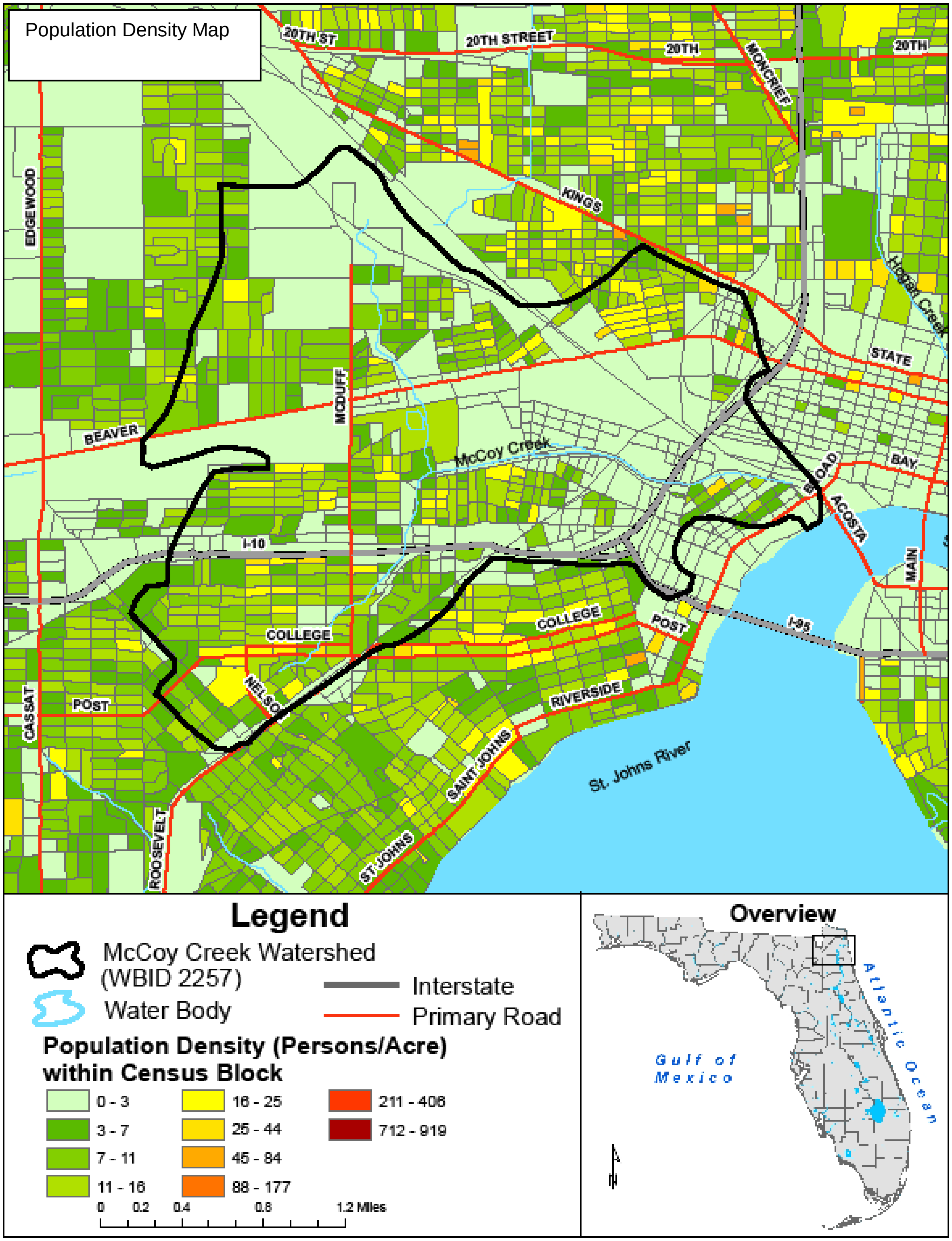


*Land use map developed by Post, Buckley, Schuh & Jernigan, Inc. (PBS&J).

Population

According to the U.S. Census Bureau, census block population densities in the McCoy Creek watershed in the year 2000 ranged from 0 to 44 people/acre, or 0 to 0.069 people/mi^2, with an average of 1,696,000 people/acre, or 2,650 people/mi^2 (calculated from U.S. Census Bureau information), in the watershed (**Figure 4.3**). Based on this average, the estimated population in the McCoy Creek watershed is 14,149. 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). For all of Duval County, 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 McCoy Creek is 1,023 residences/mi^2, based on population, which is higher than that of Duval County, but much of Duval County is rural.

Figure 4.3. Population Density in the McCoy Creek Watershed, WBID 2257, in 2000



Septic Tanks

Approximately 78 percent of Duval County residences are connected to a wastewater treatment plant, while the rest are using septic tanks (JEA Water and Sewer Expansion Authority [WSEA] septic files from PBS&J, 2007). The Florida Department of Health (FDOH) reports that as of 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 countrywide.

To focus on the McCoy Creek watershed, the Department obtained septic tank repair permit data from JEA for its service area, which includes the McCoy Creek watershed. The data include septic tank repair permit records issued from March 1990 to April 2004, areas serviced by a WWTF, and areas where large numbers of failing septic tanks are present. **Figure 4.4** presents this information in map form.

Based on these data, which are more watershed specific than the countywide FDOH data, there were 24 septic tank repair permits issued during this time. This equates to an average of 1.71 permits issued per year. If this estimate is rounded up to 3 (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 2.06×10^{10} colonies/day is derived. **Table 4.4** shows this estimation**.**

The data provided by JEA also includes areas serviced by a wastewater treatment facility (WWTF) and areas where high numbers of failing septic tanks are present. There is a small portion of the McCoy Creek watershed in a septic tank phase out area/area that has the highest priority to be sewered due to high septic tank failure rates. **Figure 4.4** shows this area in orange near the southwest corner of the watershed. The McCoy Creek Watershed area is serviced by the Buckman Street WWTF.

Table 4.3. Estimated Average Household Size in the McCoy Creek Watershed, WBID 2257

Household Size	Number of Households	% of Total	Number of People
1-person household	1662	30.42	1662
2-person household	1507	27.58	3014
3-person household	935	17.11	2805
4-person household	626	11.45	2502
5-person household	396	7.25	1981
6-person household	193	3.54	1159
7-or-more-person household	146	2.68	1024
TOTAL:	**5,464**	**100.00**	**14,149**
		AVERAGE HOUSEHOLD SIZE:	**2.59**

*Individual values for Number of People per Household size have been rounded to the nearest whole number, while Total Number of People remains based on unrounded values.

Table 4.4. Estimated Annual Fecal Coliform Loading from Failed Septic Tanks in the McCoy Creek Watershed, WBID 2257

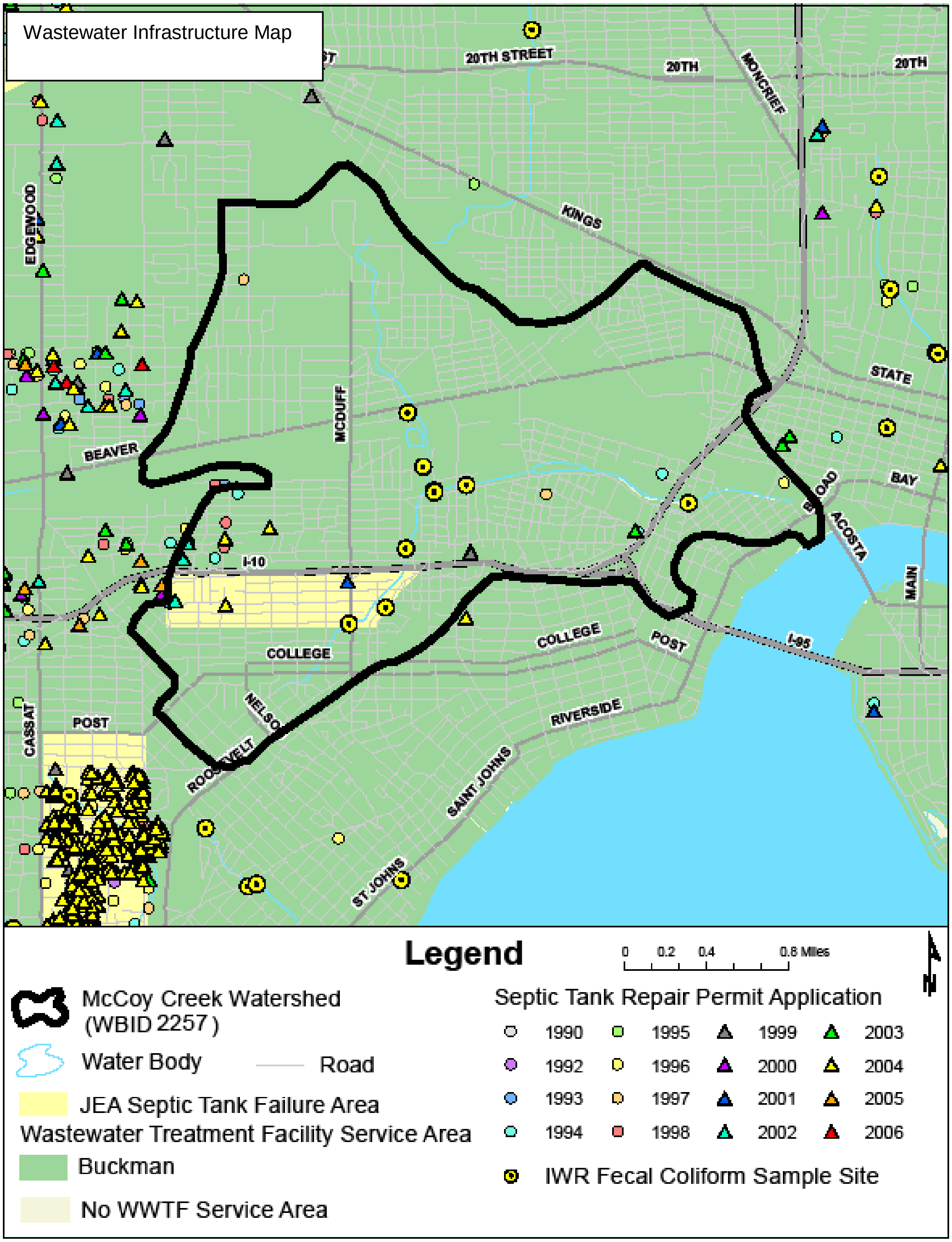
Estimated Population Density (people/mi^2)	WBID Area (mi^2)	Estimated Population in Watershed	Estimated Number of Tank Failures[1]	Estimated Load From Failed Tanks[2]	Gallons/ Person/ Day[2]	Estimated Number People per Household[3]	Estimated Daily Load from Failing Tanks	Estimated Annual Load from Failing Tanks
2,650	5.35	14,149	3	1.00×10^4 /mL	70	2.59	2.06×10^{10}	7.51×10^{12}

[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.

