FINAL

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Water Resource Management, Bureau of Watershed Management

NORTHEAST DISTRICT • NASSAU–ST. MARYS BASINS

TMDL Report

Fecal Coliform and Total Coliform TMDLs for Unnamed Branch, WBID 2156

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Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Load (TMDL) for fecal and total coliform for the Unnamed Branch watershed in the Nassau River Planning Unit of the Nassau–St. Marys Basins. The creek was verified as impaired for fecal and total coliform, and was included on the Verified List of impaired waters for the Nassau–St. Marys Basins that was adopted by Secretarial Order on May 3, 2006. The TMDL establishes the allowable coliform loadings to Unnamed Branch that would restore the waterbody so that it meets its applicable water quality criteria for coliform.

1.2 Identification of Waterbody

Unnamed Branch is located in Nassau County, in northeast Florida, near the Town of Callahan **(Figure 1.1).** With a drainage area of approximately 3.72 square miles (mi^2), it flows directly into Alligator Creek and then into Mills Creek, which discharges into the Nassau River **(Figure 1.2).** The stream, which is approximately 2.4 miles long, is a second-order stream. Additional information about its hydrology and geology are available in the Basin Status Report for the Nassau–St. Marys Basins (Florida Department of Environmental Protection [Department], 2004).

For assessment purposes, the Department has divided the Nassau–St. Marys Basins into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed or stream reach. Unnamed Branch lies within one WBID, 2156 **(Figure 1.2)**, which this TMDL addresses.

Unnamed Branch is part of the Nassau River Planning Unit. Planning units are groups of WBIDs, and are in turn part of a larger basin, in this case the Nassau–St. Marys Basins. The Nassau River Planning Unit consists of 60 WBIDs. **Figure 1.3** shows the location of these WBIDs, Unnamed Branch's location in the planning unit, and a list of other WBIDs in the planning unit.

Figure 1.2. Overview of the Unnamed Branch Watershed, WBID 2156

Figure 1.3. WBIDs in the Nassau River Planning Unit

1.3 Background

This report was developed as part of the Department's watershed management approach for restoring and protecting state waters and addressing TMDL Program requirements. The watershed approach, which is implemented using a cyclical management process that rotates through the state's 52 river basins over a five-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 designated uses. TMDLs are developed for waterbodies that are verified as not meeting 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 and total coliforms that caused the verified impairment of Unnamed Branch. These activities will depend heavily on the active participation of the St. Johns River Water Management District (SJRWMD), Nassau County, 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 source in each of these impaired 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 six waterbodies and 17 parameters in the Nassau 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.

2.2 Information on Verified Impairment

The Department used the IWR methodology to assess water quality impairments in Unnamed Branch and has verified the impairments for fecal and total coliforms based on information in its IWR database. **Tables 2.1** through **2.3** provide summary results for fecal and total coliform for the verification period - which for Group 4 waters was January 1, 1998 to June 30, 2005 - by month, season, and year, respectively. All data available for this period were from 2003 and 2004.

The available data indicate a 31.8 percent overall exceedance rate for fecal coliform and a 31.8 percent overall exceedance rate for total coliform. There were 22 samples each for both fecal and total coliforms, with seven exceedances for each.

On a monthly basis, the lowest percentage of fecal coliform exceedances (0 percent) occurred in January, July, and August, but only one or two samples were collected in each of these months **(Table 2.1)**. The highest count occurred during November (1,470 counts/100 milliliters [mL]). On a seasonal basis, fecal coliform exceedances occurred in all seasons; however, as **Table 2.2** shows, the lowest percentage (25 percent) occurred in the winter (January–March) and fall (October–November). The highest percentage (66.67 percent) occurred in the spring (April–June).

On a monthly basis, for total coliform, there was a 100 percent exceedance rate for April and June, and no exceedances in January, February, July, or August. There were no data for March, May, or December. The highest count, 6,400 counts/100 mL, was in September. When the datasets are considered on a monthly basis, all datasets are very small (between zero and four samples), making it very difficult to discern potential patterns or trends. On a seasonal basis, total coliform exceedances occurred in all seasons, except winter (January–March). The highest percentage of exceedances (100 percent) occurred in the spring (April–June).

On an annual basis **(Table 2.3)**, both fecal and total coliform showed a higher exceedance rate in 2003 (33.33 and 50 percent, respectively) than in 2004 (31.25 and 25 percent, respectively). However, it is difficult to detect long-term trends with only two years of consecutive data.

It is also difficult to evaluate downstream trends because only two stations had data (both stations had 11 samples each of fecal and total coliforms). When considering fecal coliform and using all the data, fecal coliform values decrease going downstream, while total coliform data indicate that exceedances and coliform concentrations are divided fairly evenly between the two sampling sites. **Section 5.1** discusses sampling stations and data in more detail.

Table 2.1. Summary of Fecal and Total Coliform Data by Month for the Verified Period (January 1, 1998 – June 30, 2005)

FECAL COLIFORM[1]								
Month	**N**	**Minimum**	**Maximum**	**Median**	**Mean**	**Number of Exceedances**	**% Exceedance**	**Mean Precipitation[3]**
January	2	95	340	217.5	217.5	0	0.0%	2.39
February	2	283	746	514.5	514.5	1	50.0%	3.14
March	0	-	-	-	-	-	-	3.95
April	1	660	660	660	660	1	100.0%	2.80
May	0	-	-	-	-	-	-	1.61
June	2	130	450	290	290	1	50.0%	7.40
July	2	83	313	198	198	0	0.0%	6.72
August	1	160	160	160	160	0	0.0%	6.72
September	4	230	900	440	502.5	2	50.0%	9.94
October	4	190	973	255.5	418.5	1	25.0%	3.39
November	4	13	1,470	175	458.25	1	25.0%	1.81
December	0	-	-	-	-	-	-	3.12
TOTAL COLIFORM[2]								
Month	**N**	**Minimum**	**Maximum**	**Median**	**Mean**	**Number of Exceedances**	**% Exceedance**	**Mean Precipitation[3]**
January	2	590	1,000	795	795	0	0.00%	2.39
February	2	1,030	2,000	1,515	1,515	0	0.00%	3.14
March	0	-	-	-	-	-	-	3.95
April	1	3,800	3,800	3,800	3,800	1	100.00%	2.80
May	0	-	-	-	-	-	-	1.61
June	2	2,600	3,800	3,200	3,200	2	100.00%	7.40
July	2	1,067	2,300	1,684	1,684	0	0.00%	6.72
August	1	760	760	760	760	0	0.00%	6.72
September	4	1,300	6,400	3,177	3,514	2	50.00%	9.94
October	4	1,180	4,900	2,000	2,520	1	25.00%	3.39
November	4	400	5,070	982	1,859	1	25.00%	1.81
December	0	-	-	-	-	-	-	3.12

Notes: Coliform counts are #/100 mL.
- = No data collected during indicated month
[1] Exceedances represent values above 400 counts/100 mL.
[2] Exceedances represent values above 2,400 counts/100 mL.
[3] Mean precipitation is from Jacksonville International Airport (JIA), in inches, and is the monthly mean based on data from 1955–2004.

Table 2.2. Summary of Fecal Coliform Data by Season for the Verified Period (January 1, 1998 – June 30, 2005)

FECAL COLIFORM[1]								
Season	**N**	**Minimum**	**Maximum**	**Median**	**Mean**	**Number of Exceedances**	**% Exceedance**	**Mean Precipitation[3]**
Winter	4	95	746	311.5	366.00	1	25.00%	10.72
Spring	3	130	660	450	413.33	2	66.67%	12.41
Summer	7	83	900	300	366.57	2	28.57%	21.15
Fall	8	13	1,470	210.5	438.38	2	25.00%	8.34
TOTAL COLIFORM[2]								
Season	**N**	**Minimum**	**Maximum**	**Median**	**Mean**	**Number of Exceedances**	**% Exceedance**	**Mean Precipitation[3]**
Winter	4	590	2,000	1,015.00	1,155.00	0	0.00%	10.72
Spring	3	2,600	3,800	3,800.00	3,400.00	3	100.00%	12.41
Summer	7	760	6,400	1,654.00	2,597.29	2	28.57%	21.15
Fall	8	400	5,070	1,390.00	2,189.25	2	25.00%	8.34

Note: Coliform counts are #/100 mL
Winter = January – March; spring = April – June; summer = July – September; fall = October - December
[1] Exceedances represent values above 400 counts/100 mL.
[2] Exceedances represent values above 2,400 counts/100 mL
[3] Mean precipitation is for JIA, in inches. Means are based on the three months that constitute each season from 1955–2004

Table 2.3. Annual Summaries of Fecal and Total Coliform Data for the Verified Period (January 1, 1998 – June 30, 2005)

FECAL COLIFORM[1]								
Year	**N**	**Minimum**	**Maximum**	**Median**	**Mean**	**Number of Exceedances**	**% Exceedance**	**Total Precipitation[3]**
2003	6	120	580	265	301.67	2	33.33%	44.47
2004	16	13	1,470	298	435.44	5	31.25%	69.47
TOTAL COLIFORM[2]								
Year	**N**	**Minimum**	**Maximum**	**Median**	**Mean**	**Number of Exceedances**	**% Exceedance**	**Total Precipitation[3]**
2003	6	964	4,700	1,950.00	2,394.00	3	50.00%	44.47
2004	16	400	6,400	1,627.00	2,259.44	4	25.00%	69.47

Note: Coliform counts are #/100 mL
[1] Exceedances represent values above 400 counts/100 mL.
[2] Exceedances represent values above 2,400 counts/100 mL
[3] Precipitation is for JIA, in inches, and represents the total precipitation for the year shown

Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criteria Applicable to the TMDLs

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

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

Unnamed Branch 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 criteria applicable to the impairment addressed by these TMDLs are for fecal and total coliform.

3.2 Applicable Water Quality Standards and Numeric Water Quality Target

3.2.1 Fecal and Total Coliform Criteria

Numeric criteria for bacterial quality are expressed in terms of coliform bacteria concentrations. The water quality criteria 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.*
>
> ***Total Coliform Bacteria:***
> *The MPN per 100 mL shall be less than or equal to 1,000 as a monthly average nor exceed 1,000 in more than 20 percent of the samples examined during any month; and less than or equal to 2,400 at any time.*

The criteria state that monthly averages shall be expressed as geometric means based on a minimum of ten 10 samples taken over a 30-day period. However, there were insufficient data (less than 10 samples in a given month) available to evaluate the geometric mean criterion for fecal coliform bacteria. Therefore, the criteria selected for the TMDLs were not to exceed 400 counts per 100 mL for fecal coliform, or exceed 2,400 counts per 100 mL for total coliform.

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 System (NPDES) Program. These nonpoint sources included certain urban stormwater discharges, including those from local government master drainage systems, construction sites over five acres, and a wide variety of industries (see **Appendix A** for background information on the federal and state stormwater programs).

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

The subsequent section discusses potential sources of coliform bacteria in the watershed. Fecal coliform bacteria represent a component of the total coliform bacteria population. Bacteria of both vegetative and fecal origins are included in measurements of total coliforms. Vegetative origins include bacteria associated with soils, plants, and insects. The fecal component is associated with bacteria from septic systems, sewage, and warm blooded animals. Consequently, only a fraction of the total coliform population may represent anthropogenic influences in the receiving water.

4.2 Potential Coliform Sources in the Unnamed Branch Watershed

4.2.1 Point Sources

There are no permitted wastewater treatment facilities or industrial wastewater facilities that discharge into the Unnamed Branch or any of its tributaries. If a domestic or industrial wastewater facility is permitted to discharge into the Unnamed Branch or any of its tributaries in the future, permit conditions will require that Class III bacteria standards be met at the discharge point.

Municipal Separate Storm Sewer System Permittees

At present there are no NPDES municipal separate storm sewer system (MS4) permits that covers the Unnamed Branch watershed. The area surrounding Unnamed Branch is mostly rural (aside from a few small towns and populated areas) and stormwater systems are not evident. For this reason, MS4 loadings and allocations were not considered in the development of these TMDLs.

4.2.2 Land Uses and Nonpoint Sources

Additional coliform loadings to Unnamed Branch are generated from nonpoint sources in the watershed. Potential nonpoint sources of coliforms may include loadings from surface runoff, wildlife, pets, leaking or overflowing sewage lines, and leaking septic tanks.

Land Uses

The spatial distribution and acreage of different land use categories were identified using the 2000 land use coverage contained in the Department's Geographic Information System (GIS) library, initially provided by the SJRWMD. Land use categories and acreages in the watershed were aggregated using the Level 3 codes tabulated in **Table 4.1. Figure 4.1** shows the principal land uses in the watershed.

The Unnamed Branch watershed, a fairly small area of approximately 2,381 acres (3.72 mi^2), is primarily natural **(Table 4.1)**. This becomes evident when considering that the top four land uses (forest regeneration, wetland forested mix, coniferous pine, and upland mixed coniferous/hardwoods) comprise 67.25 percent of land use, and the total sum of natural areas comprise nearly 75 percent of the total land use in the watershed. Residential and commercial services occupy approximately 7 percent of the area, and agricultural uses comprise approximately 14.5 percent. In fact, there are no high or medium-density residential areas in the watershed; the only residential areas are low density (3.69 percent of the total) and rural residential areas (0.50 percent of the total), which is further testimonial to the undeveloped nature of the watershed.

Table 4.1. Classification of Land Use Categories in the Unnamed Branch Watershed

Level 3 Land Use Code	Attribute	Acres	Percent of Total Area
4430	Forest regeneration	613.80	25.78%
6300	Wetland forested mixed	406.62	17.08%
4410	Coniferous pine	313.17	13.15%
4340	Upland mixed coniferous/hardwood	267.67	11.24%
2520	Dairies	153.62	6.45%
2150	Field crops	108.16	4.54%
1100	Residential, low density—less than 2 dwelling units/acre	87.93	3.69%
6170	Mixed wetland hardwoods	80.93	3.40%
1400	Commercial and services	51.89	2.18%
6410	Freshwater marshes	41.24	1.73%
8140	Roads and highways (divided 4-lanes with medians)	39.81	1.67%
2310	Cattle-feeding operations	39.05	1.64%
4110	Pine flatwoods	35.76	1.50%
2110	Improved pastures (monoculture, planted forage crops)	24.74	1.04%
3100	Herbaceous upland, nonforested	22.27	0.94%
6430	Wet prairies	14.35	0.60%
1620	Sand and gravel pits (must be active)	12.83	0.54%
1180	Rural residential	11.89	0.50%
2120	Unimproved pastures	9.63	0.40%
6460	Mixed scrub–shrub wetland	9.57	0.40%
6210	Cypress	9.16	0.38%
8320	Electrical power transmission lines	7.83	0.33%
1660	Holding ponds	4.21	0.18%
2140	Row crops	3.62	0.15%
5300	Reservoirs—pits, retention ponds, dams	3.17	0.13%
2610	Fallow cropland	3.00	0.13%
6250	Hydric pine flatwoods	2.08	0.09%
3300	Mixed upland, nonforested	1.96	0.08%
3200	Shrub and brushland	0.58	0.02%
8200	Communications	0.56	0.02%
2130	Woodland pastures	0.19	0.01%
	TOTAL:	**2,381.29**	**100.00%**

Figure 4.1. Principal Land Uses in the Unnamed Branch Watershed

Population

According to the U.S. Census Bureau, census block population densities in the Unnamed Branch watershed in the year 2000 ranged from 0 - 333 persons per square mile, with an average of 38.7 persons/mi^2 **(Figure 4.2).** This indicates that the watershed is sparsely inhabited. The Census Bureau reports that the total population for all of Nassau County for 2000 was approximately 57,663, with 25,917 total housing units and an average occupancy rate of 84.8 percent (21,980 units). With an average housing density of 39.8 houses per square mile, Nassau County is 39th (of 67 counties) in housing density in Florida. Within the Unnamed Branch watershed, the average housing density is

13.44 houses per square mile, which is approximately one-third of the county average. There are a reported 8,307 housing units in and around the nearby Towns of Callahan and Hilliard and surrounding areas. The majority of housing units in Nassau County are concentrated in the Fernandina Beach area (11,187 units) (U.S. Census Bureau Web site, 2006).