Figure 4.4. Septic Tank Repair Permits Issued for the McCoy Creek Watershed, WBID 2257, 1990–2006



4.3 Source Summary

Agriculture

According to Level 3 land use data, there are no agricultural areas in the McCoy Creek watershed. As noted in **Section 4.2.2**, the largest single land use category is high-density residential (35 percent).

Pets

Pets, especially dogs, may be having 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), and assuming that coliform from 10 percent of dogs reach the waterbody and are viable upon reaching it, the approximate loading is 1.58×10^{13} organisms/day. This is an estimate, as the actual loading from dogs is not known.

Table 4.5. Estimated Loading from Dogs in the McCoy Creek Watershed, WBID 2257

Estimated Number of Households in WBID 2257	Estimated Dog:Household Ratio[1]	Estimated Number of Dogs in WBID 2257	Estimated Fecal Coliform (counts/dog/day[2])	Estimated Fecal Coliform (counts/day)	Estimated Fecal Coliform (counts/year)
5464	0.58	3169	5×10^{9}	1.58×10^{13}	5.78×10^{15}

[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, it has been estimated that 78 percent of households in Duval County are connected to a wastewater facility. Assuming 5,464 homes in the watershed, with 2.59 people per home, and a 70-gallon-per-person-per-day discharge, and also assuming that the countywide average of 78 percent of households connected to a WWTF applies in the McCoy Creek watershed, a daily flow of approximately 7.31×10^{6} liters (L) 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 loadings of fecal coliform from leaking sewer lines is 7.31×10^{12} counts/day (**Table 4.6**).

Table 4.6. Estimated Loading from Wastewater Collection Systems in the McCoy Creek Watershed, WBID 2257

Estimated Number of Homes on Central Sewer in WBID 2257	Estimated Daily Flow (L)	Daily Leakage (L)	Raw Sewage (counts/100mL)	Estimated Fecal Coliform (counts/day)	Estimated Fecal Coliform (counts/year)
4,262	2.92×10^{6}	1.46×10^{5}	5×10^{6}	7.31×10^{12}	2.67×10^{15}

Table 4.7 summarizes the various estimates from potential 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, and temperature (influences coliform growth and survival) are just a few of the factors that could influence and determine the actual loadings from these sources that reach McCoy Creek.

Table 4.7. Summary of Estimated Potential Coliform Loading From Various Sources in the McCoy Creek Watershed, WBID 2257

Source	Fecal Coliform (counts/day)	Fecal Coliform (counts/year)
Septic Tanks	2.06×10^{10}	7.51×10^{12}
Dogs	1.58×10^{13}	5.78×10^{15}
Collection Systems	7.31×10^{12}	2.67×10^{15}

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 the stream gauging station on McCoy Creek only has data from August 1978 through May 1983. At least ten years of flow data is preferred and flow data collected closer to the time period when fecal coliform samples were taken is necessary. To determine the TMDL, the percent reduction that would be required for each of the exceedances to meet applicable criteria was determined, and the median value of all of these reductions for fecal coliforms determined the overall required reduction, and is therefore the TMDL.

5.1.1 Data Used in the Determination of the TMDL

Eight sampling stations on McCoy Creek have historical fecal coliform observations, as follows (**Figure 5.1**):

- *McCoy Creek at Myrtle Avenue (STORET ID: 21FLA 20030693);*
- *McCoy Creek at Myrtle Avenue (STORET ID: 21FLJXWQMC1);*
- *McCoys Creek at Leland Road (STORET ID: 21FLA 20030725);*
- *McCoy Creek at Leland Street (STORET ID: 21FLJXWQMC3);*
- *McCoys Creek at Smith Street (21FLA 20030730);*
- *McCoys Creek at McDuff Avenue (21FLA 20030881);*
- *Mccoys Creek at Edison Avenue (21FLA 20030882); and*
- *McCoys tributary at Webster Street west Lift Station (21FLA 20030883).*

Four of the stations (21FLA 20030693, 21FLJXWQMC1, 21FLJXWQMC3, and 21FLA 20030725) are located almost in the same spot, but are monitored by different entities: the city of Jacksonville and the Department. The first set of sites is located on South Myrtle Avenue just east of Interstate 95. The other set is off of Leland Street about one block to the east of Hollybrook Park and upstream from the Myrtle Avenue sites. Altogether, the Myrtle Avenue stations have 46 samples from 1995 to 2007, while 75 samples were collected at the Leland Street location. The city of Jacksonville maintained routine (mostly quarterly) sampling from 1998 to 2007 at both of its stations (21FLJXWQMC1 and 21FLJXWQMC3).

Between these two sets of stations, there is a Department station (21FLA20030730), where 3 samples were collected in 2007. About 1.41 miles after the headwaters, the stream branches. Stations 21FLA 20030881 and 21FLA 20030882 are located before the branch, while 21FLA20030883 is the one station situated on the northbound branch where fecal coliform observations were collected. **Table 5.1** shows data collection information for each station and **Figure 5.1** shows the locations of the sample sites. **Table 5.2** shows observed historical data analysis and **Appendix B** contains all of the historical fecal coliform observations from each site for the planning and verified periods for the Lower St. Johns Basin. **Figure 5.2** shows the observations over time.

All stations have an exceedance rate of at least 20 percent (see **Table 5.2**). The most downstream stations, 21FLA 20030693 and 21FLJXWQMC1, have fewer exceedances than the four upstream stations. This may be attributable to decay rates and the settling out that may occur along the stream.

Table 5.1. Sampling Station Summary for McCoy Creek, WBID 2257

Station	STORET ID	Monitoring Agency	Years With Data	N
McCoy Cr at Myrtle Ave	21FLA 20030693	Department (Northeast District)	2007	5
McCoys Creek at Leland Road	21FLA 20030725	Department (Northeast District)	2000, 2002, 2004, 2007	10
McCoys Creek at Smith Street	21FLA 20030730	Department (Northeast District)	2007	3
McCoys Cr @ McDuff Ave	21FLA 20030881	Department (Northeast District)	2007	2
McCoys Cr @ Edison Ave	21FLA 20030882	Department (Northeast District)	2007	3
McCoys Trib @ Webster St W Lift Station	21FLA 20030883	Department (Northeast District)	2007	3
McCoys Creek at Myrtle Ave	21FLJXWQMC1	City of Jacksonville	1995–96, 1998–2007	41
McCoys Creek at Leland St	21FLJXWQMC3	City of Jacksonville	1995, 1998–2007	65

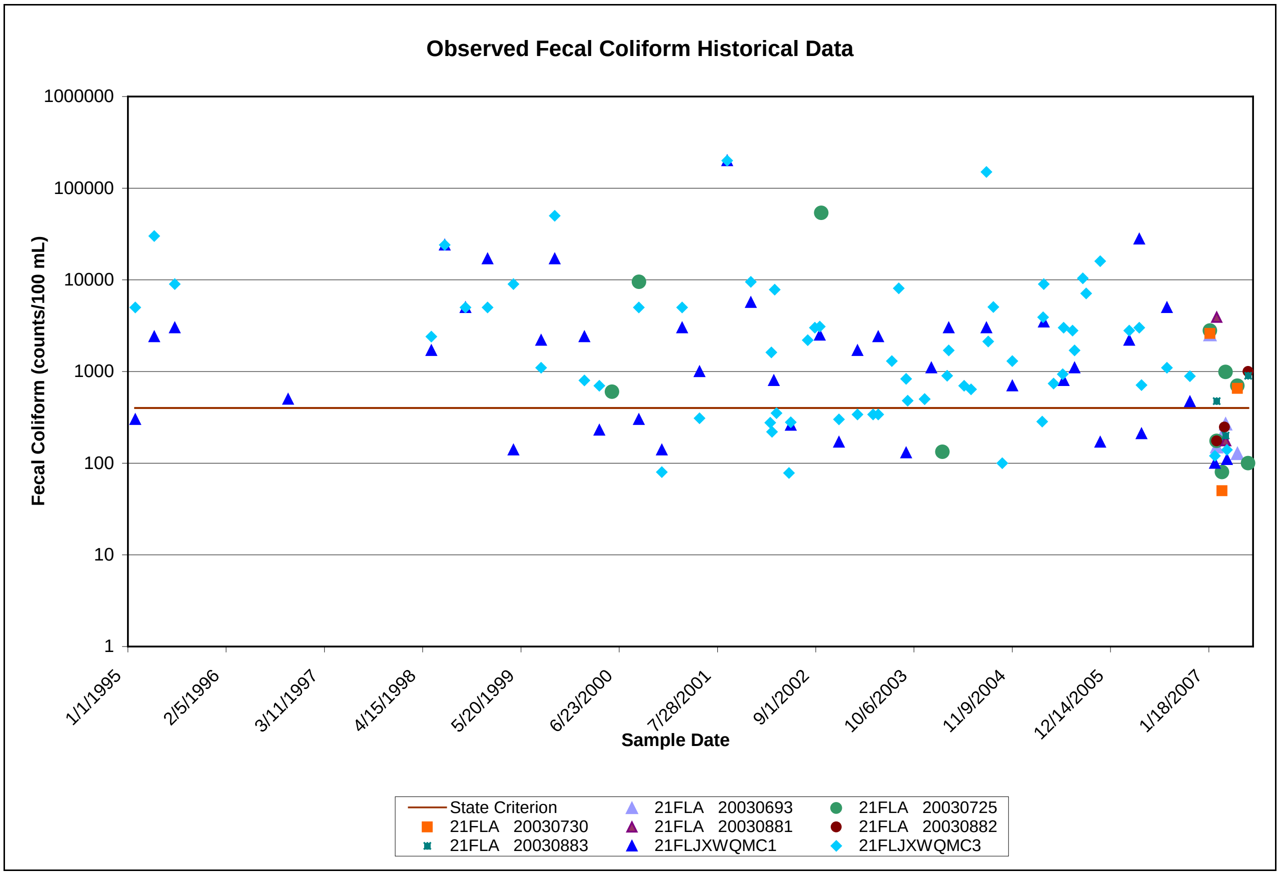
Table 5.2. Statistical Summary of All Historical Data for McCoy Creek, WBID 2257

Station	STORET ID	N	Minimum	Maximum	Median	Mean	Exceedances	% Exceedances
McCoy Cr at Myrtle Ave	21FLA 20030693	5	127	2,520	200	653	1	20.00
McCoys Creek at Leland Road	21FLA 20030725	10	80	53,800	650	6,888	6	60.00
McCoys Creek at Smith Street	21FLA 20030730	3	50	2,600	654	1,101	2	66.67
McCoys Cr @ McDuff Ave	21FLA 20030881	2	176	3,900	2,038	2,038	1	50.00
McCoys Cr @ Edison Ave	21FLA 20030882	3	175	1,000	247	474	1	33.33
McCoys Trib @ Webster St W Lift Station	21FLA 20030883	3	200	900	475	525	2	66.67
McCoys Creek at Myrtle Ave	21FLJXWQMC1	41	100	200,000	1,700	8,376	18	43.90
McCoys Creek at Leland St	21FLJXWQMC3	65	78	200,000	1,620	9,554	36	55.38

Coliform concentrations are counts/100mL.

Figure 5.1. Historical Sample Sites in McCoy Creek, WBID 2257

Figure 5.2. Historical Fecal Coliform Observations for McCoy Creek, WBID 2257



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 to the criterion of 400 counts/100mL. For each individual exceedance, an individual required reduction was calculated using the following:

$$\frac{[(\text{observed value}) - (\text{state criterion})] \times 100}{(\text{observed value})}$$

After the individual results were calculated, the median of the individual values was calculated, which is 84.06 percent. This means that in order to meet the state criterion of 400 counts/100mL, an 84.06 percent reduction in current loading is necessary, and is therefore the TMDL for McCoy Creek. **Table 5.3** shows annual summaries of exceedances used to determine the TMDL by year, and **Table 5.4** shows the individual exceedances used in the calculation of the TMDL for McCoy Creek.

Table 5.3. Annual Summary of Fecal Coliform Exceedances Used To Develop the TMDL for McCoy Creek, WBID 2257

Year	N	Minimum	Maximum	Median	Mean
1995	6	300	30,000	4,000	8,283
1996	1	500	500	500	500
1997	-	-	-	-	-
1998	6	1,700	24,000	5,000	10,350
1999	8	140	50,000	7,000	12,680
2000	10	80	9,500	650	1,975
2001	9	133	200,000	5,000	47,183
2002	18	78	53,800	576	4,497
2003	13	130	8,100	500	1,389
2004	12	100	150,000	1,500	14,102
2005	13	170	16,000	2,800	4,401
2006	10	210	28,000	1,650	4,438
2007	26	50	3,900	200	729

Coliform counts are #/100mL and represent years for which exceedances exist.

Table 5.4. Calculation of Reductions for the Fecal Coliform TMDL for McCoy Creek, WBID 2257

Sample Date	Location	Observed Value (Exceedance)	Required Reduction (%)
1/31/1995	McCoys Creek at Leland St	5,000	92.00
4/18/1995	McCoys Creek at Myrtle Ave	2,400	83.33
4/18/1995	McCoys Creek at Leland St	30,000	98.67
7/11/1995	McCoys Creek at Myrtle Ave	3,000	86.67
7/11/1995	McCoys Creek at Leland St	9,000	95.56
10/14/1996	McCoys Creek at Myrtle Ave	500	20.00
5/20/1998	McCoys Creek at Myrtle Ave	1,700	76.47
5/20/1998	McCoys Creek at Leland St	2,400	83.33
7/14/1998	McCoys Creek at Myrtle Ave	24,000	98.33
7/14/1998	McCoys Creek at Leland St	24,000	98.33
10/6/1998	McCoys Creek at Myrtle Ave	5,000	92.00
10/6/1998	McCoys Creek at Leland St	5,000	92.00
1/4/1999	McCoys Creek at Leland St	5,000	92.00
1/4/1999	McCoys Creek at Myrtle Ave	17,000	97.65
4/19/1999	McCoys Creek at Leland St	9,000	95.56
8/10/1999	McCoys Creek at Leland St	1,100	63.64
8/10/1999	McCoys Creek at Myrtle Ave	2,200	81.82
10/4/1999	McCoys Creek at Myrtle Ave	17,000	97.65
10/4/1999	McCoys Creek at Leland St	50,000	99.20
2/2/2000	McCoys Creek at Leland St	800	50.00
2/2/2000	McCoys Creek at Myrtle Ave	2,400	83.33
4/3/2000	McCoys Creek at Leland St	700	42.86
5/25/2000	McCoys Creek at Leland Road	600	33.33
9/11/2000	McCoys Creek at Leland St	5,000	92.00
9/12/2000	McCoys Creek at Leland Road	9,500	95.79

Sample Date	Location	Observed Value (Exceedance)	Required Reduction (%)
3/6/2001	McCoys Creek at Myrtle Ave	3,000	86.67
3/6/2001	McCoys Creek at Leland St	5,000	92.00
5/16/2001	McCoys Creek at Myrtle Ave	1,000	60.00
9/5/2001	McCoys Creek at Myrtle Ave	200,000	99.80
9/5/2001	McCoys Creek at Leland St	200,000	99.80
12/11/2001	McCoys Creek at Myrtle Ave	5,700	92.98
12/11/2001	McCoys Creek at Leland St	9,500	95.79
3/4/2002	McCoys Creek at Leland St	1,620	75.31
3/14/2002	McCoys Creek at Myrtle Ave	800	50.00
3/18/2002	McCoys Creek at Leland St	7,800	94.87
7/30/2002	McCoys Creek at Leland St	2,200	81.82
8/28/2002	McCoys Creek at Leland St	3,000	86.67
9/17/2002	McCoys Creek at Myrtle Ave	2,500	84.00
9/17/2002	McCoys Creek at Leland St	3,100	87.10
9/24/2002	McCoys Creek at Leland Road	53,800	99.26
2/18/2003	McCoys Creek at Myrtle Ave	1,700	76.47
5/13/2003	McCoys Creek at Myrtle Ave	2,400	83.33
7/8/2003	McCoys Creek at Leland St	1,300	69.23
8/5/2003	McCoys Creek at Leland St	8,100	95.06
9/4/2003	McCoys Creek at Leland St	830	51.81
9/10/2003	McCoys Creek at Leland St	480	16.67
11/18/2003	McCoys Creek at Leland St	500	20.00
11/18/2003	McCoys Creek at Leland St	500	20.00
12/15/2003	McCoys Creek at Myrtle Ave	1,100	63.64
2/18/2004	McCoys Creek at Leland St	900	55.56
2/24/2004	McCoys Creek at Leland St	1,700	76.47
2/24/2004	McCoys Creek at Myrtle Ave	3,000	86.67
4/27/2004	McCoys Creek at Leland St	700	42.86
5/25/2004	McCoys Creek at Leland St	640	37.50
7/27/2004	McCoys Creek at Myrtle Ave	3,000	86.67
7/27/2004	McCoys Creek at Leland St	150,000	99.73
8/3/2004	McCoys Creek at Leland St	2,130	81.22
8/24/2004	McCoys Creek at Leland St	5,050	92.08
11/9/2004	McCoys Creek at Myrtle Ave	700	42.86
11/9/2004	McCoys Creek at Leland St	1,300	69.23
3/14/2005	McCoys Creek at Leland St	3,900	89.74
3/17/2005	McCoys Creek at Myrtle Ave	3,470	88.47
3/17/2005	McCoys Creek at Leland St	9,000	95.56
4/26/2005	McCoys Creek at Leland St	740	45.95
6/2/2005	McCoys Creek at Leland St	935	57.22
6/6/2005	McCoys Creek at Myrtle Ave	800	50.00
6/6/2005	McCoys Creek at Leland St	3,000	86.67
7/12/2005	McCoys Creek at Leland St	2,800	85.71
7/20/2005	McCoys Creek at Myrtle Ave	1,100	63.64
7/20/2005	McCoys Creek at Leland St	1,700	76.47
8/23/2005	McCoys Creek at Leland St	10,400	96.15
9/6/2005	McCoys Creek at Leland St	7,100	94.37

Sample Date	Location	Observed Value (Exceedance)	Required Reduction (%)
11/2/2005	McCoys Creek at Leland St	16,000	97.50
2/28/2006	McCoys Creek at Myrtle Ave	2,200	81.82
2/28/2006	McCoys Creek at Leland St	2,800	85.71
4/10/2006	McCoys Creek at Leland St	3,000	86.67
4/10/2006	McCoys Creek at Myrtle Ave	28,000	98.57
4/19/2006	McCoys Creek at Leland St	710	43.66
7/31/2006	McCoys Creek at Leland St	1,100	63.64
7/31/2006	McCoys Creek at Myrtle Ave	5,000	92.00
11/2/2006	McCoys Creek at Myrtle Ave	470	14.89
11/2/2006	McCoys Creek at Leland St	890	55.06
1/23/2007	McCoys Creek at Myrtle Ave	2,520	84.13
1/23/2007	McCoys Creek at Smith Street	2,600	84.62
1/23/2007	McCoys Creek at Leland Road	2,800	85.71
2/19/2007	McCoys Trib @ Webster St W Lift Station	475	15.79
2/19/2007	McCoys Cr @ McDuff Ave	3,900	89.74
3/27/2007	McCoys Creek at Leland Road	988	59.51
5/14/2007	McCoys Creek at Smith Street	654	38.84
5/14/2007	McCoys Creek at Leland Road	700	42.86
6/27/2007	McCoys Trib @ Webster St W Lift Station	900	55.56
6/27/2007	McCoys Cr @ Edison Ave	1,000	60.00
	MEDIAN:	**2,510**	**84.06**

5.1.3 Critical Conditions/Seasonality

Exceedances in McCoy Creek cannot easily be associated with flows, as flow data within the watershed were only collected from 1978 to 1983, before any fecal coliform samples were taken. Therefore, the effects of flow under various conditions cannot be determined or be considered as a critical condition.

Appendix B provides historical fecal coliform observations in McCoy Creek. Coliform data are presented by month, season, and year to determine whether certain patterns are evident in the dataset.