Figure 4.2. Population Density in the Unnamed Branch Watershed

Septic Tanks

Using data supplied by the Florida Department of Revenue and Florida Department of Health (FDOH), it is estimated that approximately 75.5 percent of residences within Nassau County are utilizing septic tanks (Department of Revenue cadastral data, 2003, and FDOH Web site, 2006a). The FDOH reports that, as of fiscal year 2004–05, there were 19,587 permitted septic tanks in Nassau County (FDOH Web site, 2006b). For fiscal years 1994–2005, 604 permits for repairs were issued, or an average of approximately 60.4 repairs annually (FDOH Web site, 2006c) countywide. The Town of Callahan does have a WWTF; however, the Department has confirmed with town officials that the area serviced by this facility does not include the Unnamed Branch watershed.

As noted previously, there are an estimated 39 persons/mi^2 in the WBID, which, at 3.7 mi^2, equates to 145 persons in the watershed area. The average household in the watershed is estimated to have 2.90 persons **(Table 4.2).** Assuming the annual average repair rate for Nassau County (0.095 permits/mi^2/year) applies to the Unnamed Branch watershed, then there is an average of less than one (0.3) failure in the Unnamed Branch watershed annually.

Table 4.2. Estimation of Average Household Size in the Unnamed Branch Watershed

Household Size	Number of Households	Percentage of Total	Number of People
1-person household	8	16%	8
2-person household	16	32%	32
3-person household	9	18%	27
4-person household	10	20%	40
5-person household	4	8%	20
6-person household	3	6%	18
7-or-more-person household	0	0%	0
TOTAL:	**50**	**100.00%**	**145**
AVERAGE HOUSEHOLD SIZE:			**2.90**

Note: Data are from the U.S. Census Bureau website and are based on census block groups found in the Unnamed Branch watershed.

Conservatively allowing for one septic tank failure annually, and using 70 gallons/day/person (EPA, 2001), 2.90 persons/household, and the total population in the watershed (since it is known not to be sewered), the estimated loading of fecal coliform to Unnamed Branch from failing septic tanks is 7.68 x 10^9 coliform counts/day or 2.80 x 10^{12} counts/year, and 7.68 x 10^{14} counts/day for total coliform or 2.80 x 10^{17} counts/year **(Table 4.3).**

Table 4.3. Estimation of Annual Fecal Coliform Loading from Failed Septic Tanks in the Unnamed Branch Watershed

Coliform Type	Estimated Population Density (per/mi^2)	WBID Area (mi^2)	Estimated Population in Watershed	Estimated Number of Tank Failures[1]	Estimated Load From Failed Tank[2]	Gallons/ Person/ Day[2]	Estimated Number Persons Per Household[3]	Estimated Daily Load From Failing Tanks	Estimated Annual Load From Failing Tanks
Fecal	38.7	3.72	145	1	1.00 x 10^4/mL	70	2.90	7.68 x 10^9	2.80 x 10^{12}
Total	38.7	3.72	145	1	1.00 x 10^9/mL	70	2.90	7.68 x 10^{14}	2.80 x 10^{17}

[1] Based on septic tank repair permits issued in Nassau County from 1994–2005 by the FDOH—see text for more information.
[2] Fecal coliform concentration and daily wastewater usage per person from the EPA document, *Protocol for Developing Pathogen TMDLs,* January 2001; total coliform concentration from the EPA manual, *Onsite Wastewater Treatment Systems Manual,* February 2002.
[3] Based on U. S Census Bureau data; see **Table 4.2** for more information on this estimate.

Agriculture

According to Level 3 land use data for 2000, approximately 154 acres of land are designated for dairy operations, and another 39 acres are associated with cattle-feeding operations. All of this acreage is in the extreme northern portion of the watershed **(Figure 4.3),** along U.S. 1. The parcels shown for these land uses are quite large, but only a portion of the land is located within the Unnamed Branch watershed. A recent survey of the area (April 2006) by Department staff indicates that the majority of this land, including the portion in the Unnamed Branch watershed, is not currently being used for cattle; rather, the land is currently planted. The photos in **Figure 4.4,** which were taken within the watershed boundary, show that parts of the area are currently planted, and other parts have been readied for planting. There was no evidence that these areas have been used for cattle recently, as no fencing or other signs of cattle were seen.

A cattle-feeding operation in the upper portion of the parcel is designated as dairy. However, it is unlikely that it is affecting Unnamed Branch. The area is approximately 0.5 miles north of the uppermost extent of the watershed boundary **(Figure 4.3)**. It is located within the Mills Creek watershed (WBID 2120A), which is not currently impaired for fecal or total coliform. It is a medium size dairy (200 to 699 mature dairy cattle, milking or dry) and does not hold a permit to discharge to surface waters. A manure-composting facility on land just south of the dairy does not currently hold a permit to discharge to surface waters, either. Also, this general area lies at some distance from Unnamed Branch—approximately 1.25 miles (in a direct line). Based on this information, neither the effects from the dairy nor the composting facility are expected to contribute to coliform in Unnamed Creek; therefore, this report does not include loading estimations from these facilities.

Figure 4.3. Location of Cattle-feeding and Dairy Parcels in the Unnamed Branch Watershed

Figure 4.4. Pictures of Land Designated as Cattle-feeding and Dairy Operations in the Unnamed Branch Watershed

Planted field on parcels designated as cattle-feeding operations within the Unnamed Branch watershed, according to the Department's Level 3 land use GIS coverage. The area is located in the northern part of the watershed. on the eastern side of U. S. 1.

Planted field on parcels designated as dairy operations within the Unnamed Branch watershed according to the Department's Level 3 land use GIS coverage. The area is located in the northern part of the watershed, on the western side of U. S. 1.

Pictures taken by Department staff on April 24, 2006.

Pets

With so few people in the watershed, it is doubtful that pets are a significant contributor to the coliform impairments in Unnamed Branch. The Department has been unable to obtain specific information regarding the number of dogs in the area; however, estimates can be made using literature-based values of dog ownership rates **(Table 4.4)**. For example, using household-to-dog ratio estimates from the American Veterinary Medical Association (AVMA), and assuming that coliforms from10 percent of dogs reach the waterbody and are viable upon reaching it, the approximate loading is 9.03 x 10^9 counts/day. Estimates of total coliform concentrations from pet waste are not known, but concentrations are assumed to be greater than those of fecal coliform. These are estimates, as the actual loading from dogs is not known.

Table 4.4. Estimated Loading from Dogs in the Unnamed Branch Watershed

Coliform Type	Estimated Number of Households in WBID 2156	Estimated Household: Dog Ratio[1]	Estimated Total Dog Population in Watershed	Load Reaching Waterbody	Estimated Number of Pets with Impact to Stream	Estimated Counts/Pet /Day[2]	Estimated Counts/ Day	Estimated Counts/ Day
Fecal	50	0.361	18	10%	1.8	5 x 10^9	9.03 X 10^9	3.29 x 10^{12}
Total	50	0.361	18	10%	1.8	5 x 10^9	>9.03 X 10^9	>3.29 x 10^{12}

[1] From the AVMA Web site, which states the original source to be the *U. S. Pet Ownership and Demographics Sourcebook,* 2002.
[2] From the EPA document, *Protocol for Developing Pathogen TMDLs,* January 2001.

4.3 Summary of Fecal and Total Coliform Loadings into Unnamed Branch from Various Sources

Table 4.5 summarizes estimates from various sources in the watershed, and demonstrates relative *potential* loadings from the various sources considered. 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 are just a few of the factors that could influence and determine the actual loadings from the sources reaching Unnamed Branch. For some estimates, total coliform concentrations were not available. However, fecal coliform is a component of total coliform, and so total coliform loading is expected to be greater than that of fecal coliform.

Table 4.5. Summary of Estimated Potential Fecal and Total Coliform Loading from Various Sources in the Unnamed Branch Watershed

Source	Fecal Coliform		Total Coliform	
	Estimated Daily Load	Estimated Annual Load	Estimated Daily Load	Estimated Annual Load
NPDES Facilities	NA[1]	NA[1]	NA[1]	NA[1]
Failing Septic Tanks	7.68×10^{9}	2.80×10^{12}	7.68×10^{14}	2.80×10^{17}
Agriculture	NA[2]	NA[2]	NA[2]	NA[2]
Dogs	9.03×10^{9}	3.29×10^{12}	$>9.03 \times 10^{9}$	$>3.29 \times 10^{12}$

[1] Not applicable; there are currently no permitted NPDES discharges in the watershed.
[2] Not applicable; as discussed in the text, the contribution from agricultural sources is believed to be of minimal concern.

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

The methodology used for these TMDLs was the “percent reduction” methodology. The Department generally prefers to use the load duration curve, or “Kansas” method, for coliform TMDLs, but this method could not be used because there are no stream gauging stations on Unnamed Branch. To determine the TMDLs, 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 both fecal and total coliform determined the overall required reductions, and therefore the TMDLs.

5.1.1 Data Used in the Determination of the TMDLs

There are two sampling stations in Unnamed Branch that have historical coliform observations. The primary data collector of historical data is the Department’s Northeast District (Jacksonville), which collected data in response to the 1998 303(d) listing of Unnamed Branch for coliform. All data used in the assessment were collected in 2003 and 2004, with 11 samples being collected for both fecal and total coliform at each site, for a total of 22 samples of each. **Table 5.1** shows summaries, by station, of the Department’s data inventory for Unnamed Branch. **Figure 5.1** shows the location of the sample sites, and **Table 5.2** provides an overview of historical coliform data from each site. **Figures 5.2** and **5.3** are charts showing the observed historical data over time, and **Appendices B** and **C** contain all historical observations for fecal and total coliform, respectively, from all sites. **Table 2.3** shows average coliform counts by year. All data were considered in developing these TMDLs.

Table 5.1. Sampling Station Summary for the Unnamed Branch Watershed

FECAL COLIFORM				
Station	**STORET ID**	**Station Owner**	**Year(s) with Data**	**N**
Unnamed Tributary to Little Mills Cr. @ U. S. 1	21FLA 19020069	Florida Department of Environmental Protection	2003–04	11
Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	21FLA 19020070	Florida Department of Environmental Protection	2003–04	11
TOTAL COLIFORM				
Station	**STORET ID**	**Station Owner**	**Year(s) with Data**	**N**
Unnamed Tributary to Little Mills Cr. @ U. S. 1	21FLA 19020069	Florida Department of Environmental Protection	2003–04	11
Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	21FLA 19020070	Florida Department of Environmental Protection	2003–04	11

Figure 5.2. Historical Fecal Coliform Observations for Unnamed Branch

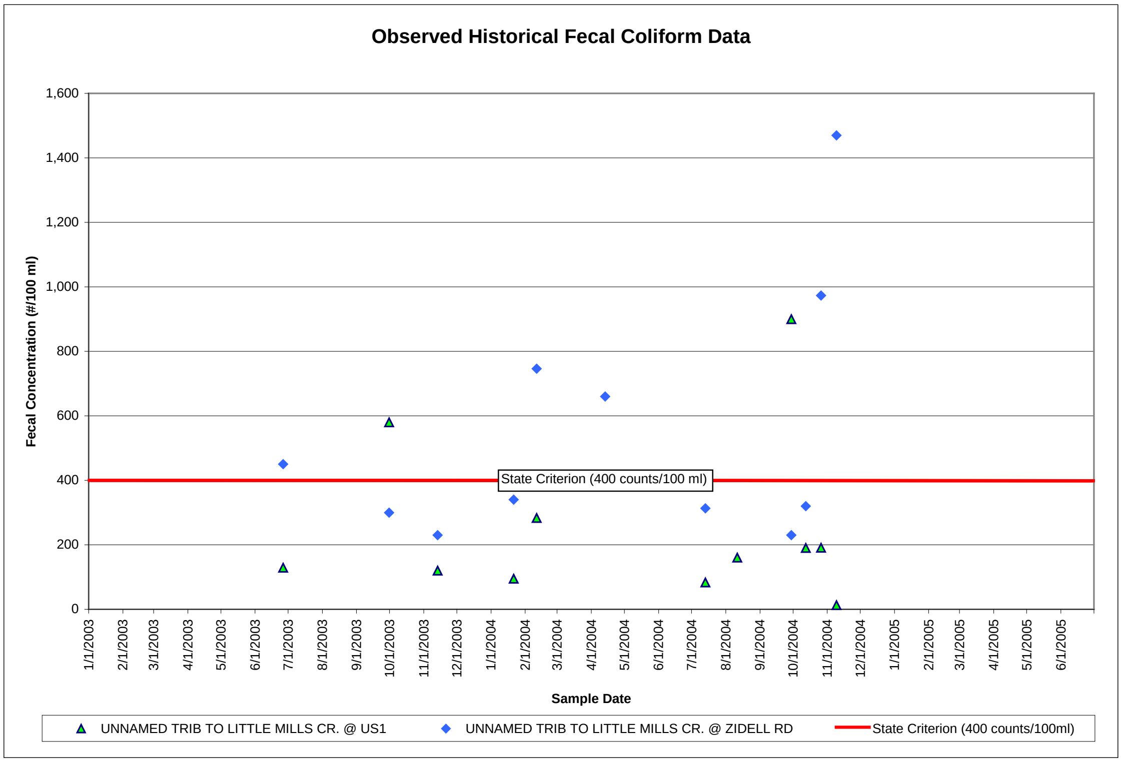
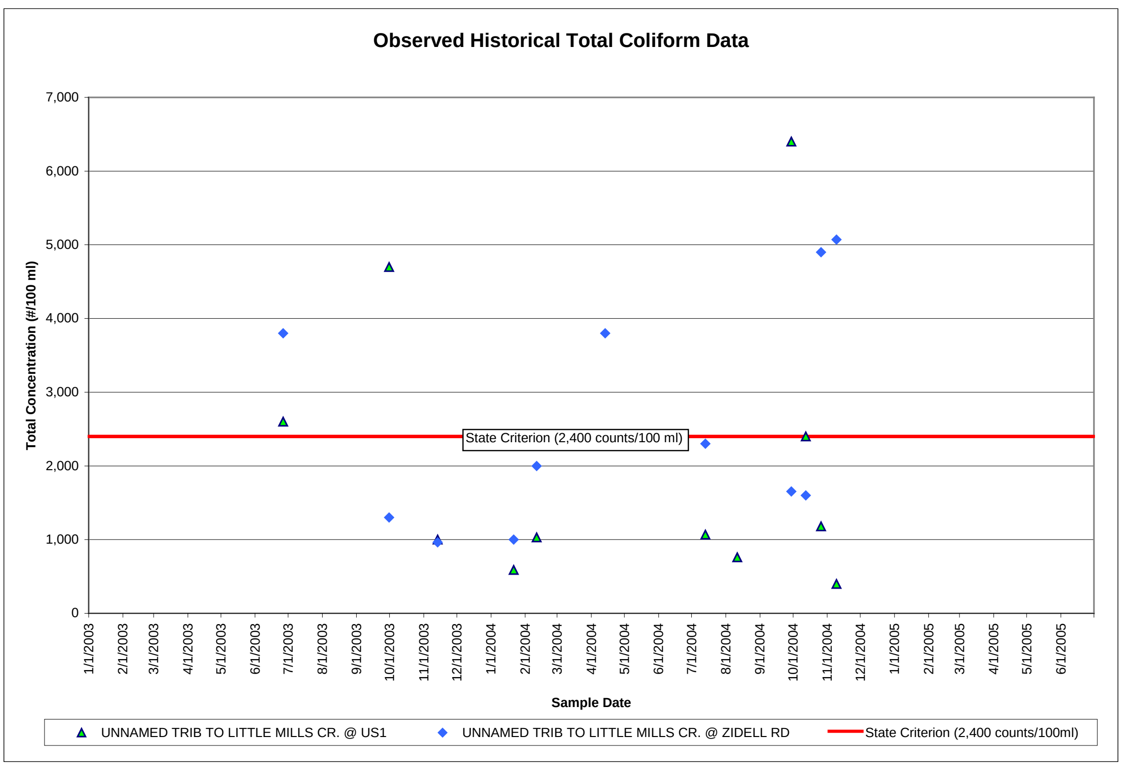


Figure 5.3. Historical Total Coliform Observations for Unnamed Branch



An April 2006 visit to the Unnamed Branch area by Department staff showed that water was pooled and not flowing at the Zidell Road site. Based on the size of the pool, it appeared that water had not been flowing in this segment for some time. There was more water at the U.S. 1 site, but there was no evidence that water was flowing at this location, either. **Figure 5.4** contains pictures of Unnamed Branch at both Zidell Road and U. S. 1 from this survey.