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 were significant differences among seasons and months (**Appendices C** and **D**). It is very difficult to evaluate possible patterns among months due to the small sample sizes; the range in monthly observations for fecal coliforms varies from 0 to 10 in a given month (**Table 2.1**). January, July, August, and October all had exceedance rates of 100 percent, while December had the lowest exceedance rate among months of 33.33 percent. Grouping observations by season increased sample sizes for statistical comparison, as seen in **Table 2.2**, but sample size is still relatively small (between 11 and 15 samples). Summer demonstrated the greatest percentage of exceedances (92.86 percent) and spring exhibited the lowest (46.67 percent). **Appendix E** presents comparisons by station and season.

A factor that could contribute to these monthly or seasonal differences would be the pattern of rainfall. Rainfall records for Jacksonville International Airport (**Appendix F** illustrates rainfall from 1990 to 2008) were used to determine 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 sampling and 29 days prior (30D) were all paired with the respective coliform observation based on date. A Spearman correlation matrix was generated that summarized the simple correlation coefficients between the various rainfall and coliform values (**Appendix G**). The simple correlations (r values in the Spearman correlation table) between both fecal coliform and the various rainfall totals were all 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 the rainfall recorded on the day of sampling (1D) and the cumulative total for the day of the previous 6 days (7D) were not significant. The r^2 values between coliform observations and the rainfall cumulative total for the day of and the previous 2 days (3D) and the cumulative total for the day of sampling and 29 days prior (30D) were significant (see **Appendix H**). This significance could be due to the size of the watershed and the possibility of some delay time between a rain event and the time it takes to flow through the system.

A table of historical monthly average rainfall (**Appendix I**) indicates that monthly rainfall totals increase in June and peak in September and by October return to the levels observed in February and March. **Appendix J** includes a graph of annual rainfall from 1955 to 2008 versus the long-term average (52.47 inches) over this period. The years 1996 to 1998 represented above-average rainfall years while 1999 to 2001 were below average and 2002 was again above average. Data exceedances occur almost all of the time, making it difficult to correlate them to rainfall patterns; however, the data in **Table 2.3** indicate that exceedances appear to be following the same pattern as the rainfall. The highest percentage of exceedances was seen in 1996 and 1998 (100 percent), both above-average rainfall years. The lowest percentage of exceedances was observed in 2003 (40 percent) which was a year with below-average rainfall.

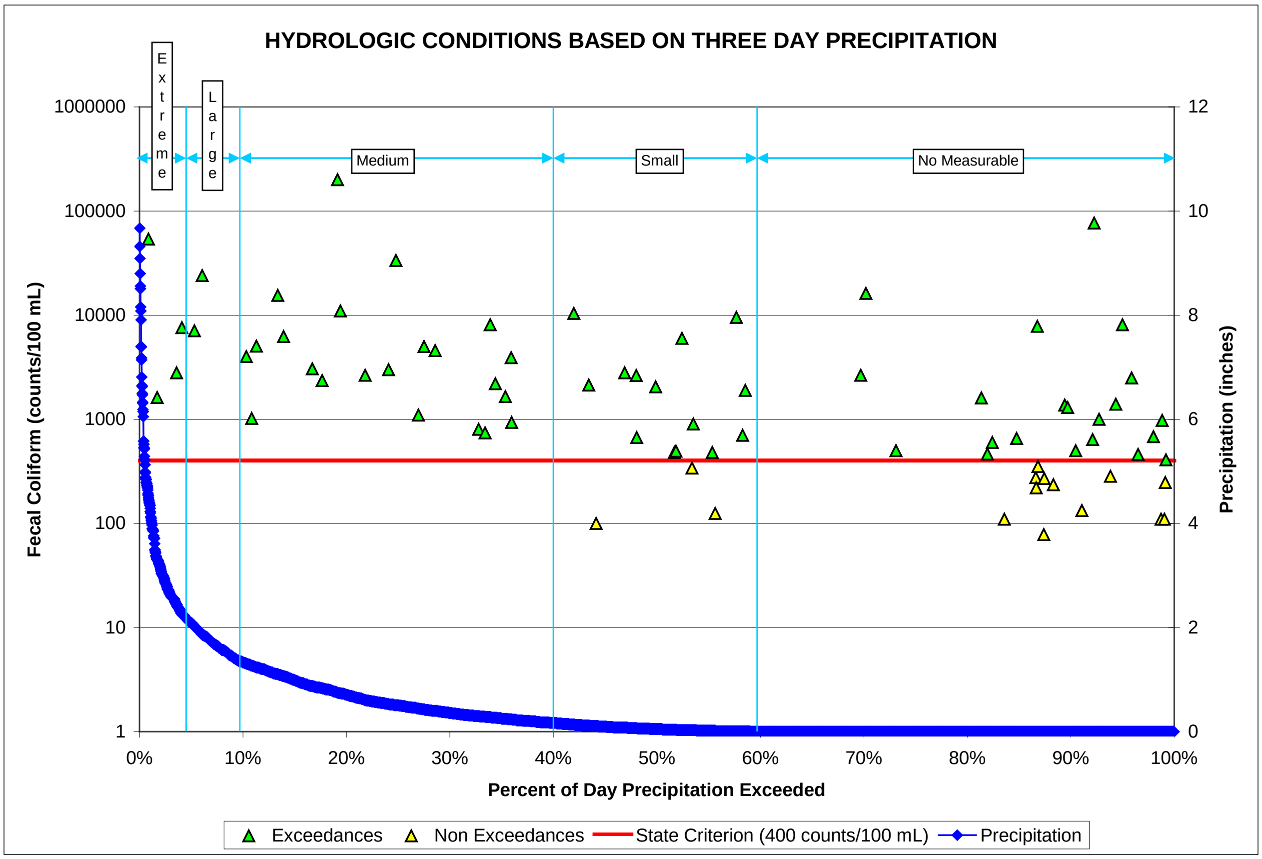
As no current flow data were available, hydrologic conditions were analyzed using rainfall. A loading curve type chart, that would normally be applied to flow events, was created using precipitation data from JIA from 1990 – 2008 instead. The chart was divided in the same manner as if flow was being 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 (day of and two days prior to sampling) precipitation accumulations were used in the analysis (**Figure 5.3**).

Data show that fecal coliform exceedances occurred over all hydrologic conditions for which data exist, and all have at least a 60 percent exceedance rate. The least percentage of exceedances (63.64 percent) occurred when there were no measurable precipitation events (<0.01”). There were only four samples collected within three days of an extreme precipitation event and two within three days of a large precipitation event. The greatest percentage of exceedances (100 percent) occurred after extreme, large and medium precipitation events. If a high percentage of exceedances are found to be occurring after large and extreme precipitation events, this may indicate that exceedances tend to be nonpoint source driven; perhaps from stormwater conveyance systems or various land uses. It is difficult to draw conclusions with so few samples representing extreme and large precipitation events; however, exceedances appear to decrease as precipitation amounts decrease indicating that nonpoint sources are probably the main contributing factor. **Table 5.5** is a summary of data and hydrologic conditions. **Figure 5.3** shows the same data visually.

Table 5.5. Summary of Fecal Coliform Data by Hydrologic Condition

Precipitation Event	Event Range (inches)	Total Samples	Number of Exceedances	% Exceedance	Number of Nonexceedances	% Nonexceedances
Extreme	>2.1"	4	4	100.00	0	0.00
Large	1.33" - 2.1"	2	2	100.00	0	0.00
Medium	0.18" - 1.33"	22	22	100.00	0	0.00
Small	0.01" - 0.18"	17	14	82.35	3	17.65
None/ No Measurable	<0.01"	33	21	63.64	12	36.36

Figure 5.3. Fecal Coliform Data by Hydrologic Condition Based on Rainfall



Chapter 6: DETERMINATION OF THE TMDL

6.1 Expression and Allocation of the TMDL

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

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

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

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

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

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

This approach is consistent with federal regulations (40 CFR § 130.2[I]), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or **other appropriate measure**. The TMDL for McCoy Creek 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**).

Table 6.1. TMDL Components for McCoy Creek, WBID 2257

WBID	Parameter	TMDL (colonies/ 100mL)	WLA		LA (% reduction)	MOS
			Wastewater (colonies/day)	NPDES Stormwater		
2257	Fecal Coliform	400	N/A	84%	84%	Implicit

N/A -Not Applicable

6.2 Load Allocation

The LA for nonpoint sources is 84 percent reduction of instream fecal coliform concentrations. 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

There is currently only one permitted NPDES discharge into McCoy Creek; however, the permit is for a ground water remediation facility (CSX Transportation, Inc. Permit #FL0176877) and does not require fecal coliform to be monitored. Any future discharge permits issued in the McCoy Creek watershed must meet the state's Class III criterion for fecal coliform as well as the TMDL value, and therefore will not be allowed to 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.

6.3.2 NPDES Stormwater Discharges

The WLA for the city of Jacksonville and FDOT's MS4 permit is to address anthropogenic sources in the watershed to result in an 84 percent reduction of in-stream fecal coliform concentrations. 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 have been 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 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 used 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.

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 McCoy Creek, 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 K**. 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 Post, Buckley, Schuh & Jernigan (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:

1. ***Source Identification****—Sources of fecal coliform impairment are particularly difficult to trace. For this reason, the BMAP includes source identification studies as management actions.*

2. ***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.*

3. ***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. While some of the projects and activities in the BMAP are recently completed or currently ongoing, several projects will require more time to design, secure funding, and construct. Although 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 Florida Department of Transportation throughout the 15 counties meeting the population criteria. EPA authorized the Department to implement the NPDES Stormwater Program (except for tribal lands) in October 2000.

An important difference between the federal and the state's stormwater/environmental resource permitting programs is that the NPDES program covers both new and existing discharges, while the state's program focuses on new discharges only. Additionally, Phase II of the NPDES Program, implemented in 2003, expands the need for these permits to construction sites between 1 and 5 acres, and to local governments with as few as 10,000 people. These 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 McCoy Creek, WBID 2257

Waterbody	WBID	Sample Date	Station	Location	Value (#/100mL)	Remark Code
McCoy Creek	2257	1/31/1995	21FLJXWQMC1	McCoys Creek at Myrtle Ave	300	
McCoy Creek	2257	1/31/1995	21FLJXWQMC3	McCoys Creek at Leland St	5,000	
McCoy Creek	2257	4/18/1995	21FLJXWQMC3	McCoys Creek at Leland St	30,000	
McCoy Creek	2257	4/18/1995	21FLJXWQMC1	McCoys Creek at Myrtle Ave	2,400	
McCoy Creek	2257	7/11/1995	21FLJXWQMC3	McCoys Creek at Leland St	9,000	
McCoy Creek	2257	7/11/1995	21FLJXWQMC1	McCoys Creek at Myrtle Ave	3,000	
McCoy Creek	2257	10/14/1996	21FLJXWQMC1	McCoys Creek at Myrtle Ave	500	
McCoy Creek	2257	5/20/1998	21FLJXWQMC1	McCoys Creek at Myrtle Ave	1,700	
McCoy Creek	2257	5/20/1998	21FLJXWQMC3	McCoys Creek at Leland St	2,400	
McCoy Creek	2257	7/14/1998	21FLJXWQMC1	McCoys Creek at Myrtle Ave	24,000	
McCoy Creek	2257	7/14/1998	21FLJXWQMC3	McCoys Creek at Leland St	24,000	
McCoy Creek	2257	10/6/1998	21FLJXWQMC3	McCoys Creek at Leland St	5,000	
McCoy Creek	2257	10/6/1998	21FLJXWQMC1	McCoys Creek at Myrtle Ave	5,000	
McCoy Creek	2257	1/4/1999	21FLJXWQMC3	McCoys Creek at Leland St	5000	
McCoy Creek	2257	1/4/1999	21FLJXWQMC1	McCoys Creek at Myrtle Ave	17,000	
McCoy Creek	2257	4/19/1999	21FLJXWQMC3	McCoys Creek at Leland St	9,000	
McCoy Creek	2257	4/19/1999	21FLJXWQMC1	McCoys Creek at Myrtle Ave	140	
McCoy Creek	2257	8/10/1999	21FLJXWQMC1	McCoys Creek at Myrtle Ave	2,200	
McCoy Creek	2257	8/10/1999	21FLJXWQMC3	McCoys Creek at Leland St	1,100	
McCoy Creek	2257	10/4/1999	21FLJXWQMC1	McCoys Creek at Myrtle Ave	17,000	
McCoy Creek	2257	10/4/1999	21FLJXWQMC3	McCoys Creek at Leland St	50,000	
McCoy Creek	2257	2/2/2000	21FLJXWQMC3	McCoys Creek at Leland St	800	
McCoy Creek	2257	2/2/2000	21FLJXWQMC1	McCoys Creek at Myrtle Ave	2,400	
McCoy Creek	2257	4/3/2000	21FLJXWQMC3	McCoys Creek at Leland St	700	
McCoy Creek	2257	4/3/2000	21FLJXWQMC1	McCoys Creek at Myrtle Ave	230	
McCoy Creek	2257	5/25/2000	21FLA 20030725	McCoys Creek at Leland Road	600	
McCoy Creek	2257	9/11/2000	21FLJXWQMC3	McCoys Creek at Leland St	5,000	
McCoy Creek	2257	9/11/2000	21FLJXWQMC1	McCoys Creek at Myrtle Ave	300	
McCoy Creek	2257	9/12/2000	21FLA 20030725	McCoys Creek at Leland Road	9,500	
McCoy Creek	2257	12/13/2000	21FLJXWQMC3	McCoys Creek at Leland St	80	
McCoy Creek	2257	12/13/2000	21FLJXWQMC1	McCoys Creek at Myrtle Ave	140	
McCoy Creek	2257	3/6/2001	21FLJXWQMC1	McCoys Creek at Myrtle Ave	3,000	
McCoy Creek	2257	3/6/2001	21FLJXWQMC3	McCoys Creek at Leland St	5,000	
McCoy Creek	2257	5/16/2001	21FLJXWQMC1	McCoys Creek at Myrtle Ave	1,000	
McCoy Creek	2257	5/16/2001	21FLJXWQMC3	McCoys Creek at Leland St	310	
McCoy Creek	2257	9/5/2001	21FLJXWQMC1	McCoys Creek at Myrtle Ave	200,000	K
McCoy Creek	2257	9/5/2001	21FLJXWQMC3	McCoys Creek at Leland St	200,000	K
McCoy Creek	2257	12/11/2001	21FLJXWQMC1	McCoys Creek at Myrtle Ave	5,700	
McCoy Creek	2257	12/11/2001	21FLJXWQMC3	McCoys Creek at Leland St	9,500	
McCoy Creek	2257	2/28/2002	21FLJXWQMC3	McCoys Creek at Leland St	276	
McCoy Creek	2257	3/4/2002	21FLJXWQMC3	McCoys Creek at Leland St	1,620	
McCoy Creek	2257	3/7/2002	21FLJXWQMC3	McCoys Creek at Leland St	220	
McCoy Creek	2257	3/14/2002	21FLJXWQMC1	McCoys Creek at Myrtle Ave	800	L
McCoy Creek	2257	3/18/2002	21FLJXWQMC3	McCoys Creek at Leland St	7,800	
McCoy Creek	2257	3/25/2002	21FLJXWQMC3	McCoys Creek at Leland St	352	
McCoy Creek	2257	5/15/2002	21FLJXWQMC3	McCoys Creek at Leland St	78	
McCoy Creek	2257	5/22/2002	21FLJXWQMC1	McCoys Creek at Myrtle Ave	260	
McCoy Creek	2257	5/22/2002	21FLJXWQMC3	McCoys Creek at Leland St	280	
McCoy Creek	2257	7/30/2002	21FLJXWQMC3	McCoys Creek at Leland St	2,200	
McCoy Creek	2257	8/28/2002	21FLJXWQMC3	McCoys Creek at Leland St	3,000	
McCoy Creek	2257	9/17/2002	21FLJXWQMC3	McCoys Creek at Leland St	3,100	

Waterbody	WBID	Sample Date	Station	Location	Value (#/100mL)	Remark Code
McCoy Creek	2257	9/17/2002	21FLJXWQMC1	McCoys Creek at Myrtle Ave	2,500	
McCoy Creek	2257	9/24/2002	21FLA 20030725	McCoys Creek at Leland Road	53,800	B
McCoy Creek	2257	12/4/2002	21FLJXWQMC3	McCoys Creek at Leland St	300	
McCoy Creek	2257	12/4/2002	21FLJXWQMC1	McCoys Creek at Myrtle Ave	170	
McCoy Creek	2257	2/18/2003	MC1	McCoys Creek at Myrtle Ave	1,700	
McCoy Creek	2257	2/18/2003	MC3	McCoys Creek at Leland St	340	
McCoy Creek	2257	4/22/2003	21FLJXWQMC3	McCoys Creek at Leland St	340	
McCoy Creek	2257	5/13/2003	MC1	McCoys Creek at Myrtle Ave	2,400	
McCoy Creek	2257	5/13/2003	MC3	McCoys Creek at Leland St	340	
McCoy Creek	2257	7/8/2003	21FLJXWQMC3	McCoys Creek at Leland St	1,300	
McCoy Creek	2257	8/5/2003	21FLJXWQMC3	McCoys Creek at Leland St	8,100	
McCoy Creek	2257	9/4/2003	MC1	McCoys Creek at Myrtle Ave	130	
McCoy Creek	2257	9/4/2003	MC3	McCoys Creek at Leland St	830	
McCoy Creek	2257	9/10/2003	21FLJXWQMC3	McCoys Creek at Leland St	480	
McCoy Creek	2257	11/18/2003	21FLJXWQMC3	McCoys Creek at Leland St	500	
McCoy Creek	2257	11/18/2003	MC3	McCoys Creek at Leland St	500	
McCoy Creek	2257	12/15/2003	MC1	McCoys Creek at Myrtle Ave	1,100	
McCoy Creek	2257	1/30/2004	21FLA 20030725	McCoys Creek at Leland Road	133	
McCoy Creek	2257	2/18/2004	21FLJXWQMC3	McCoys Creek at Leland St	900	
McCoy Creek	2257	2/24/2004	MC1	McCoys Creek at Myrtle Ave	3,000	
McCoy Creek	2257	2/24/2004	MC3	McCoys Creek at Leland St	1,700	
McCoy Creek	2257	4/27/2004	MC3	McCoys Creek at Leland St	700	
McCoy Creek	2257	5/25/2004	21FLJXWQMC3	McCoys Creek at Leland St	640	
McCoy Creek	2257	7/27/2004	MC1	McCoys Creek at Myrtle Ave	3,000	
McCoy Creek	2257	7/27/2004	MC3	McCoys Creek at Leland St	150,000	
McCoy Creek	2257	8/3/2004	21FLJXWQMC3	McCoys Creek at Leland St	2,130	
McCoy Creek	2257	8/24/2004	21FLJXWQMC3	McCoys Creek at Leland St	5,050	
McCoy Creek	2257	9/29/2004	21FLJXWQMC3	McCoys Creek at Leland St	100	
McCoy Creek	2257	11/9/2004	MC1	McCoys Creek at Myrtle Ave	700	
McCoy Creek	2257	11/9/2004	MC3	McCoys Creek at Leland St	1,300	
McCoy Creek	2257	3/11/2005	21FLJXWQMC3	McCoys Creek at Leland St	284	
McCoy Creek	2257	3/14/2005	21FLJXWQMC3	McCoys Creek at Leland St	3,900	
McCoy Creek	2257	3/17/2005	MC1	McCoys Creek at Myrtle Ave	3,470	
McCoy Creek	2257	3/17/2005	MC3	McCoys Creek at Leland St	9,000	
McCoy Creek	2257	4/26/2005	21FLJXWQMC3	McCoys Creek at Leland St	740	
McCoy Creek	2257	6/2/2005	21FLJXWQMC3	McCoys Creek at Leland St	935	
McCoy Creek	2257	6/6/2005	MC1	McCoys Creek at Myrtle Ave	800	
McCoy Creek	2257	6/6/2005	MC3	McCoys Creek at Leland St	3,000	
McCoy Creek	2257	7/12/2005	21FLJXWQMC3	McCoys Creek at Leland St	2,800	
McCoy Creek	2257	7/20/2005	MC1	McCoys Creek at Myrtle Ave	1,100	
McCoy Creek	2257	7/20/2005	MC3	McCoys Creek at Leland St	1,700	
McCoy Creek	2257	8/23/2005	21FLJXWQMC3	McCoys Creek at Leland St	10,400	
McCoy Creek	2257	9/6/2005	21FLJXWQMC3	McCoys Creek at Leland St	7,100	
McCoy Creek	2257	11/2/2005	MC1	McCoys Creek at Myrtle Ave	170	
McCoy Creek	2257	11/2/2005	MC3	McCoys Creek at Leland St	16,000	
McCoy Creek	2257	2/28/2006	MC1	McCoys Creek at Myrtle Ave	2,200	
McCoy Creek	2257	2/28/2006	MC3	McCoys Creek at Leland St	2,800	
McCoy Creek	2257	4/10/2006	MC1	McCoys Creek at Myrtle Ave	28,000	
McCoy Creek	2257	4/10/2006	MC3	McCoys Creek at Leland St	3,000	
McCoy Creek	2257	4/19/2006	MC1	McCoys Creek at Myrtle Ave	210	
McCoy Creek	2257	4/19/2006	MC3	McCoys Creek at Leland St	710	
McCoy Creek	2257	7/31/2006	MC1	McCoys Creek at Myrtle Ave	5,000	
McCoy Creek	2257	7/31/2006	MC3	McCoys Creek at Leland St	1,100	