Figure 5.4. Unnamed Branch at Zidell Road and U. S. 1

Unnamed Branch at Zidell Road. The stream was pooled and was not flowing. The right side of the picture shows the extent of the pool on the downstream side.

Unnamed Branch at U. S. 1. The stream was most likely pooled and did not appear to be flowing.

Pictures taken by Department staff on April 24, 2006

5.1.2 TMDL Development Process

Due to the lack of supporting flow data, a simple calculation was performed to determine the needed reduction. Exceedances of the state criterion for fecal coliform were compared with the criterion of 400 counts/100mL, and exceedances of the total coliform criterion were compared with the criterion of 2,400 counts/100 mL. For each exceedance, the 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 all the individual values was calculated, which is 46 percent for fecal coliform and 49 percent for total coliform. This means that in order to meet the state criterion of 400 counts/100mL, a 46 percent reduction in current loading of fecal coliform is required, and to meet the state criterion of 2,400 counts/100 mL, a 49 percent reduction or total coliform is necessary. Therefore, these are the fecal and total coliform TMDLs for Unnamed Branch. **Table 5.3** shows the individual reduction calculations for fecal coliform, and **Table 5.4** shows the individual reduction calculations for total coliform for Unnamed Branch.

Table 5.3. Calculation of Required Reductions for the Fecal Coliform TMDL for Unnamed Branch

Date	Location	Value	Required Reduction
6/26/2003	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	450	11.11%
9/30/2003	Unnamed Tributary to Little Mills Cr. @ U. S. 1	580	31.03%
2/11/2004	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	746	46.38%
4/13/2004	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	660	39.39%
9/29/2004	Unnamed Tributary to Little Mills Cr. @ U. S. 1	900	55.56%
10/26/2004	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	973	58.89%
11/9/2004	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	1,470	72.79%
	MEDIAN:	**746**	**46.38%**

Table 5.4. Calculation of Required Reductions for the Total Coliform TMDL for Unnamed Branch

Date	Location	Value	Required Reduction
6/26/2003	Unnamed Tributary to Little Mills Cr. @ U. S. 1	2,600	7.69%
6/26/2003	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	3,800	36.84%
9/30/2003	Unnamed Tributary to Little Mills Cr. @ U. S. 1	4,700	48.94%
4/13/2004	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	3,800	36.84%
10/26/2004	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	4,900	51.02%
11/9/2004	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	5,070	52.66%
9/29/2004	Unnamed Tributary to Little Mills Cr. @ U. S. 1	6,400	62.50%
	MEDIAN:	**4,700**	**48.94%**

5.1.3 Critical Conditions/Seasonality

Exceedances in Unnamed Branch cannot be associated with flows, as no flow data within the watershed have been reported. Therefore, the effects of flow under various conditions cannot be determined or be considered as a critical condition. **Appendices B** and **C** provide historical fecal and total coliform observations, respectively, in Unnamed Branch.

Coliform data were analyzed by month, season, and year to determine whether certain patterns were evident in the dataset. A nonparametric test (Kruskal–Wallis) was applied to both the fecal and total coliform datasets to determine whether there were significant differences among months or seasons. At an alpha (α) level of 0.05, neither fecal nor total coliform showed significant differences among months or seasons (**Appendices D, E, F,** and **G**). However, it is very difficult to evaluate possible patterns among months due to the small sample sizes. The range in monthly observations for both fecal and total coliform varies from zero to four, while nine months have two or less observations. Grouping observations by season increases sample sizes for statistical comparison, but sample sizes are still relatively small, with no season having more than eight observations.

As seen in **Table 2.2**, the highest percentage of exceedances for both fecal and total coliform occurred in the spring (fecal coliform had a 66.67 percent exceedance rate, while total coliform had a 100 percent exceedance rate). However, it should be noted that the spring season also had the fewest samples - three for both coliform types. The lowest number of exceedances occurred in the winter and fall for fecal coliform (a 25 percent exceedance rate for both seasons) and in the winter for total coliform (no exceedances). A likely factor contributing to these monthly or seasonal differences is the pattern of rainfall.

Rainfall records for JIA (representing the closest and precipitation record to the Unnamed Branch area; **Appendix H** lists rainfall from 1990–2004) 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 two days (3D), the cumulative total for the day of and the previous six days (7D), and the day of sampling and the previous 29 days (30D) were all paired with the respective coliform observation. A Spearman correlation matrix was generated that summarized the simple correlation coefficients between the various rainfall and coliform measures (**Appendices I** and **J**). The simple correlations (r values in the Spearman correlation table) between both fecal and total coliform are positive for all but the day-of-sampling rainfall totals, suggesting that as rainfall (and possible runoff) increases, the coliform concentrations increases as well. However, with both coliform types, the day of sampling shows a small, but negative, correlation, indicating that as rainfall increases, coliform concentrations decrease.

Simple linear regressions were performed between the coliform observation and rainfall total to determine whether any of the relationships were significant at an α level of 0.05. The correlations between fecal and total coliform to any of the precipitation regimes showed no significance (**Appendices K** and **L**). As noted previously, the highest percentage of exceedances of fecal coliform occurred in April (100 percent). For total coliform, the greatest percentage of exceedances occurred in April and June (both had 100 percent). A table of historical monthly and annual rainfall from 1955–2004 **(Appendix M)** indicates that monthly rainfall totals increase in June and peak in September, and by October return to levels observed in February and March. **Appendix N** contains graphs of annual and monthly rainfall over the 1955–2004 period versus the long-term average (52.27 inches) over this period.

All of the coliform data used in the development of these TMDLs were collected in 2003 or 2004. When compared with the long-term average of 52.27 inches per year, 2003 was a below-average year for rainfall (44.47 inches), while 2004 was above average (69.47 inches). For both fecal and total coliforms, exceedance rates were greater in 2003 when the total rainfall was below the long-term average, and both had fewer exceedances in 2004 when the total annual precipitation was above average. This suggests an inverse relationship between coliform exceedances and precipitation when considered on an annual basis; however, with data collected in only two consecutive years, it is difficult to draw a definite conclusion.

As no flow data were available, hydrologic conditions were analyzed using rainfall to further assess impacts and exceedances within the stream. A loading curve–type chart, which would normally be applied to flow events, was created using all precipitation data from JIA from 1990–2004. The analysis used three-day (the day of and two days prior to the sample collection date) precipitation accumulations. The chart is divided into various precipitation events, based on total daily rainfall, where extreme precipitation events represent the upper percentiles of the three day total precipitation (0–5th percentile, indicating that the three day total precipitation was two inches or greater five percent of the time), followed by large precipitation events (5th–15th percentile, indicating that total precipitation was greater than 1.33 inches 15 percent of the time), medium precipitation events (15th–40th percentile, indicating that total precipitation was greater than 0.18 inches 40 percent of the time), small precipitation events (40th–60th percentile, indicating that total precipitation was greater than 0.1

inches 60 percent of the time), and no recordable precipitation events (60th–100th percentile, indicating that 39.9 percent of the time no precipitation was recorded during the three days).

Data show that most fecal coliform exceedances (40 percent) occurred when no measurable precipitation was reported for the day of and two days prior to sample collection (**Table 5.5** and **Figure 5.5**). The only other precipitation range that had exceedances was the small regime (22.22 percent).

Total coliform had a 100 percent exceedance rate within the medium event range (**Table 5.6** and **Figure 5.6**). Samples collected when no rainfall was reported had a 50 percent exceedance rate; the small precipitation event range had an 11.11 percent exceedance rate. There were no exceedances within the extreme event range, and no samples had been collected following a large event.

If a large percentage of exceedances are occurring during no measurable precipitation days, point sources would be suspected as contributors. Likewise, if a large percentage of exceedances were to occur after large and extreme precipitation events, this could indicate that the exceedances were nonpoint source driven, perhaps from stormwater conveyance systems or various land uses. Fecal coliform exceedances in Unnamed Branch occurred only within the small event range and when no measurable precipitation was reported, indicating that they are most likely point source driven with some nonpoint source influences. However, there were only a total of three observations outside these two ranges, which may not represent medium, large, and extreme events well.

As with fecal coliform, all total coliform exceedances occurred when no precipitation was reported, or after small and medium precipitation events. A 100 percent exceedance rate was seen after medium events, but this was based on only one sample. Like fecal coliform, point sources are most the likely source, with perhaps some influence from nonpoint sources.

Table 5.5. Summary of Fecal Coliform Data by Hydrologic Condition for Unnamed Branch

Precipitation Event	Event Range	Total Values	Number of Exceedances	% Exceedance	Number of Non-exceedances	% Non-exceedance
Extreme	>2.1"	2	0	0.00%	2	100.00%
Large	1.33" – 2.1"	0	0	0.00%	0	0.00%
Medium	0.18" – 1.33"	1	0	0.00%	1	100.00%
Small	0.01" – 0.18"	9	2	22.22%	7	77.78%
None/Not Measurable	<0.01"	10	4	40.00%	6	60.00%

Table 5.6. Summary of Total Coliform Data by Hydrologic Condition for Unnamed Branch

Precipitation Event	Event Range	Total Values	Number of Exceedances	% Exceedance	Number of Non-exceedances	% Non-exceedance
Extreme	>2.1"	2	0	0.00%	2	100.00%
Large	1.33" – 2.1"	0	0	0.00%	0	0.00%
Medium	0.18" – 1.33"	1	1	100.00%	0	0.00%
Small	0.01"– 0.18"	9	1	11.11%	8	88.89%
None/Not Measurable	<0.01"	10	5	50.00%	5	50.00%

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

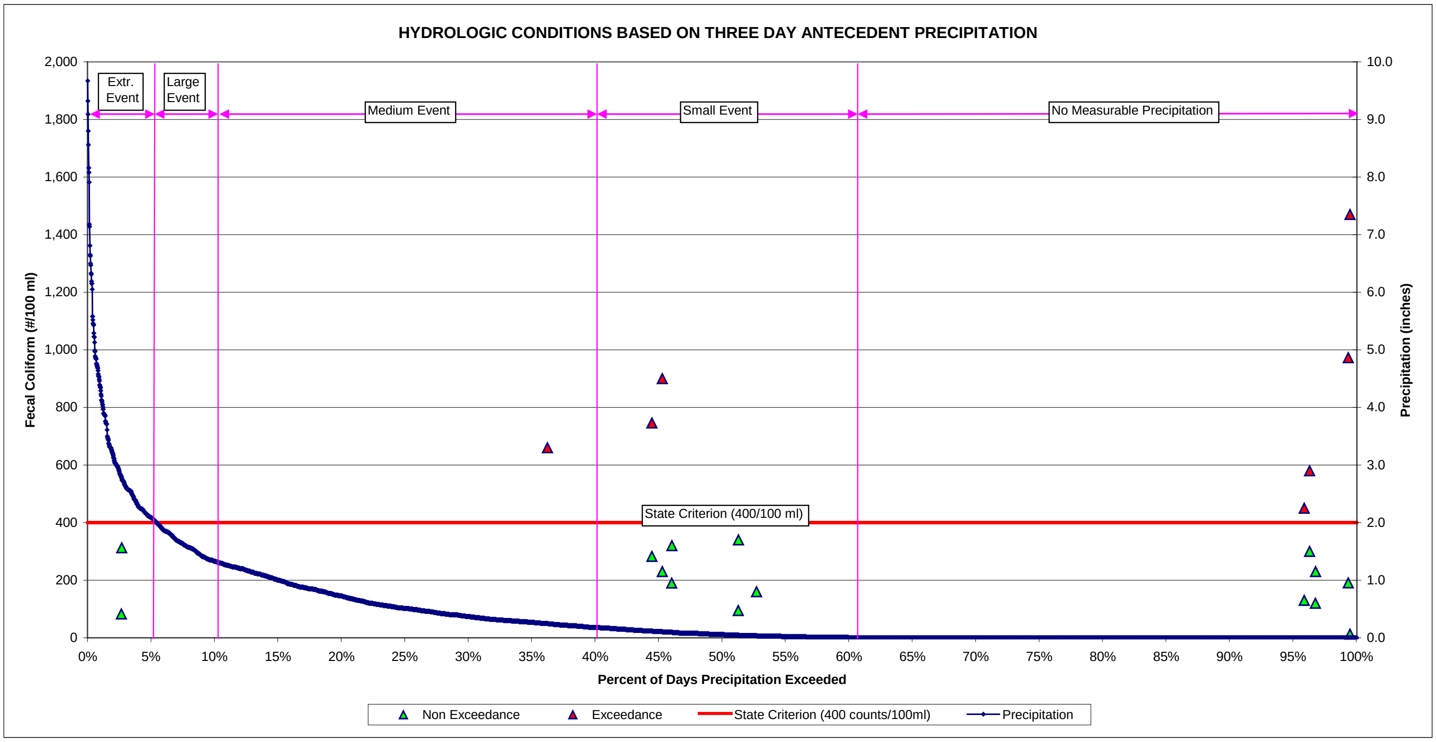
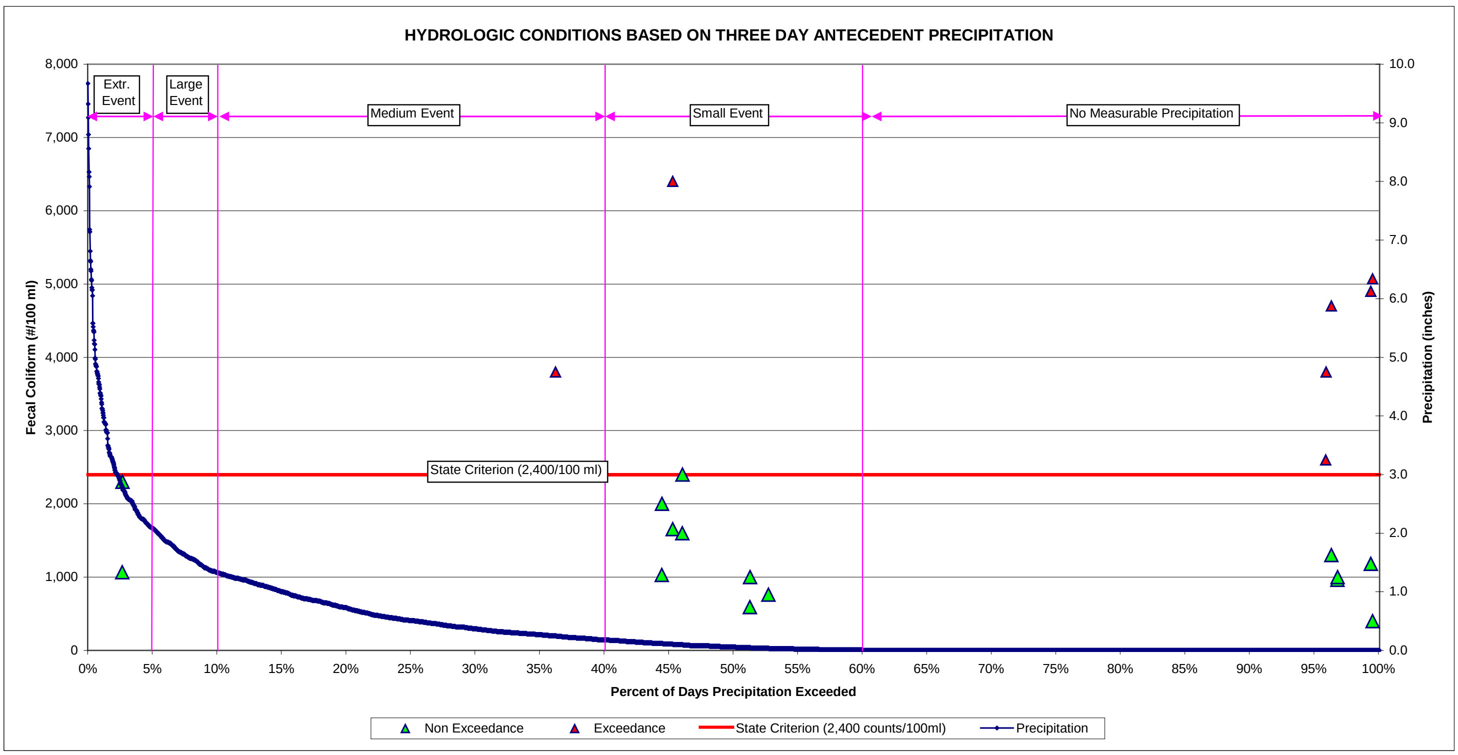


Figure 5.6. Total Coliform Data by Hydrologic Condition Based on Rainfall



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 TMDLs for Unnamed Branch are expressed in terms of counts per 100 mL and percent reduction, and represent the maximum fecal and total coliform load the stream can assimilate and maintain the applicable coliform criteria **(Table 6.1).**

The verified list of impairments for the Nassau/St. Marys Basin adopted by Secretarial order on May 3, 2006 included both fecal and total coliforms for the unnamed branch. The draft TMDL document and the public meeting held on July 19, 2006 addressed both these impairments. However, based upon the approval of the Environmental Regulation Commission, the total coliform criteria was rescinded effective December 7, 2006. On January 3, 2007 a secretarial order was signed that removed total coliform impairments from the Group 1-4 Basin verified lists of impaired waters (which included the unnamed branch listing). Information on total coliform concentrations and potential sources has been retained in this document for historical reasons, but a TMDL for total coliforms is not being adopted.

Table 6.1. TMDL Components for Unnamed Branch

WBID	Parameter	TMDL (counts/100 mL)	WLA		LA (% reduction)	MOS
			Wastewater (colonies/day)	NPDES Stormwater		
2156	Fecal Coliform	400	N/A	46%	46%	Implicit
2156	Total Coliform	2,400	N/A	49%	49%	Implicit

6.2 Load Allocation

The LA for nonpoint sources is a 46 percent reduction of in-stream fecal coliform concentrations and a 49 percent reduction of in-stream total coliform concentrations. It should be noted that the LA 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 are currently no permitted NPDES wastewater discharges in the Unnamed Branch watershed. However, as part of these TMDLs, any future wastewater discharge permits issued within the watershed will be required to meet the state Class III criterion for fecal coliform as well as the TMDL value, and therefore will not be allowed to exceed a fecal coliform count of 200 counts/100 mL as a monthly average, or 400 counts/100 mL in 10 percent of the samples during a month. Similarly, total coliform values will not be allowed to exceed 1,000 counts/100 mL as a monthly average, or exceed 1,000 counts/100 mL in 20 percent of the samples examined during any month, or exceed 2,400 counts/100 mL at any time.

6.3.2 NPDES Stormwater Discharges

There are currently no MS4 permits in the Unnamed Branch watershed. 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 is not responsible for reducing other nonpoint source loads within its jurisdiction.

While the LA and WLA for fecal and total coliform are expressed as the percent reductions needed to attain the applicable Class III criteria, it is the combined reductions from both anthropogenic point and nonpoint sources that will result in the required reduction of in-stream fecal and total coliform concentrations. However, it is not the intent of these TMDLs to abate natural background conditions.

6.4 Margin of Safety

Consistent with the recommendations of the Allocation Technical Advisory Committee (Department, February 2001), an implicit MOS was used in the development of these TMDLs. A MOS was included in the TMDLs by not allowing any exceedances of the state criteria, even though intermittent natural exceedances of the criteria would be expected and would be taken into account when determining impairment. Additionally, the TMDL calculated for fecal coliform was based on meeting the water quality criterion of 400 counts/100 mL and 2,400 counts/100 mL for total coliform without any exceedances, while the actual fecal coliform criterion allows for 10 percent exceedances over the criterion.

Chapter 7: NEXT STEPS: IMPLEMENTATION PLAN DEVELOPMENT AND BEYOND

7.1 Basin Management Action Plan

Following the adoption of these TMDLs by rule, the next step in the TMDL process is to develop an implementation plan for the TMDLs, referred to as the BMAP. This document will be developed over the next two years in cooperation with local stakeholders, who will attempt to reach consensus on detailed allocations and on how load reductions will be accomplished. The BMAP will include, among other things:

Appropriate load reduction allocations among the affected parties,

A description of the load reduction activities to be undertaken, including structural projects, nonstructural BMPs, and public education and outreach,

A description of further research, data collection, or source identification needed in order to achieve the TMDLs,

Timetables for implementation,

Confirmed and potential funding mechanisms,

Any applicable signed agreement(s),

Local ordinances defining actions to be taken or prohibited,

Any applicable local water quality standards, permits, or load limitation agreements,

Milestones for implementation and water quality improvement, and

Implementation tracking, water quality monitoring, and follow-up measures.

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

Following the adoption of this TMDL by rule, the next step in the TMDL process is to develop an implementation plan for the TMDL, which will be a component of the Basin Management Action Plan (BMAP) for Unnamed Branch. This document will be developed over the next year in cooperation with local stakeholders and will attempt to reach consensus on more detailed allocations and on how load reductions will be accomplished. The BMAP will include the following:

Appropriate allocations among the affected parties,

A description of the load reduction activities to be undertaken,

Timetables for project implementation and completion,

- Funding mechanisms that may be utilized,
- Any applicable signed agreement,
- Local ordinances defining actions to be taken or prohibited,
- Local water quality standards, permits, or load limitation agreements, and
- Monitoring and follow-up measures.

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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. To date, stormwater PLRGs have been established for Tampa Bay, Lake Thonotosassa, the Winter Haven Chain of Lakes, the Everglades, Lake Okeechobee, and Lake Apopka. No PLRG had been developed for Newnans Lake when this report was published.

In 1987, the U. S. Congress established Section 402(p) as part of the federal Clean Water Act Reauthorization. This section of the law amended the scope of the federal NPDES permitting program to designate certain stormwater discharges as point sources of pollution. The EPA promulgated regulations and began implementing the Phase I NPDES stormwater program in 1990. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific standard industrial classification (SIC) codes, construction sites disturbing 5 or more acres of land, and the master drainage systems of local governments with a population above 100,000, which are better known as MS4s. However, because the master drainage systems of most local governments in Florida are interconnected, the EPA implemented Phase I of the MS4 permitting program on a countywide basis, which brought in all cities (incorporated areas), Chapter 298 urban water control districts, and the FDOT throughout the 15 counties meeting the population criteria. The Department received authorization to implement the NPDES stormwater program in 2000.

An important difference between the federal NPDES and the state's Stormwater/Environmental Resource Permit 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 1,000 people. While these urban stormwater discharges are now technically referred to as point sources for the purpose of regulation, they are still diffuse sources of pollution that cannot be easily collected and treated by a central treatment facility, as are other point sources of pollution such as domestic and industrial wastewater discharges. It should be noted that all MS4 permits issued in Florida include a reopener clause that allows permit revisions to implement TMDLs when the implementation plan is formally adopted.

Appendix B: Historical Fecal Coliform Observations in Unnamed Branch

Waterbody	WBID	Sample Date	Station	Location	Value (#/100mL)	Remark Code
Unnamed Branch	2156	6/26/2003	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	130	B
Unnamed Branch	2156	6/26/2003	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	450	
Unnamed Branch	2156	9/30/2003	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	580	
Unnamed Branch	2156	9/30/2003	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	300	B
Unnamed Branch	2156	11/13/2003	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	120	B
Unnamed Branch	2156	11/13/2003	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	230	
Unnamed Branch	2156	1/21/2004	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	95	A
Unnamed Branch	2156	1/21/2004	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	340	B
Unnamed Branch	2156	2/11/2004	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	283	A
Unnamed Branch	2156	2/11/2004	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	746	A
Unnamed Branch	2156	4/13/2004	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	660	B
Unnamed Branch	2156	7/13/2004	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	83	A
Unnamed Branch	2156	7/13/2004	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	313	A
Unnamed Branch	2156	8/11/2004	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	160	
Unnamed Branch	2156	9/29/2004	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	900	B
Unnamed Branch	2156	9/29/2004	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	230	
Unnamed Branch	2156	10/12/2004	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	190	B
Unnamed Branch	2156	10/12/2004	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	320	
Unnamed Branch	2156	10/26/2004	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	191	A
Unnamed Branch	2156	10/26/2004	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	973	A
Unnamed Branch	2156	11/9/2004	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	13	B
Unnamed Branch	2156	11/9/2004	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	1,470	B

Shaded cells are values that exceed the state criterion of 400 counts/100 mL.

Remark Codes: A – Value reported is the mean of two or more determinations.
B – Results based on colony counts outside the acceptable range.

Appendix C: Historical Total Coliform Observations in Unnamed Branch

Waterbody	WBID	Sample Date	Station	Location	Value (#/100mL)	Remark Code
Unnamed Branch	2156	6/26/2003	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	2,600	
Unnamed Branch	2156	6/26/2003	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	3,800	
Unnamed Branch	2156	9/30/2003	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	4,700	
Unnamed Branch	2156	9/30/2003	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	1,300	
Unnamed Branch	2156	11/13/2003	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	1,000	B
Unnamed Branch	2156	11/13/2003	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	964	B
Unnamed Branch	2156	1/21/2004	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	590	
Unnamed Branch	2156	1/21/2004	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	1,000	B
Unnamed Branch	2156	2/11/2004	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	1,030	
Unnamed Branch	2156	2/11/2004	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	2,000	
Unnamed Branch	2156	4/13/2004	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	3,800	A
Unnamed Branch	2156	7/13/2004	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	1,067	
Unnamed Branch	2156	7/13/2004	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	2,300	A
Unnamed Branch	2156	8/11/2004	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	760	A
Unnamed Branch	2156	9/29/2004	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	6,400	
Unnamed Branch	2156	9/29/2004	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	1,654	A
Unnamed Branch	2156	10/12/2004	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	2,400	
Unnamed Branch	2156	10/12/2004	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	1,600	B
Unnamed Branch	2156	10/26/2004	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	1,180	
Unnamed Branch	2156	10/26/2004	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	4,900	
Unnamed Branch	2156	11/9/2004	21FLA 19020069	Unnamed Tributary to Little Mills Cr. @ U. S. 1	400	B
Unnamed Branch	2156	11/9/2004	21FLA 19020070	Unnamed Tributary to Little Mills Cr. @ Zidell Rd.	5,070	

Shaded cells are values that exceed the state criterion of 2,400 counts/100 mL.

Remark Codes: A – Value reported is the mean of two or more determinations.
B – Results based on colony counts outside the acceptable range.

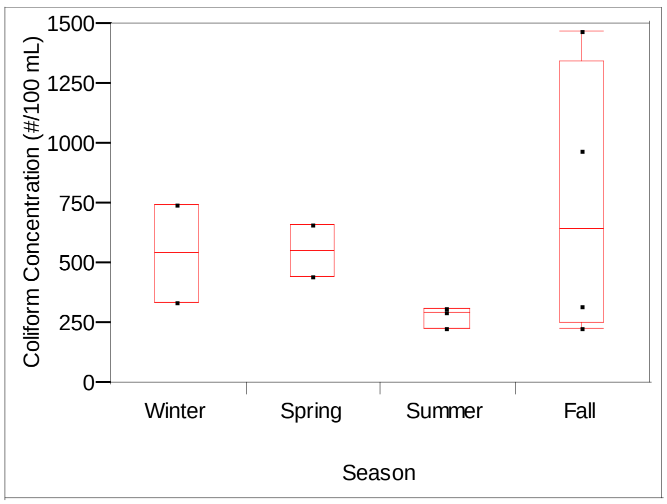
Appendix D: Kruskal–Wallis Analysis of Fecal Coliform Observations versus Season in Unnamed Branch

Kruskal–Wallis One-Way Analysis of Variance for 22 cases

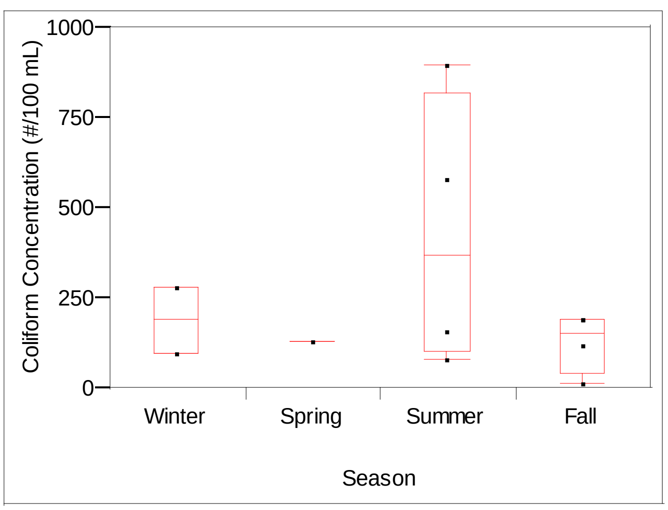
Group	Count	Rank Sum
Winter	4	48.000
Spring	3	39.000
Summer	7	79.500
Fall	8	86.500

Kruskal–Wallis Test Statistic = 0.277
Probability is 0.964 assuming Chi-square distribution with 3 df