Waterbody	WBID	Sample Date	Station	Location	Value (#/100mL)	Remark Code
McCoy Creek	2257	11/2/2006	MC1	McCoys Creek at Myrtle Ave	470	
McCoy Creek	2257	11/2/2006	MC3	McCoys Creek at Leland St	890	
McCoy Creek	2257	1/23/2007	21FLA 20030730	McCoys Creek at Smith Street	2,600	B
McCoy Creek	2257	1/23/2007	21FLA 20030693	McCoy Cr at Myrtle Ave	2,520	B
McCoy Creek	2257	1/23/2007	21FLA 20030725	McCoys Creek at Leland Road	2,800	B
McCoy Creek	2257	2/12/2007	MC1	McCoys Creek at Myrtle Ave	100	
McCoy Creek	2257	2/12/2007	MC3	McCoys Creek at Leland St	120	
McCoy Creek	2257	2/19/2007	21FLA 20030881	McCoys Cr @ McDuff Ave	3,900	
McCoy Creek	2257	2/19/2007	21FLA 20030883	McCoys Trib @ Webster St W Lift Station	475	A
McCoy Creek	2257	2/19/2007	21FLA 20030725	McCoys Creek at Leland Road	175	A
McCoy Creek	2257	2/19/2007	21FLA 20030882	McCoys Cr @ Edison Ave	175	A
McCoy Creek	2257	2/19/2007	21FLA 20030693	McCoy Cr at Myrtle Ave	150	A
McCoy Creek	2257	3/13/2007	21FLA 20030730	McCoys Creek at Smith Street	50	B
McCoy Creek	2257	3/13/2007	21FLA 20030725	McCoys Creek at Leland Road	80	A
McCoy Creek	2257	3/13/2007	21FLA 20030693	McCoy Cr at Myrtle Ave	200	B
McCoy Creek	2257	3/23/2007	21FLA 20030882	McCoys Cr @ Edison Ave	247	A
McCoy Creek	2257	3/27/2007	21FLA 20030693	McCoy Cr at Myrtle Ave	267	
McCoy Creek	2257	3/27/2007	21FLA 20030725	McCoys Creek at Leland Road	988	A
McCoy Creek	2257	3/27/2007	21FLA 20030881	McCoys Cr @ McDuff Ave	176	A
McCoy Creek	2257	3/27/2007	21FLA 20030883	McCoys Trib @ Webster St W Lift Station	200	A
McCoy Creek	2257	4/2/2007	MC1	McCoys Creek at Myrtle Ave	110	
McCoy Creek	2257	4/2/2007	MC3	McCoys Creek at Leland St	140	
McCoy Creek	2257	5/14/2007	21FLA 20030730	McCoys Creek at Smith Street	654	A
McCoy Creek	2257	5/14/2007	21FLA 20030725	McCoys Creek at Leland Road	700	A
McCoy Creek	2257	5/14/2007	21FLA 20030693	McCoy Cr at Myrtle Ave	127	A
McCoy Creek	2257	6/27/2007	21FLA 20030882	McCoys Cr @ Edison Ave	1,000	B
McCoy Creek	2257	6/27/2007	21FLA 20030725	McCoys Creek at Leland Road	100	U
McCoy Creek	2257	6/27/2007	21FLA 20030883	McCoys Trib @ Webster St W Lift Station	900	B

*Deleted blank result entries and dups.

(yellow)	COJ data from PBS&J.
(gray)	Values that exceed the state criterion of 400 counts/100mL.

Remark Code:

A – Average value.

B – Results based on colony counts outside the acceptable range.

K – Less than.

L – Off-scale high. Actual value not known, but known to be greater than value shown.

U – Not detected.

Appendix C: Kruskal–Wallis Analysis of Fecal Coliform Observations versus Season in McCoy Creek, WBID 2257

Categorical values encountered during processing are:
SEASON$ (4 levels)
FALL, SPRING, SUMMER, WINTER

Kruskal-Wallis One-Way Analysis of Variance for 132 cases
Dependent variable is FECALS
Grouping variable is SEASON$

Group	Count	Rank Sum
FALL	20	1327.000
SPRING	35	1880.000
SUMMER	33	2977.000
WINTER	44	2594.000

Kruskal-Wallis Test Statistic = 18.316
Probability is 0.000 assuming Chi-square distribution with 3 df

Appendix D: Kruskal–Wallis Analysis of Fecal Coliform Observations versus Month in McCoy Creek, WBID 2257

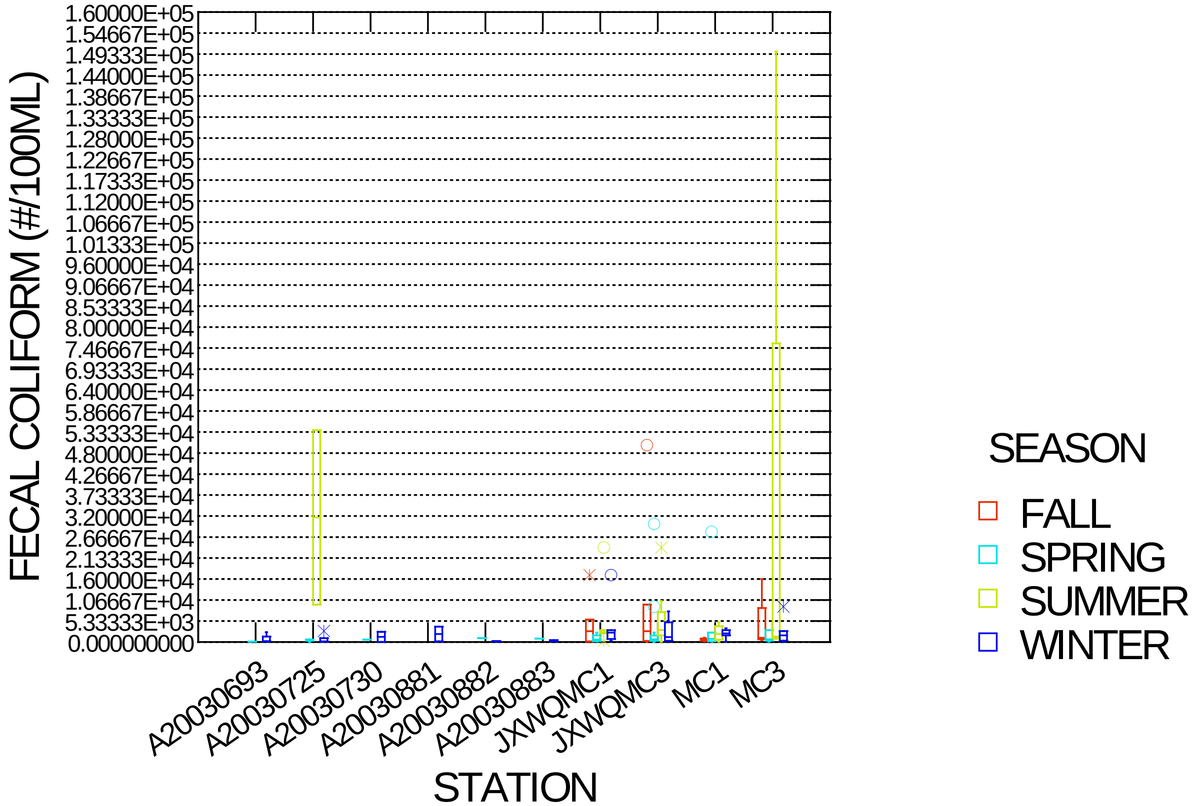
Categorical values encountered during processing are:
MONTH (12 levels)
1, 2, 3, 4, 5, 6, 7,
8, 9, 10, 11, 12

Kruskal-Wallis One-Way Analysis of Variance for 132 cases
Dependent variable is FECALS
Grouping variable is MONTH

Group	Count	Rank Sum
1	8	645.500
2	17	899.500
3	19	1049.000
4	15	883.500
5	14	648.500
6	6	348.000
7	13	1245.000
8	7	665.500
9	13	1066.500
10	5	507.500
11	8	452.500
12	7	367.000

Kruskal-Wallis Test Statistic = 29.039
Probability is 0.002 assuming Chi-square distribution with 11 df