Fecal Coliform Concentrations by Season for Unnamed Branch at Zidell Road



Fecal Coliform Concentrations by Season for Unnamed Branch at U. S. 1



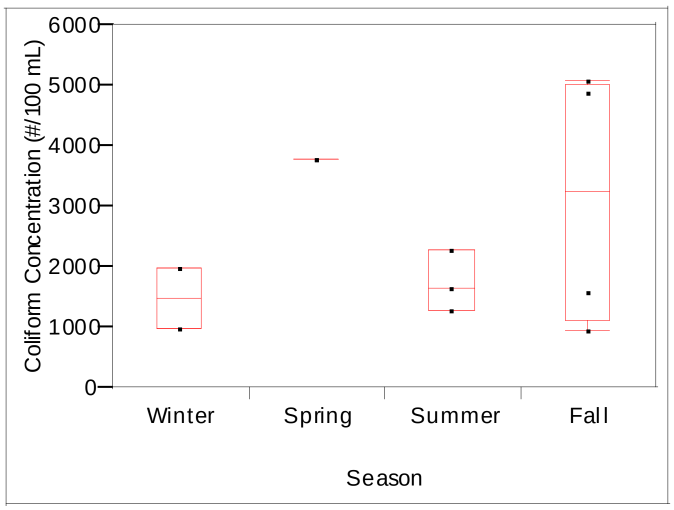
Appendix E: Kruskal–Wallis Analysis of Total Coliform Observations versus Season in Unnamed Branch

Kruskal-Wallis One-Way Analysis of Variance for 22 cases

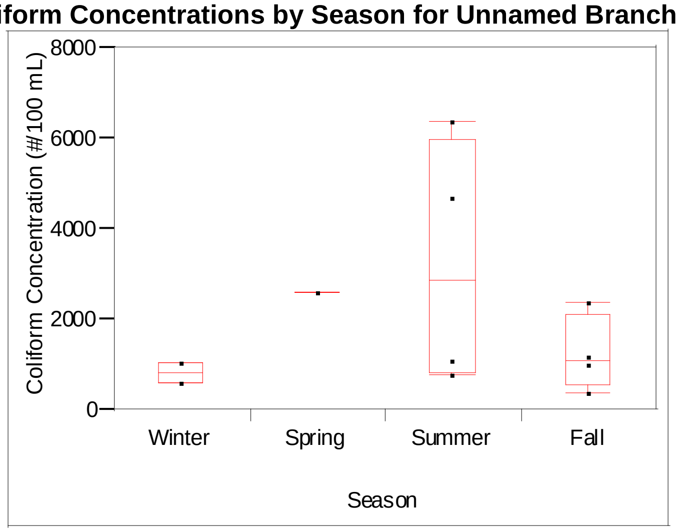
Group	Count	Rank Sum
Winter	4	27.500
Spring	3	51.000
Summer	7	88.000
Fall	8	86.500

Kruskal–Wallis Test Statistic = 4.467
Probability is 0.215 assuming Chi-square distribution with 3 df

Total Coliform Concentrations by Season for Unnamed Branch at Zidell Road



Total Coliform Concentrations by Season for Unnamed Branch at U.S. 1



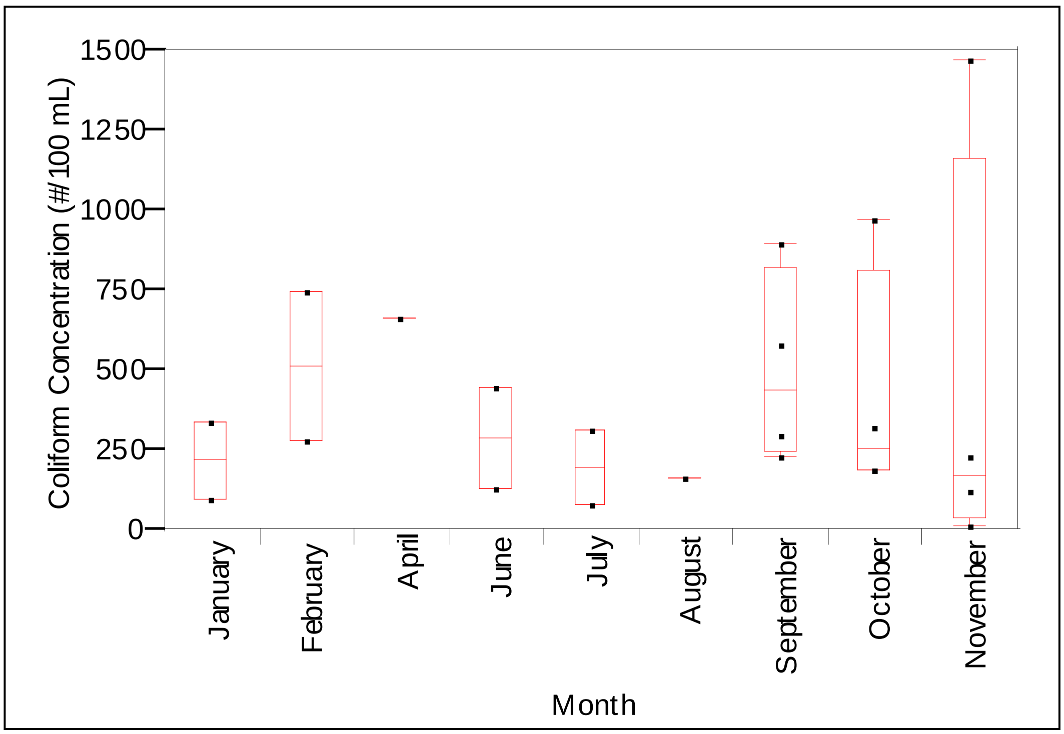
Appendix F: Kruskal–Wallis Analysis of Fecal Coliform Observations versus Month in Unnamed Branch

Kruskal–Wallis One-Way Analysis of Variance for 22 cases

Group	Count	Rank Sum
January	2	18.000
February	2	30.000
April	1	18.000
June	2	21.000
July	2	15.000
August	1	6.000
September	4	58.500
October	4	50.000
November	4	36.500

Kruskal–Wallis Test Statistic = 4.962
Probability is 0.762 assuming Chi-square distribution with 8 df

Fecal Coliform Concentrations by Month



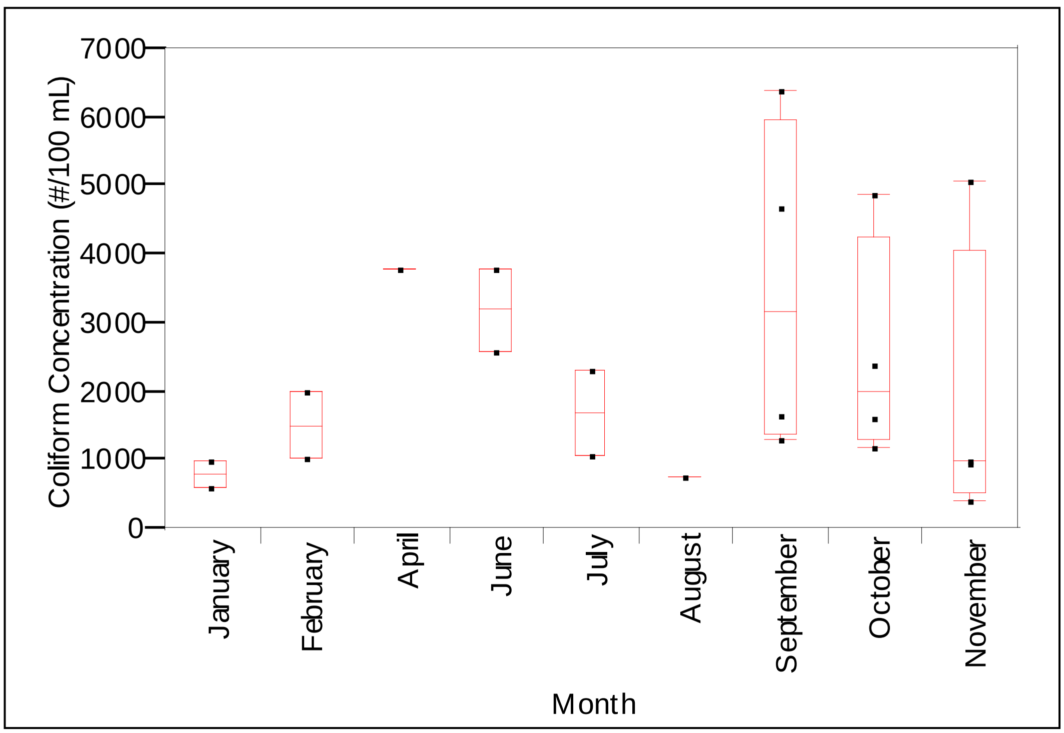
Appendix G: Kruskal–Wallis Analysis of Total Coliform Observations versus Month in Unnamed Branch

Kruskal–Wallis One-Way Analysis of Variance for 22 cases

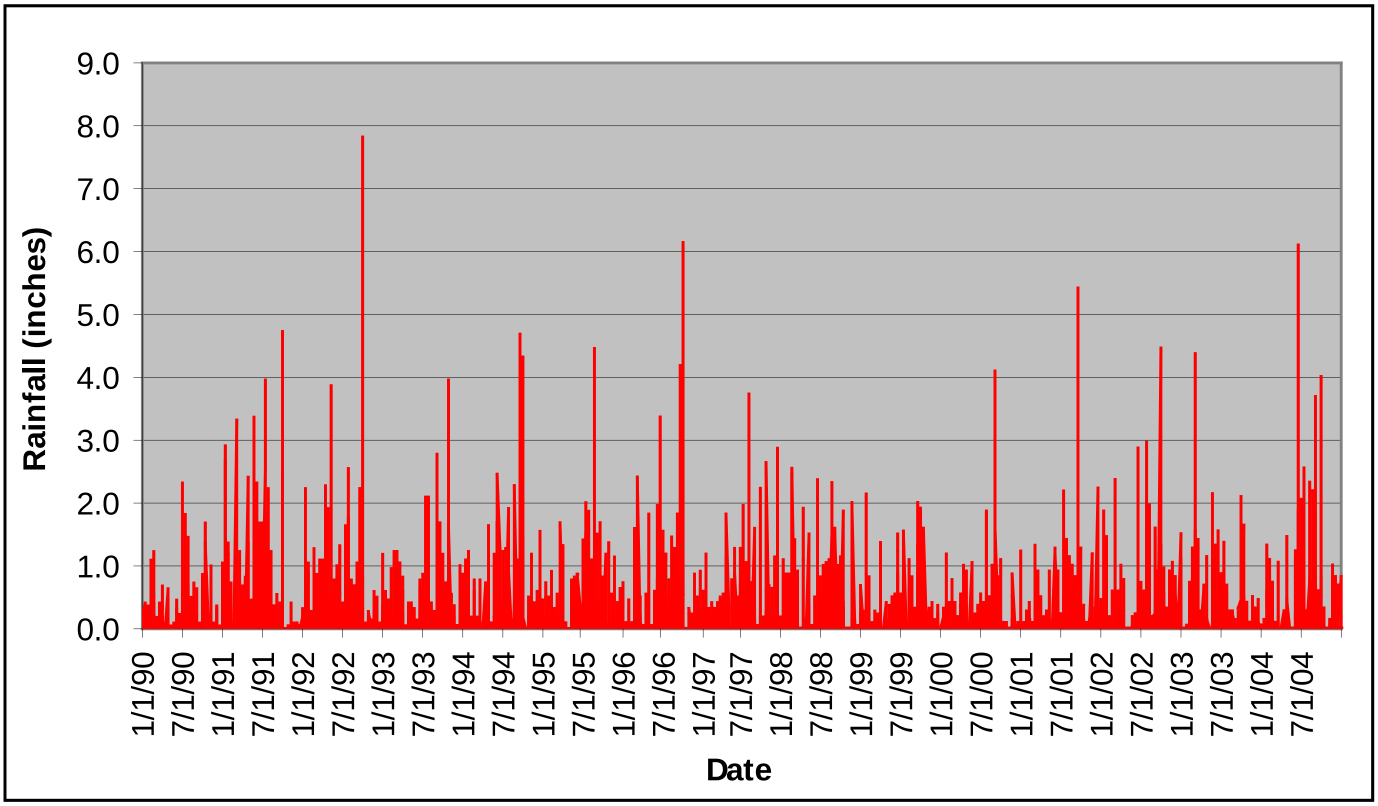
Group	Count	Rank Sum
January	2	7.500
February	2	20.000
April	1	17.500
June	2	33.500
July	2	22.000
August	1	3.000
September	4	63.000
October	4	55.000
November	4	31.500

Kruskal–Wallis Test Statistic = 10.294
Probability is 0.245 assuming Chi-square distribution with 8 df

Total Coliform Concentration by Month

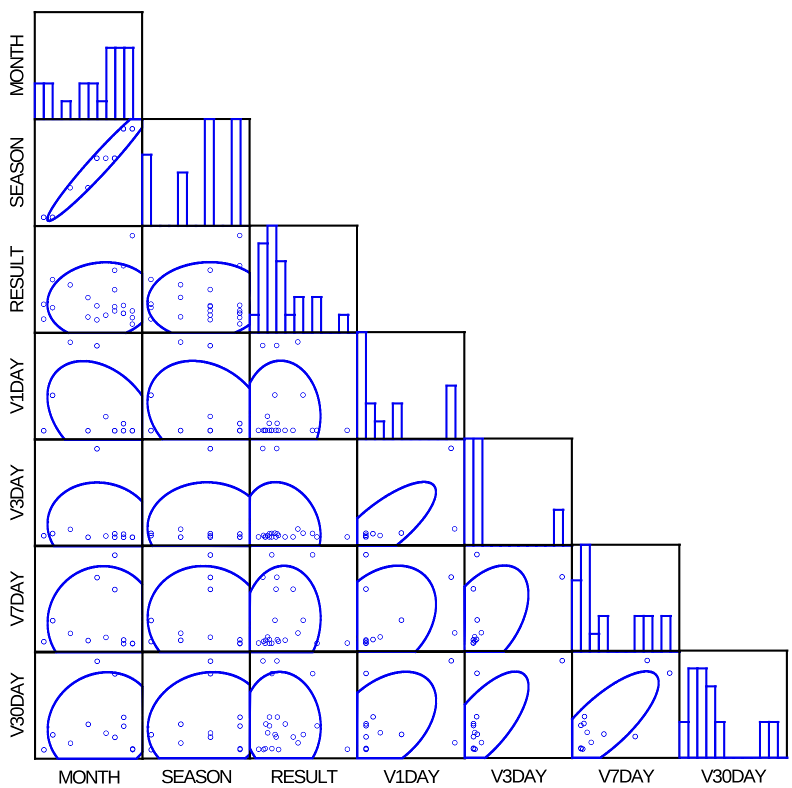


Appendix H: Chart of Rainfall for JIA, 1990–2004



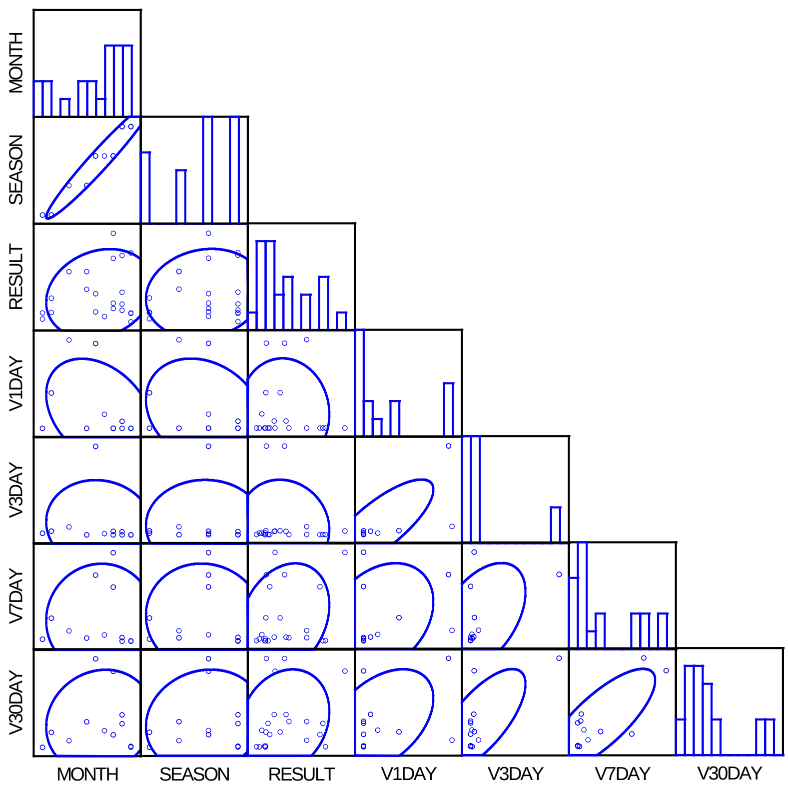
Appendix I: Spearman Correlation Matrix Analysis for Precipitation, Month, Season, and Fecal Coliform in Unnamed Branch

	MONTH	SEASON	RESULT	V1DAY	V3DAY	V7DAY	V30DAY
MONTH	1.000						
SEASON	0.965	1.000					
RESULT	-0.067	-0.095	1.000				
V1DAY	-0.374	-0.252	-0.001	1.000			
V3DAY	-0.521	-0.427	0.054	0.801	1.000		
V7DAY	-0.411	-0.419	0.146	0.457	0.679	1.000	
V30DAY	-0.020	0.094	0.016	0.360	0.447	0.566	1.000



Appendix J: Spearman Correlation Matrix Analysis for Precipitation, Month, Season, and Total Coliform in Unnamed Branch

	MONTH	SEASON	RESULT	V1DAY	V3DAY	V7DAY	V30DAY
MONTH	1.000						
SEASON	0.965	1.000					
RESULT	0.040	0.040	1.000				
V1DAY	-0.374	-0.252	-0.021	1.000			
V3DAY	-0.521	-0.427	0.029	0.801	1.000		
V7DAY	-0.411	-0.419	0.276	0.457	0.679	1.000	
V30DAY	-0.020	0.094	0.394	0.360	0.447	0.566	1.000



Appendix K: Analysis of Fecal Coliform Observations versus Precipitation in Unnamed Branch

Analysis of Sample Day Precipitation (1 Day)

Dep Var: RESULT N: 22 Multiple R: 0.036 Squared multiple R: 0.001

Adjusted squared multiple R: 0.000 Standard error of estimate: 366.120

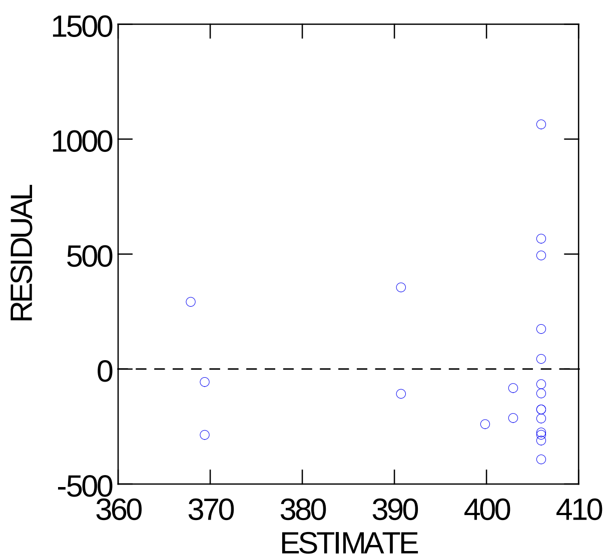
Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	405.944	89.054	0.000	.	4.558	0.000
V1DAY	-152.240	933.774	-0.036	1.000	-0.163	0.872

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	3563.033	1	3563.033	0.027	0.872
Residual	2680879.922	20	134043.996		

Durbin–Watson D Statistic 1.606
First Order Autocorrelation -0.032

Plot of residuals against predicted values



Analysis of Sample Day and Two Days Prior Precipitation (3 Day)

Dep Var: RESULT N: 22 Multiple R: 0.173 Squared multiple R: 0.030

Adjusted squared multiple R: 0.000 Standard error of estimate: 360.853

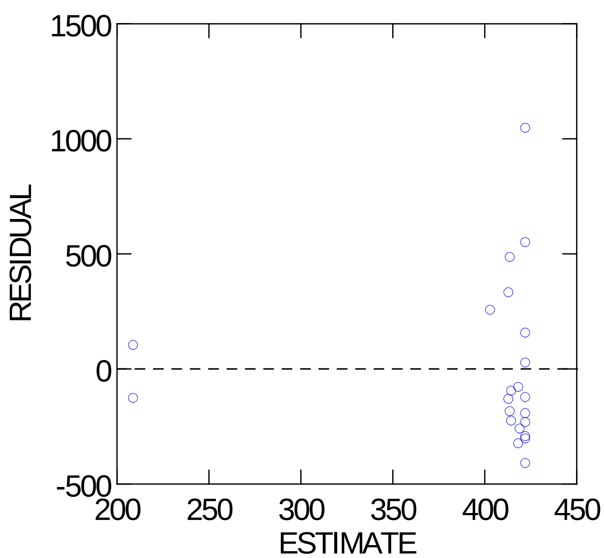
Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	421.994	82.349	0.000	.	5.124	0.000
V3DAY	-76.450	97.449	-0.173	1.000	-0.785	0.442

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	80142.158	1	80142.158	0.615	0.442
Residual	2604300.797	20	130215.040		

Durbin–Watson D Statistic 1.656
First Order Autocorrelation -0.059

Plot of residuals against predicted values



Analysis of Sample Day and Six Days Prior Precipitation (7 Day)

Dep Var: RESULT N: 22 Multiple R: 0.049 Squared multiple R: 0.002

Adjusted squared multiple R: 0.000 Standard error of estimate: 365.918

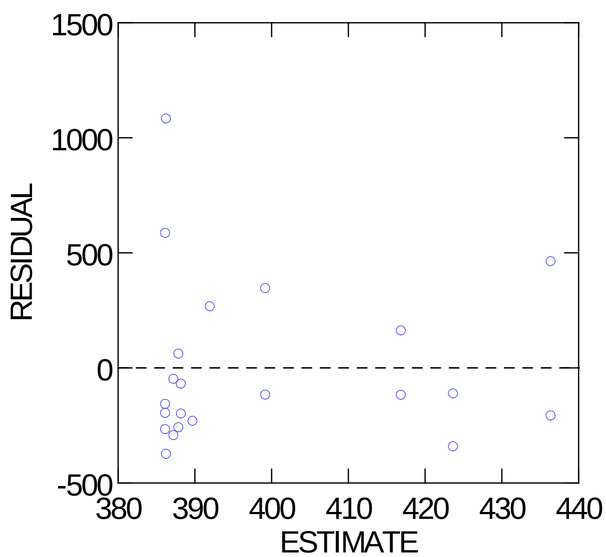
Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	386.125	97.279	0.000	.	3.969	0.001
V7DAY	10.777	48.815	0.049	1.000	0.221	0.828

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	6526.415	1	6526.415	0.049	0.828
Residual	2677916.540	20	133895.827		

Durbin–Watson D Statistic 1.588
First Order Autocorrelation -0.029

Plot of residuals against predicted values



Analysis of Sample Day and Twenty-Nine Days Prior Precipitation (30 Day)

Dep Var: RESULT N: 22 Multiple R: 0.067 Squared multiple R: 0.004

Adjusted squared multiple R: 0.000 Standard error of estimate: 365.547

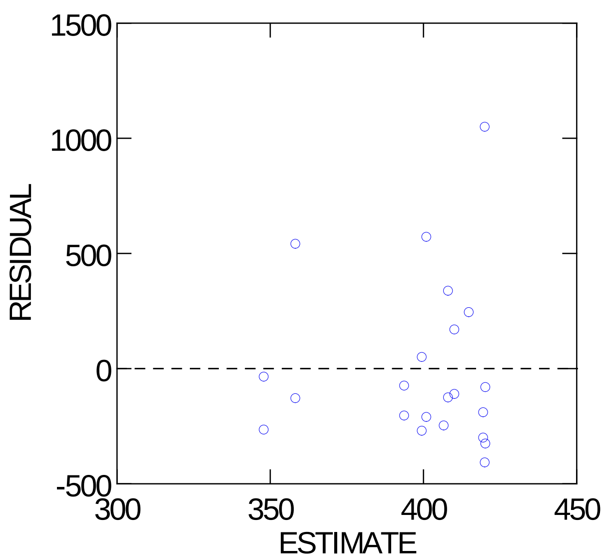
Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	421.630	108.725	0.000	.	3.878	0.001
V30DAY	-3.806	12.725	-0.067	1.000	-0.299	0.768

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	11954.424	1	11954.424	0.089	0.768
Residual	2672488.531	20	133624.427		

Durbin–Watson D Statistic 1.640
First Order Autocorrelation -0.046

Plot of residuals against predicted values



Appendix L: Analysis of Total Coliform Observations versus Precipitation in Unnamed Branch

Analysis of Sample Day Precipitation (1 Day)

Dep Var: RESULT   N: 22   Multiple R: 0.048   Squared multiple R: 0.002

Adjusted squared multiple R: 0.000   Standard error of estimate: 1759.493

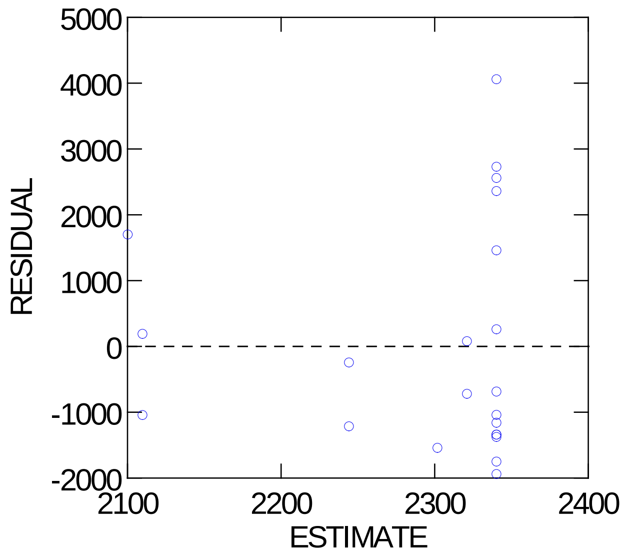
Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	2340.220	427.975	0.000	.	5.468	0.000
V1DAY	-960.229	4487.513	-0.048	1.000	-0.214	0.833

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	141746.801	1	141746.801	0.046	0.833
Residual	6.19163E+07	20	3095816.290		

Durbin–Watson D Statistic 1.766
First Order Autocorrelation 0.032

Plot of residuals against predicted values



Analysis of Sample Day and Two Days Prior Precipitation (3 Day)

Dep Var: RESULT N: 22 Multiple R: 0.107 Squared multiple R: 0.011

Adjusted squared multiple R: 0.000 Standard error of estimate: 1751.402

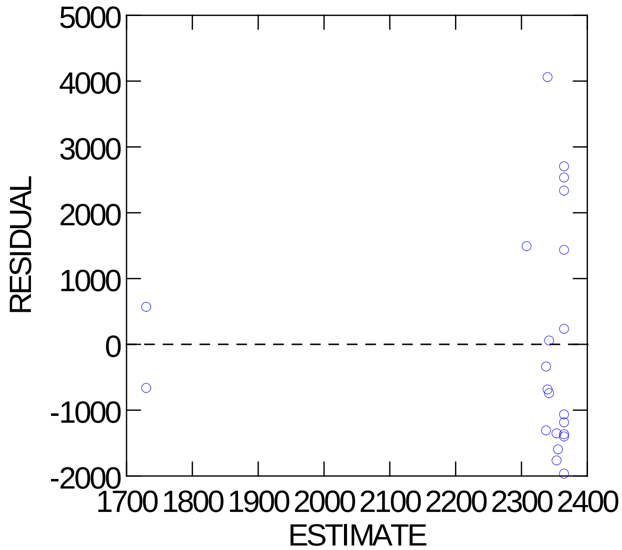
Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	2364.707	399.680	0.000	.	5.917	0.000
V3DAY	-227.535	472.967	-0.107	1.000	-0.481	0.636

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	709911.318	1	709911.318	0.231	0.636
Residual	6.13482E+07	20	3067408.064		

Durbin–Watson D Statistic 1.774
First Order Autocorrelation 0.028

Plot of residuals against predicted values



Analysis of Sample Day and Six Days Prior Precipitation (7 day)

Dep Var: RESULT   N: 22   Multiple R: 0.240   Squared multiple R: 0.058

Adjusted squared multiple R: 0.011   Standard error of estimate: 1709.968

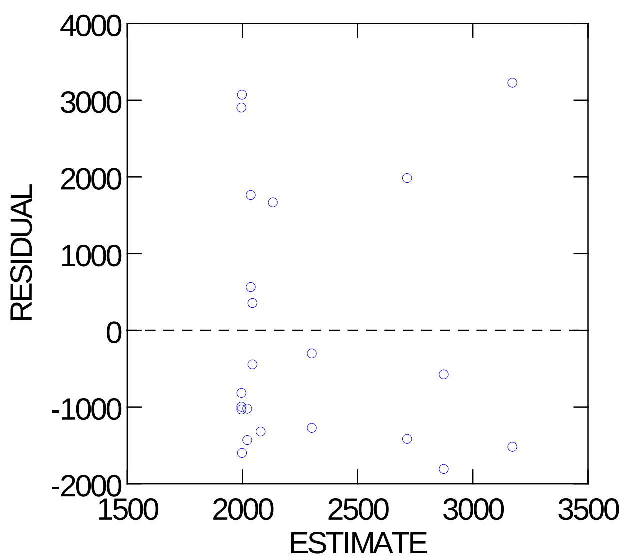
Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	1995.727	454.592	0.000	.	4.390	0.000
V7DAY	252.348	228.115	0.240	1.000	1.106	0.282

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	3578248.270	1	3578248.270	1.224	0.282
Residual	5.84798E+07	20	2923991.216		

Durbin–Watson D Statistic   1.762
First Order Autocorrelation   0.021

Plot of residuals against predicted values



Analysis of Sample Day and Twenty-Nine Days Prior Precipitation (30 Day)