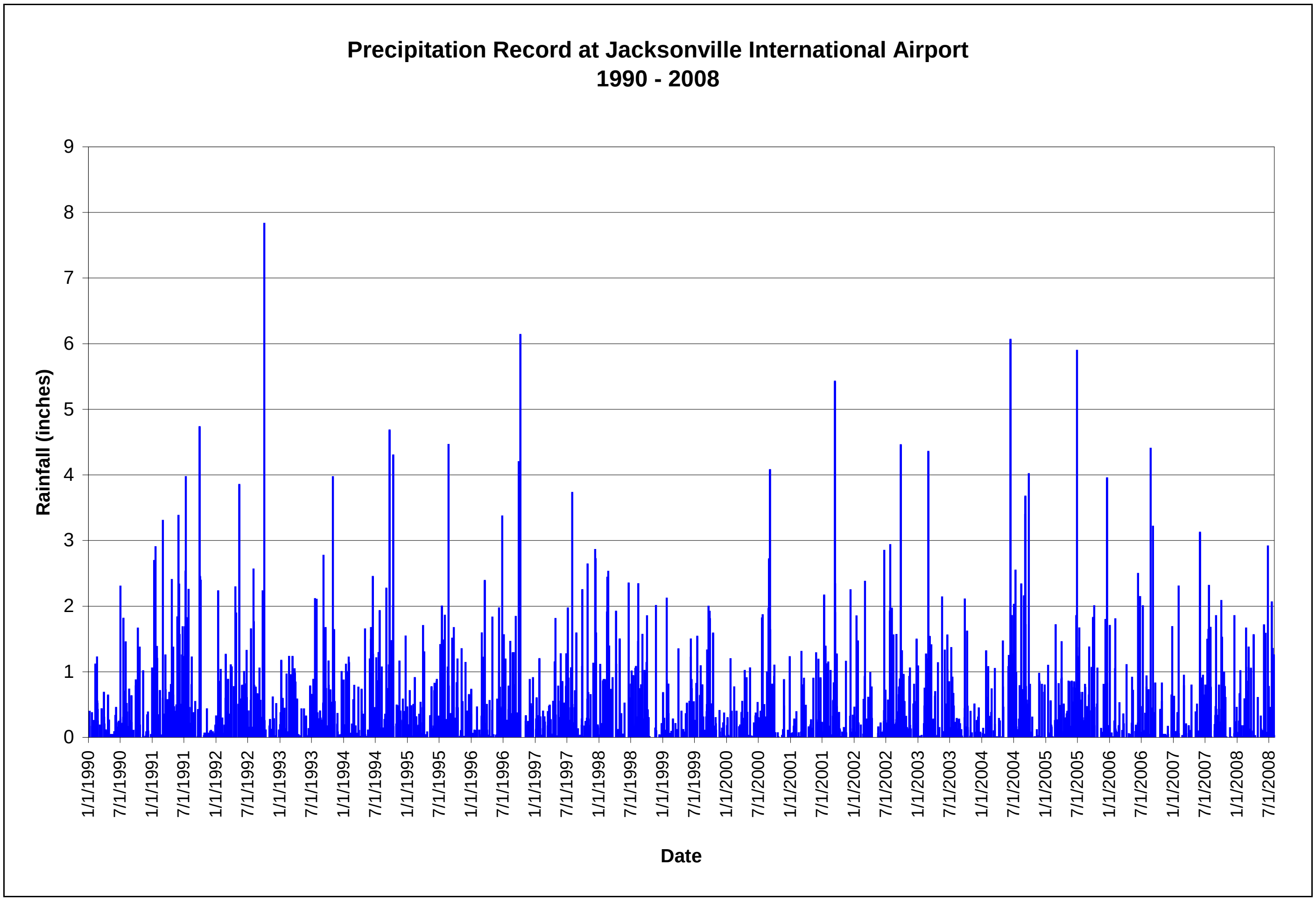
Appendix E: Chart of Fecal Coliform Observations by Season and Station in McCoy Creek, WBID 2257



Of 132 cases, 2 were excluded by making graph range less than data range.

Station	STORET ID
MCCOY CR AT MYRTLE AVE	21FLA 20030693
MCCOYS CREEK AT LELAND ROAD	21FLA 20030725
MCCOYS CREEK AT SMITH STREET	21FLA 20030730
MCCOYS CR @ MCDUFF AVE	21FLA 20030881
MCCOYS CR @ EDISON AVE	21FLA 20030882
MCCOYS TRIB @ WEBSTER ST W LIFT STATION	21FLA 20030883
MCCOYS CREEK AT MYRTLE AVE	21FLJXWQMC1
MCCOYS CREEK AT LELAND ST	21FLJXWQMC3

Appendix F: Chart of Biannual Rainfall for JIA, 1990–2008

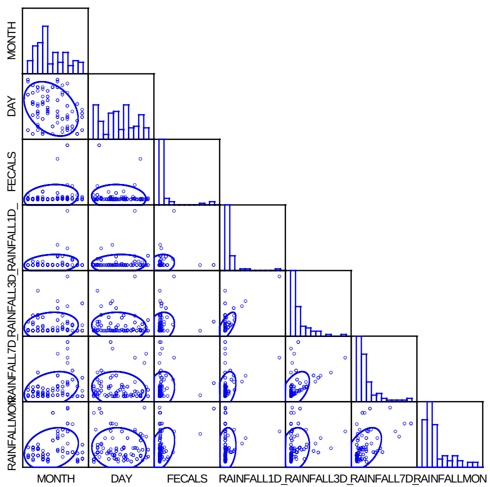


Appendix G: Spearman Correlation Matrix Analysis for Precipitation and Fecal Coliform in McCoy Creek, WBID 2257

Spearman correlation matrix

	MONTH	DAY	FECALS	RAINFALL1D_	RAINFALL3D_
MONTH	1.000				
DAY	-0.336	1.000			
FECALS	0.166	-0.086	1.000		
RAINFALL1D_	0.244	-0.045	0.363	1.000	
RAINFALL3D_	0.110	-0.074	0.570	0.545	1.000
RAINFALL7D_	0.247	-0.241	0.521	0.402	0.692
RAINFALLMON	0.182	-0.031	0.389	0.244	0.442

	RAINFALL7D_	RAINFALLMON
RAINFALL7D_	1.000	
RAINFALLMON	0.514	1.000



Number of observations: 132

Appendix H: Analysis of Fecal Coliform Observations and Precipitation in McCoy Creek, WBID 2257

FECAL COLIFORM DATA VERSUS DAY OF SAMPLING PRECIPITATION

2 case(s) deleted due to missing data.

Dep Var: FECALS N: 132 Multiple R: 0.135 Squared multiple R: 0.018

Adjusted squared multiple R: 0.011 Standard error of estimate: 28085.861

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	6974.605	2521.220	0.000	.	2.766	0.006
RAINFALL1D_	8400.145	5418.657	0.135	1.000	1.550	0.124

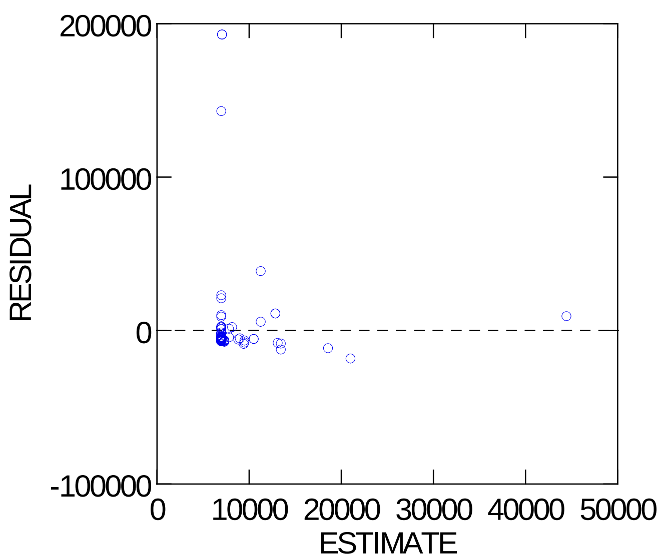
Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	1.89568E+09	1	1.89568E+09	2.403	0.124
Residual	1.02546E+11	130	7.88816E+08		

*** WARNING ***
Case 36 is an outlier (Studentized Residual = 8.628)
Case 37 is an outlier (Studentized Residual = 8.628)
Case 53 has large leverage (Leverage = 0.711)
Case 76 is an outlier (Studentized Residual = 5.698)

Durbin-Watson D Statistic 1.270
First Order Autocorrelation 0.365

Plot of residuals against predicted values



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

2 case(s) deleted due to missing data.

Dep Var: FECALS   N: 132   Multiple R: 0.184   Squared multiple R: 0.034

Adjusted squared multiple R: 0.026   Standard error of estimate: 27862.655

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	5275.530	2727.075	0.000	.	1.935	0.055
RAINFALL3D_	7469.252	3508.181	0.184	1.000	2.129	0.035

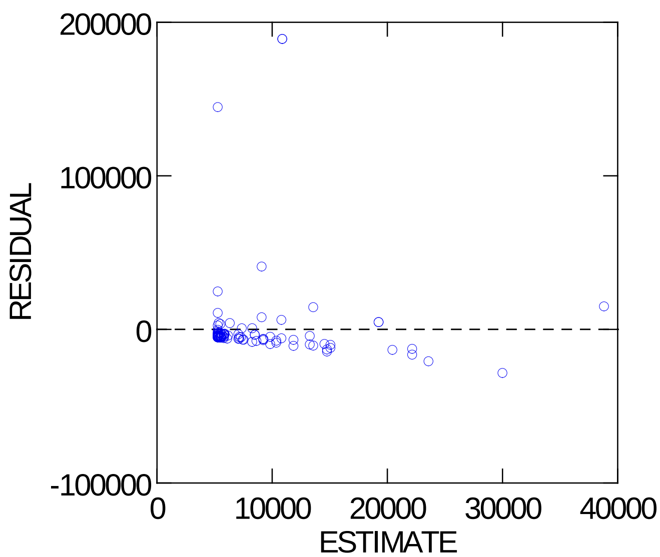
Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	3.51913E+09	1	3.51913E+09	4.533	0.035
Residual	1.00923E+11	130	7.76328E+08		

*** WARNING ***
Case 36 is an outlier (Studentized Residual = 8.481)
Case 37 is an outlier (Studentized Residual = 8.481)
Case 41 has large leverage (Leverage = 0.146)
Case 53 has large leverage (Leverage = 0.279)
Case 76 is an outlier (Studentized Residual = 5.848)

Durbin-Watson D Statistic 1.333
First Order Autocorrelation 0.333

Plot of residuals against predicted values



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

2 case(s) deleted due to missing data.

Dep Var: FECALS N: 132 Multiple R: 0.132 Squared multiple R: 0.017

Adjusted squared multiple R: 0.010 Standard error of estimate: 28095.193

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	5458.834	2935.935	0.000	.	1.859	0.065
RAINFALL7D_	2543.142	1671.362	0.132	1.000	1.522	0.131

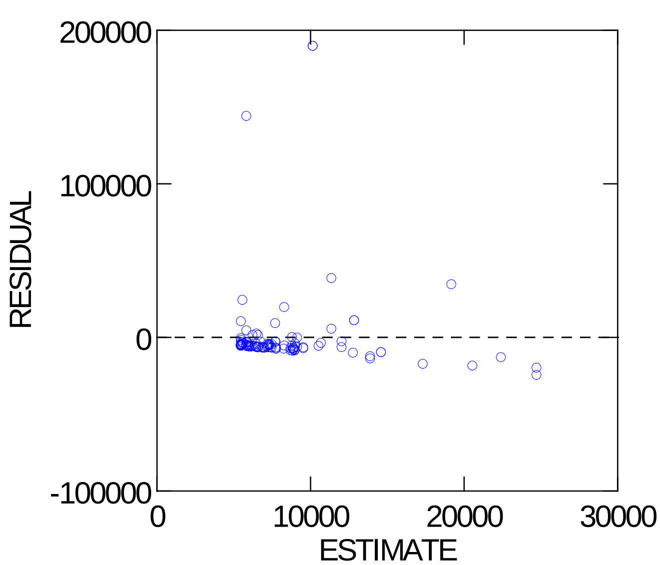
Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	1.82753E+09	1	1.82753E+09	2.315	0.131
Residual	1.02614E+11	130	7.89340E+08		

*** WARNING ***
Case 27 has large leverage (Leverage = 0.162)
Case 28 has large leverage (Leverage = 0.162)
Case 29 has large leverage (Leverage = 0.122)
Case 36 is an outlier (Studentized Residual = 8.425)
Case 37 is an outlier (Studentized Residual = 8.425)
Case 76 is an outlier (Studentized Residual = 5.761)

Durbin-Watson D Statistic 1.303
First Order Autocorrelation 0.348

Plot of residuals against predicted values



FECAL COLIFORM DATA VERSUS DAY OF SAMPLING AND 29 DAYS PRIOR PRECIPITATION
2 case(s) deleted due to missing data.