Dep Var: RESULT N: 22 Multiple R: 0.183 Squared multiple R: 0.033

Adjusted squared multiple R: 0.000 Standard error of estimate: 1731.909

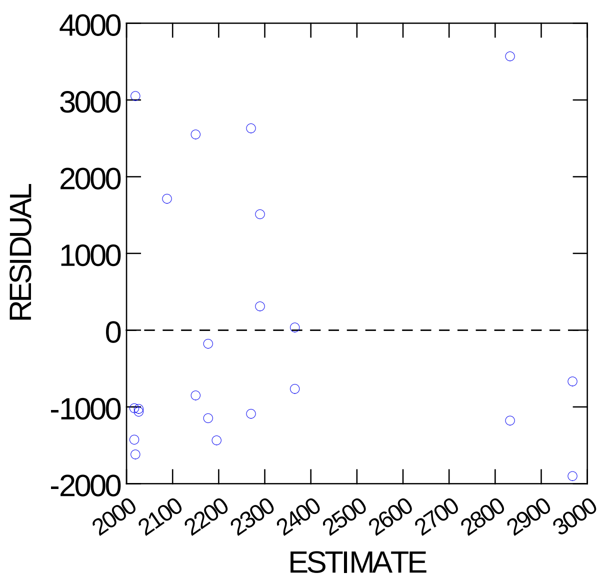
Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	1997.904	515.123	0.000	.	3.878	0.001
V30DAY	50.058	60.288	0.183	1.000	0.830	0.416

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	2067919.497	1	2067919.497	0.689	0.416
Residual	5.99902E+07	20	2999507.655		

Durbin–Watson D Statistic 1.713
First Order Autocorrelation 0.049

Plot of residuals against predicted values

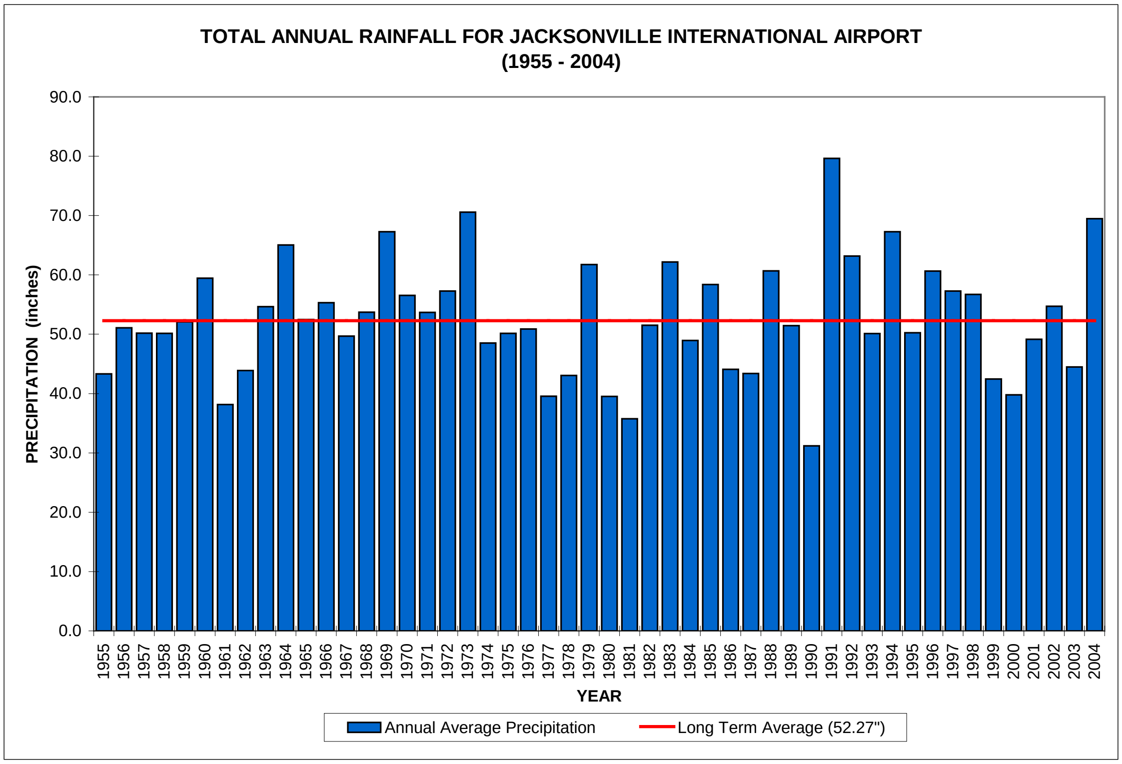


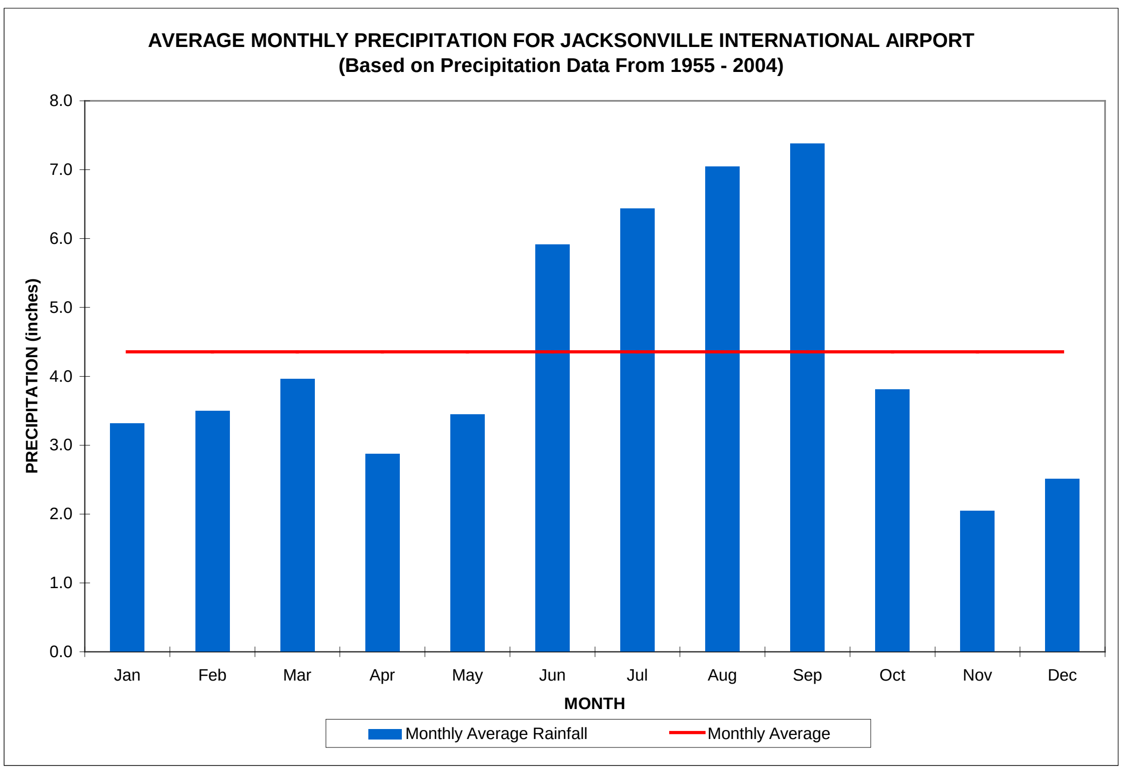
Appendix M: Monthly and Annual Precipitation at JIA, 1955–2004

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
1955	3.09	2.46	1.66	1.5	4.51	2.7	5.53	3.85	10.56	5.36	1.9	0.21	**43.33**
1956	2.91	2.94	0.81	2.33	3.98	7.87	8.25	5.24	2.89	13.44	0.38	0.04	**51.08**
1957	0.33	1.69	3.87	1.61	5.25	7.1	12.34	3.3	8.33	3.5	1.55	1.31	**50.18**
1958	3.39	3.74	3.38	8.24	3.79	3.96	4.37	4.67	4.75	5.07	2.02	2.76	**50.14**
1959	2.97	5.22	9.75	2.65	9.2	2.94	4.51	2.86	5.67	3.12	2.24	0.95	**52.08**
1960	2.07	5.17	6.94	3.54	1.18	4.7	16.21	6.5	8.57	2.95	0.11	1.51	**59.45**
1961	2.87	4.85	1.17	4.16	3.06	5.27	3.48	10.64	1.02	0.27	0.89	0.47	**38.15**
1962	2.16	0.52	3.1	2.36	1.12	8.22	6.31	10.07	4.37	1.13	2.08	2.46	**43.90**
1963	5.39	6.93	2.23	1.75	1.74	12.49	6.47	4.95	4.88	1.53	2.7	3.6	**54.66**
1964	7.29	6.55	1.76	4.65	4.8	4.67	6.12	5.63	10.31	5.09	3.33	4.83	**65.03**
1965	0.65	5.5	3.91	0.95	0.94	9.79	2.71	9.58	11.02	1.75	1.92	3.75	**52.47**
1966	4.56	5.97	0.71	2.25	10.43	7.74	11.09	3.88	5.94	1.38	0.21	1.14	**55.30**
1967	3.05	4.35	0.81	2	1.18	12.9	5.22	12.31	1.8	1.13	0.24	4.69	**49.68**
1968	0.82	3.05	1.2	0.99	2.17	12.25	6.84	16.24	2.68	5.09	1.3	1.09	**53.72**
1969	0.84	3.39	4.23	0.34	3.78	5.12	5.89	15.1	10.33	9.81	4.56	3.87	**67.26**
1970	4.18	8.85	9.98	1.77	1.84	2.65	7.6	10.96	3.2	3.95	0	1.57	**56.55**
1971	2.01	2.55	2.41	4.07	1.9	5.52	5.07	12.83	4.17	6.46	0.83	5.87	**53.69**
1972	5.77	3.48	4.43	2.98	8.26	6.75	3.15	9.76	2.6	4.46	4.22	1.43	**57.29**
1973	4.64	5.07	10.18	11.61	5.33	4.1	5.45	7.49	7.86	4.08	0.44	4.32	**70.57**
1974	0.28	1.28	3.47	1.53	4.14	5.53	9.83	11.23	8.13	0.34	1.03	1.73	**48.52**
1975	3.48	2.58	2.46	5.78	7	5.21	6.36	6.23	5.24	3.63	0.39	1.79	**50.15**
1976	2.29	1.05	3.41	0.63	10.02	4.26	5.41	6.37	8.56	1.63	2.43	4.81	**50.87**
1977	2.96	3.24	1.03	1.76	3.07	2.65	1.97	7.26	7.45	1.68	3.11	3.38	**39.56**
1978	4.64	4.17	2.83	2.24	9.18	2.62	6.67	2.39	4.4	1.26	0.8	1.84	**43.04**
1979	6.28	3.75	1	4.18	7.54	5.91	4.67	4.78	17.75	0.25	3.64	2.01	**61.76**
1980	2.61	1.06	6.83	3.91	3.02	4.59	5.29	3.97	3.03	2.69	2.32	0.21	**39.53**
1981	0.92	4.53	5.41	0.32	1.48	3.31	2.46	6.47	1.22	1.35	4.92	3.38	**35.77**
1982	3	1.67	4.26	3.6	3.55	8.06	3.81	6.93	9.32	3.37	1.93	2.02	**51.52**
1983	7.19	4.27	8.46	4.65	1.38	6.86	6.11	4.63	4.61	4.29	3.32	6.42	**62.19**
1984	2.13	4.67	5.77	3.14	1.46	4.76	6.01	3.78	12.28	1.53	3.3	0.13	**48.96**
1985	1.05	1.45	1.26	2.76	2.08	3.71	6.33	8.93	16.82	8.34	2.07	3.59	**58.39**
1986	4.19	4.72	5.44	0.93	2.13	2.53	3.27	9.6	1.99	1.8	2.85	4.65	**44.10**
1987	4.09	6.47	6.27	0.14	0.75	4.18	4.4	4.48	7.13	0.3	5.02	0.16	**43.39**
1988	6.36	6.08	2.65	3.44	1.35	3.71	4.5	8.48	16.36	2.35	4.27	1.13	**60.68**
1989	1.73	1.77	2.14	2.79	1.55	3.66	8.98	9.16	14.37	1.39	0.51	3.4	**51.45**
1990	1.84	4.07	1.59	1.34	0.18	1.59	6.53	3.81	2.6	4.54	1.17	1.94	**31.20**
1991	10.2	1.52	7.33	6.31	9.35	11.7	15.9	3.48	6.2	6.36	0.71	0.57	**79.63**
1992	5.79	2.64	4.09	5.33	5.97	7.04	3.32	10.76	7.33	8.34	1.92	0.65	**63.18**
1993	3.86	2.89	5.98	0.85	1.6	2.52	7.54	2.96	7.6	8.84	3.58	1.9	**50.12**
1994	6.58	0.92	2.14	1.51	3.15	13.96	8.26	3.29	9.79	10.23	3.49	3.94	**67.26**
1995	1.91	2.07	3.67	1.77	1.77	5.35	9.45	9.93	5.41	3.53	3.2	2.19	**50.25**
1996	1.11	1.11	6.83	2.85	0.72	11.41	4.2	7.83	8.49	11.46	1.39	3.23	**60.63**
1997	2.91	1.28	1.84	4.56	3.43	6.33	7.69	8.24	3.97	4.84	2.41	9.77	**57.27**
1998	3.49	11.12	2.64	4.71	0.96	2.95	7.29	10.09	7.65	3.01	2.39	0.42	**56.72**
1999	4.63	1.7	0.4	1.92	1.02	7.75	3.56	3.51	13	3.24	0.83	0.88	**42.44**
2000	2.77	1.17	1.79	2.6	1.15	2.43	5.69	7.38	11.64	0.23	1.55	1.37	**39.77**
2001	0.91	0.68	5.48	0.62	2.56	5.59	8.31	3.58	16.03	0.81	1.44	3.13	**49.14**
2002	4.48	0.82	4.38	2.41	0.47	6.24	7.8	8.14	9.31	2.58	2.68	5.41	**54.72**
2003	0.07	4.66	10.71	2.63	2.54	6.75	7.33	1.83	3.04	2.98	0.74	1.19	**44.47**
2004	1.64	4.47	1.36	2.02	1.24	17.15	8.6	9.85	16.31	1.32	2.85	2.66	**69.47**
AVG	**3.32**	**3.50**	**3.96**	**2.88**	**3.45**	**5.92**	**6.44**	**7.05**	**7.38**	**3.81**	**2.05**	**2.51**	**52.27**

Note: Rainfall is in inches, and represents data from JIA.

Appendix N: Annual and Monthly Average Precipitation at JIA, 1955–2004





Appendix O: Response to Comments

Unnamed Branch (WBID 2156)
Total & Fecal Coliform TMDL Public Workshop

July 19, 2006
2PM
Town of Callahan Fire Department
542300 US Highway 1
Callahan, FL

Attendees:
Chip Campbell, Okeefenokee
Dean Woehrle, St. Marys River Management Committee
Trish Gramanjo, Nature Conservancy
Paula Staples, Nassau County Water Action Volunteers
Beth Belk, Environmental Protection Agency
Dave Melgaard, Environmental Protection Agency
Wayne Magley, Florida Department of Environmental Protection
David Wainwright, Florida Department of Environmental Protection
Jennifer Gihring, Florida Department of Environmental Protection

Began: 2:20PM

Wayne Magley, Florida Department of Environmental Protection
Introduction

David Wainwright, Florida Department of Environmental Protection
Review of Draft Unnamed Branch Total and Fecal Coliform TMDL

Specific Comments on the TMDL from Attendees
None received

General Questions and Comments from the Attendees

Chip Campbell: Do the total coliform exceedances correspond closely to the fecal exceedances?

RESPONSE (D. Wainwright): They should, because fecal coliform is a subset of total coliform; but that is not necessarily the case. It is not necessarily a defined ration, but typically if you do see high fecal coliform counts you will often see high total coliform counts. However, total coliform also includes vegetative forms, and it also matters how much of the total coliform is fecal. I [David Wainwright] looked at these [the coliform and total exceedances] and that was the case in most instances, but not all of them.

Chip Campbell: How are the exceedances distributed between the two sampling sites? Are they evenly distributed or, does one site exhibit higher exceedances than another?

RESPONSE (D. Wainwright): I [David Wainwright] looked at that [during TMDL development], and I don't recall specifically how they were split. However, as best I can remember, for the most part, they were evenly divided – four at one site and three at another; but I think that the fecal coliform had three exceedances at one site while the totals had four, and the rest at the other site. Actually, if you look in the TMDL, and I forget which table it is, there is a table that summarizes the total number of samples collected, what years, and the number of exceedances, broken down by station. We like to, when we can, look at all the stations and see if there is a trend that we can identify, and see if concentrations increase or decrease as you go downstream. So if, for example, we see a lot of exceedances at two stations, and not many at other places, it may indicate that a source is nearby – maybe there is a tributary that comes in with high coliform counts that we need to pay closer attention to. In this case though, it is a small stream and we only have two stations, both of which are at the mouth, so we can't really do that in this situation.

Trish Gramajo: I am interested in the BMAP legislation [mentioned during the presentation by Wayne Magley prior to the TMDL summary presentation]; I have not heard anything about this, and I was wondering if you could perhaps elaborate on this a little more for me, and also a little bit about how the BMAP process works?

RESPONSE (W. Magley): In the original legislation, in the fourth phase, that there would be a consensus among the stakeholders in terms of the best approach to developing that allocation and meet water quality standards. There was a consensus building process on the first two BMAPs to be done, one was the Oklawaha Basin and the other was the Orange Creek Basin, and there are drafts out there now. If anyone is interested in seeing what they look like, they should be posted on our website, or we can make them available to you if you contact us. These are our first attempts at BMAP development. They have identified the potential sources, and have tried to come to a consensus with the stakeholders over were these reductions will be coming from. The idea then is that these reductions will be implemented in phase five.

In the legislation that came out this past year, in 2005, there were some refinements in the BMAP process. One of the things is that BMAPs are going to be signed documents, so they are going to be enforceable. So, when stakeholders commit to a given reduction, they will sign the document and it will be enforceable, and it will be able to be challenged and there can then be a hearing process. It also stated that there may not be a need to allocate a lot of resources towards BMAP development in all basins. So the situations were we have a lot of sources, issues and stakeholders will probably be the ones with the highest priority. In other situations, where the issues aren't as complex, and we know what needs to be done, we may be able to take a less formal approach.

RESPONSE (J. Ghiring): Also, this latest legislation stated that the BMAPs will be adopted and signed by the secretary [of DEP]. Another important item from the latest legislation was that of the linkage to MS4 permits. Now, any provisions that are in a BMAP, if they are adopted straight into an MS4 permit, then they can only be challenged on a whole. In other words, if the MS4 reduction comes straight out of an adopted BMAP, it can no longer be challenged; you have to challenge it at the BMAP level and not at the MS4 level.

There were also changes to the agricultural BMPs. So, under the new legislation, an agricultural operator will have on of two options. One, they can use BMPs that that have been developed and approved by the Department and the Department of Agriculture, or they can undertake a water sample program and show that they are not impacting the water quality. Then, if they decide not to take one action or the other, then there is a forceful backstop.

RESPONSE (W.Magley): Also, there was some question about implementation to permitted dischargers. When should BMAP elements apply? Do we wait until the permit is renewed, or do we go ahead and open up an existing permit? The legislation allowed for a certain amount of time for implementation to be included in the permit. So, depending on where that permit stands, we may open an existing permit, or wait until renewal, depending on where the permit stands at the time of BMAP adoption.

Trish Gramajo: I have not seen the two BMAPs that have been done, but it seems that in the summary for this TMDL you don't know what the sources are; you haven't been able to link it to any. So, I guess my question in a "next step" question.

RESPONSE (J. Ghiring): Part of the new legislation states that we do not necessarily have to do a BMAP for every basin, and this may be one of those basins where it isn't feasible. It may just be a case of going to the Department of Agriculture and having them verify that the dairy [located at the extreme northern end of the watershed] is not impacting the creek. Also, going to the county health department and getting them to analyze the septic tanks and seeing if they think there are any issues with them. Then we would probably analyze where we are, and we may just end up with more of an agreement between the various agencies, and that may just be the BMAP for this basin. It wouldn't be a formal BMAP that would be adopted.

RESPONSE (W. Magley): There may also be some education and perhaps some better cooperation with BMPs, such as with the health department. Remember, we will be coming back to this basin again in five years. We will be testing all these waters again and re-assessing them as well.

RESPONSE (D. Wainwright): The Department could probably go out and spend three to four hundred thousand dollars attempting to better identify source in the basin with a microbial source tracking study. The results may not yield conclusive results; is it worth it to spend that kind of money on this basin? Probably not.

Trish Gramajo: Would the 319 money be the best funding source to pursue for education purposes and other implementation ideas, or is there another funding opportunities with in DEP that would be better for that?

RESPONSE (J. Ghiring): Yes, 319 money remains the best source of funding for such opportunities. However, under the new legislation, there was a pot of money tat was set aside for BMAP implementation. Most of that money will most likely go towards larger basins were we know what the sources are and will require a large expense, and basically get the most out of the money. The Department does have some smaller, flexible funds, but if anyone has any ideas or plans, please get with me and let me know.

RESPONSE (W. Magley): The Department of Health may have some funds or grants available as well.

Chip Campbell: If I was a county commissioner, and there was a TMDL on a waterbody in my county, what does that mean to me? What do I have to look forward to? What are going to be the regulatory impacts? I would have constituents to answer to; what does this mean? What about planning and zoning?

RESPONSE (W. Magley): The Department is aware that some of the waters in your area have water quality issues. You would need to be aware of this, because it may impact development; you need to be aware that future development can affect water quality. We would try and identify sources and try to come up with ways to address those issues. Maybe, depending on the parameters of concern, there needs to be further discussions addressing those issues in the future. If we know what the sources are now, then we need to address them now, and make sure that they going to be addressed in the future as well. As a commissioner, who is concerned about the future, you would need to be aware of what waters are on the verified list and for which parameters they are listed for. You may also want to look at the Planning List and see which waters may potentially be impaired in the future. Remember, we assess these waters every five years, so we will be coming back to them. We will be looking to see if things are getting better. If these issues aren't addressed now, then you may face even tougher restrictions in the future if things continue to get worse. We also have a category 4 in our assessment process. This is used when a TMDL has been done or impairment has been addressed. Those will me watched especially close to see if water quality is improving.

Chip Campbell: A commissioner would look at this TMDL and know that a 46 percent reduction in fecal coliform is necessary. How do you do that? Are you going to say that this is what you are going to have to have in terms of conservation overlay over that area to reach the reduction? Are you going to have specific areas and number that reflect where these reductions will need to come from? Are they going to have that information in order to make real decision making that will need to be done?

RESPONSE (W. Magley): That type of information comes out in the BMAP process. That is when we will investigate the sources and the contributors, and what mechanisms that can be employed to address these problems. In the Ocklawaha BMAP for example, the Department went through and looked at the stormwater projects that have been done, as well as which ones were planned to be done. In this case, they parameter of concern was phosphorous. The developed an anticipated reduction for each project and how much of the basin was affected by the project. We then had a list of completed project, projects underway, and proposed projects along with the effects of each of them, which we then totaled up to see how close we were to the TMDL. If we found we were not at our target, we went back in and looked again to see what else we could do. We not only consider construction projects, but non-structural BMPs as well. Public education and awareness is a good example of this. This can be another component of a BMAP. How are we going to educate land and home owners, stakeholders, and the general public about certain activities that maybe they can modify that might help alleviate some of the pollutant loading? For example, a farmer may have cattle in a field that has a stream running through it. In a case like this, perhaps something as simple as re-fencing the pasture to keep the cattle out of the stream would help reduce coliform loading. Or, perhaps if unrestrained dogs are an issue we could address that. In many instance it requires a combination of both structural and non-structural BMPs.

Chip Campbell: How far can enforcement be carried? Suppose a city chooses to ignore or not take part in the BMAP process and then stays in violation of the Clean Water Act? Do you then get federal involvement and force, say a building moratorium, on that city? Can it go that far? What would be the next step?

Response (W. Magley): That would be an extreme case; that would be way back there. I would hope it would never come to that. We all want clean water and we all want to make sure that that resource is protected so we can all enjoy the activities associated with that resource. In the background, yes, there may be other ramifications, especially if someone holds a permit, which we certainly could enforce.

Length of meeting: 1:04:10

EPA Summary and Review of the Total and Fecal Coliforms TMDLs for Unnamed Branch (to Alligator Creek) WBID 2156

About the Stream/TMDL:

1. The Unnamed Branch in WBID 2156 is a small, second-order tributary of Alligator Creek in Nassau County, Florida. The area of WBID 2156 is only 3.72 mi^2.
2. Unnamed Branch (WBID 2156) is designated a Class III freshwater.
3. WBID 2156 is 303(d)-listed for fecal and total coliforms and nutrients (it was listed jointly with 2120A of Mills Creek).
4. The TMDL was developed using a percent reduction approach. The percent reduction for each sample to meet the TMDL target was calculated, and the median of all percent reductions was used as the Load Allocation and Waste Load Allocation for MS4s.
5. TMDL: The overall TMDL is essentially set equal to the TMDL endpoints, which were based on the criteria.
6. WLA MS4: The TMDL discusses that WBID 2156 is within FDOT District 2, which holds a Phase I MS4 permit for its stormwater collection systems (FLS000012). However, since there are no collection systems evident in WBID 2156, the TMDL did not consider the MS4.
7. WLA NPDES: There are no NPDES-permitted facilities in WBID 2156, so no Wastewater (NPDES) WLA is provided. The TMDL does have language about any future point source dischargers being required to meet all of the criteria for coliforms.
8. LA: Nonpoint sources are considered to include surface runoff, wildlife, livestock, pets, leaking sewer lines, and failing septic tanks. Most of the watershed is used for forest regeneration, wetland forest, coniferous pine, and upland mixed coniferous/hardwoods, which combined make up about 75% of the WBID. The only residential areas are low density or rural developments, where the residents are on septic systems. There is a dairy and a cattle feeding operation in WBID 2156, but they are located in the far northern corner of the WBID and are thought to have minimal impact, especially since the portion of the cattle operation within the Unnamed Branch watershed is currently planted and not being used for cattle.
9. **TMDL endpoints:**

For fecal coliform: 400 /100ml.
For total coliform: 2,400 /100ml.
These are consistent with targets that EPA has used.

Comments:

1. A simple approach is appropriate given the limited dataset available, including the lack of flow data. While various analyses were performed in order to understand when exceedances occurred in relation to seasons and rain events, etc, the limited dataset makes it difficult to draw conclusions. The percent reduction approach used to develop the TMDLs is consistent with others that FDEP and EPA have developed and established in the past.

   No response necessary

2. Unless a TMDL is already expressed as a daily load, EPA has started incorporating language into each TMDL to translate them to daily allocations (or explain how the way the TMDL is expressed is protective on a daily basis). FDEP should incorporate such language into this TMDL. This should be easy, since the TMDLs are basically set to the standard, which applies every day.

   Comment noted

3. Many of the data are associated with remark code B, meaning the colony units were outside the acceptable range. Please explain the meaning of this remark code further and how it might affect interpretation of such data.

   The remark code is used to indicate that results are based upon colony counts outside the acceptable range. According to standard methods, the desired range for fecal and total colony counts on a membrane are 20 to 60 and 20 to 80, respectively. If counts were outside these desired ranges, the B remark code has been used. We have not felt it necessary to exclude coliform results based upon a B remark code.

4. It would be good to include more information about total coliform bacteria in the source assessment or discussion of the data. Some sample language: "Total coliform bacteria generally indicate the presence of soil-associated bacteria. While total coliform bacteria are generally harmless, their presence may indicate that other pathogens have entered the system. One sub-group of total coliforms is fecal coliform bacteria, which are used as indicators of fecal contamination since they are abundant in the intestines and feces of animals and people. As such, total coliform bacteria concentrations may result from natural influences on a water body, as well as unnatural influences such as sewage inflows."

   Language has been added to section 4.1.

5. Selection of 400 MPN/100ml as the TMDL endpoint for fecal coliforms clearly leads to a higher percent reduction (than using the instantaneous criterion of 800 MPN/100ml), especially since the 400 MPN/100ml is applied without allowing exceedances 10% of the time, as the criteria are written. However, for total coliforms, it is not as clear that the instantaneous criterion of 2400 MPN/100ml is more conservative than the 1,000 MPN/100ml criterion, which

allows exceedances 20% of the time. For example, if the 1,000 MPN/100ml total coliform criterion were applied as was the criterion for fecal coliforms, i.e. without allowing exceedances, the percent reduction would be greater (~57%). It might be good to include more of an explanation about why the target selected for total coliforms is protective of the other parts of the criteria.

The total coliform criteria was expressed in Rule 62-302.530(7), FAC in Class III freshwaters as:

> $\leq$ 1,000 as a monthly average; nor exceed 1,000 in more than 20% of the samples examined during any month; $\leq$ 2,400 at any time. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30 day period, using either the MPN or MF counts. of 1,000 #/100 ml

Based on consultation with EPA, TMDLs for total coliforms were based on the 2,400 #/100 ml criterion. As noted in an earlier comment, total coliforms include bacteria of both fecal and vegetative origin. Bacteria associated with soils, plants, and insects fall under the vegetative origin. Bacteria of fecal origin are associated with septic systems, sewage, and warm blooded animals. Since fecal coliforms can represent a large fraction of the total coliform population, basing the fecal coliform on 400 #/100 ml will also lower the total coliform population.

Since the State removed the total coliform criteria from Chapter 62-302, FAC in late 2006, only the fecal coliform described in this document has been adopted by rule.

6. You may consider explaining that domestic wastewater facilities do not have total coliform limits in their NPDES permits. However, they do have end-of-pipe limits for fecal coliform equivalent to the water quality standard. Generally, it is expected that by meeting the limits for fecal coliforms, which are a sub-group of total coliforms, the water quality standard for total coliforms in the receiving water should be protected.

   A comment has been added to the point sources section that any new domestic or industrial wastewater facility that is permitted to discharge to the Unnamed Branch or any of its tributaries will be required to meet Class III bacteria criteria at the point of discharge. Regression of total coliform versus fecal coliform data for Unnamed Branch indicated that 67% of the variance in total coliform concentrations was explained by the corresponding fecal coliform concentrations.

   Since the State removed the total coliform criteria from Chapter 62-302, FAC in late 2006, only the fecal coliform described in this document has been adopted by rule.

7. The document states that FDOT District 2 is covered by an MS4 permit, but it is not entirely clear whether WBID 2156 is within its jurisdiction. On page 10, the statement is made that "MS4 loadings and allocations were not considered in the development of these TMDLs" because stormwater collection systems are not evident. However, the TMDL components table on page 29 has a percent reduction allocation for the MS4. This is a bit confusing.

The FDOT District 2 MS4 permit identified in the document applies only to the Duval County/Jacksonville area. According to our MS4 staff, att present there are no permitted MS4s in Nassau County. Reference to this permit has been removed.

8. This is a minor typo: Winter is written as “inter” in the appendix D chart, page 37.

The text has been corrected.

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