Dep Var: FECALS N: 132 Multiple R: 0.407 Squared multiple R: 0.165

Adjusted squared multiple R: 0.159 Standard error of estimate: 25894.209

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	-5414.581	3463.015	0.000	.	-1.564	0.120
RAINFALLMON	3136.576	617.937	0.407	1.000	5.076	0.000

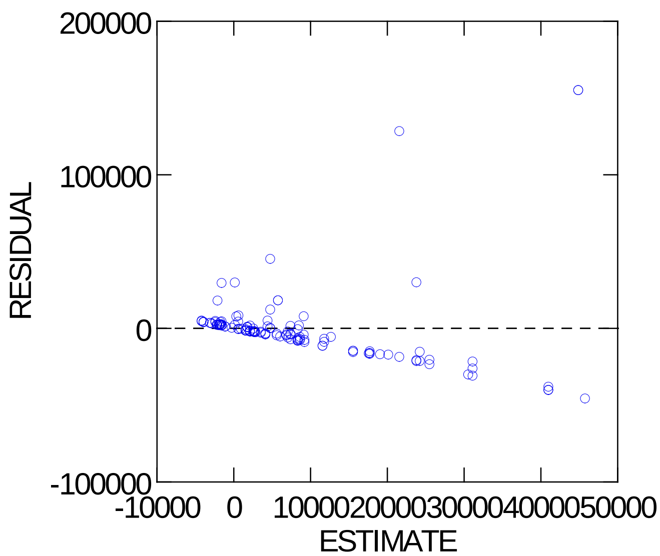
Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	1.72754E+10	1	1.72754E+10	25.765	0.000
Residual	8.71663E+10	130	6.70510E+08		

*** WARNING ***
Case 36 is an outlier (Studentized Residual = 7.475)
Case 37 is an outlier (Studentized Residual = 7.475)
Case 76 is an outlier (Studentized Residual = 5.551)

Durbin-Watson D Statistic 1.334
First Order Autocorrelation 0.332

Plot of residuals against predicted values



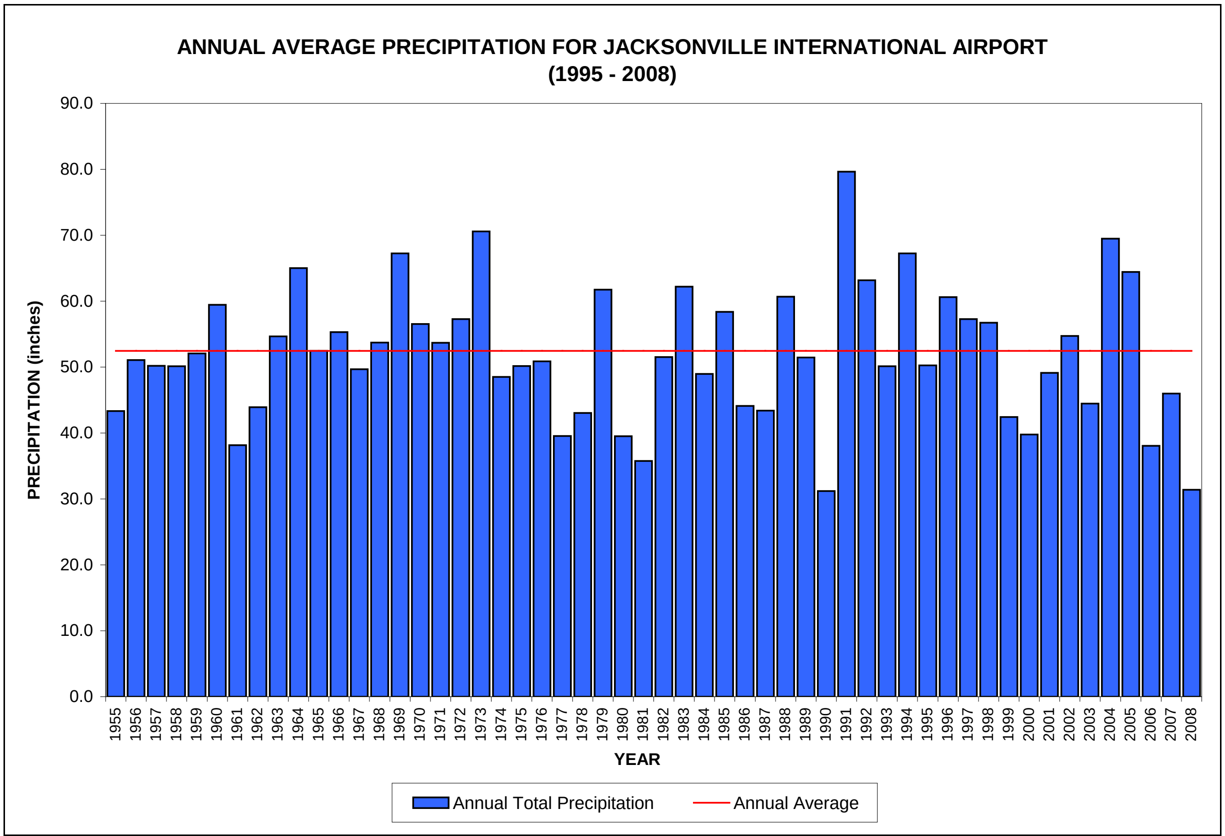
Appendix I: Monthly and Annual Precipitation from JIA, 1955–2008

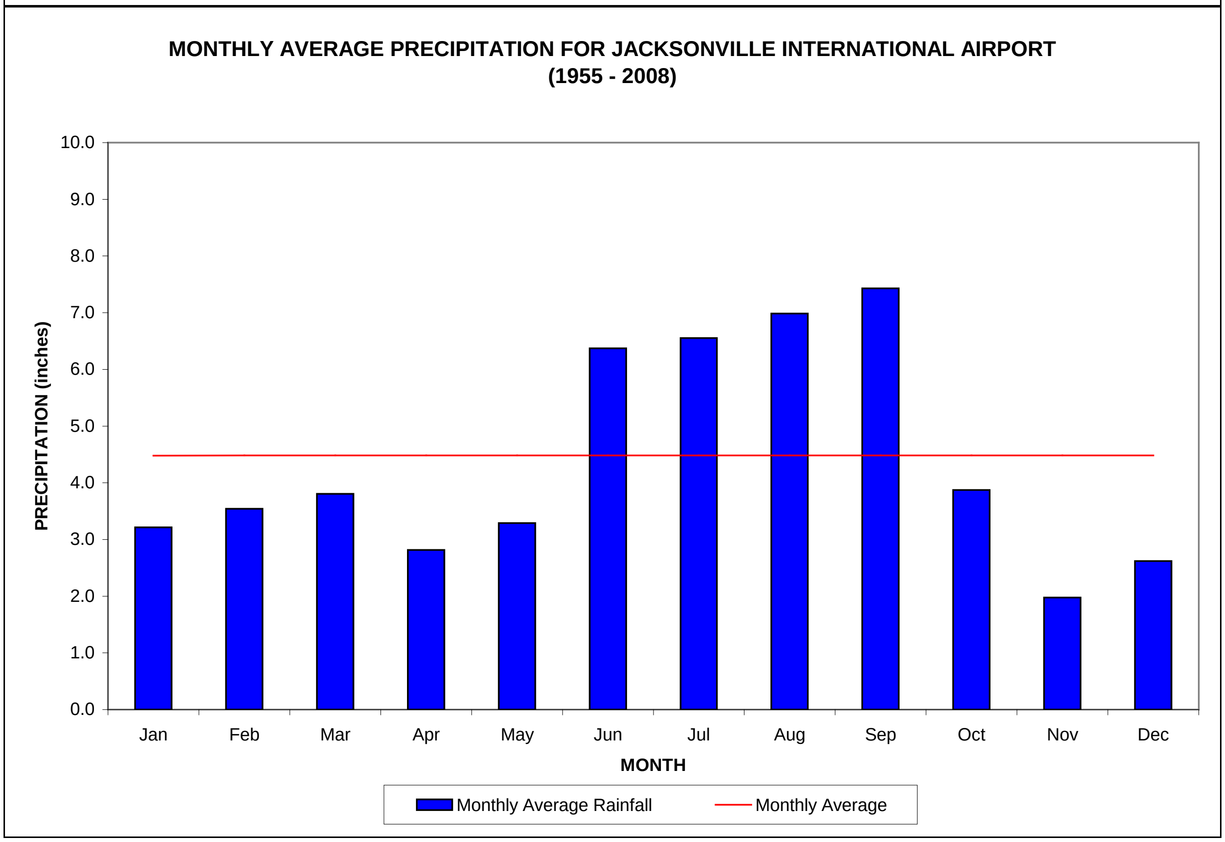
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
1955	3.1	2.46	1.66	1.5	4.51	2.7	5.53	3.85	10.6	5.36	1.9	0.2	**43.33**
1956	2.9	2.94	0.81	2.33	3.98	7.87	8.25	5.24	2.89	13.4	0.4	0	**51.08**
1957	0.3	1.69	3.87	1.61	5.25	7.1	12.3	3.3	8.33	3.5	1.6	1.3	**50.18**
1958	3.4	3.74	3.38	8.24	3.79	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**
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**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
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 J: Annual and Monthly Average Precipitation at JIA





Appendix K: Executive Summary of 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.

For additional information, please contact: Don Deis, PBS&J Project Manager, at (904) 363-8442 or drdeis@pbsj.com.

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