FINAL

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Water Resource Management, Bureau of Watershed Management

SOUTHWEST DISTRICT • TAMPA BAY BASIN

TMDL Report

Fecal and Total Coliform TMDL for Delaney Creek (WBID 1605)

Candice Burger

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Acknowledgments

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For additional information on the watershed management approach and impaired waters in the Tampa Bay Basin, contact

Tom Singleton
Florida Department of Environmental Protection
Bureau of Watershed Management
Watershed Planning and Coordination Section
2600 Blair Stone Road, Mail Station 3565
Tallahassee, FL 32399-2400
thomas.singleton@dep.state.fl.us
Phone: (850) 245-8561; Suncom: 205-8561
Fax: (850) 245-8434

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

Kevin Petrus
Florida Department of Environmental Protection
Bureau of Watershed Management
Watershed Assessment Section
2600 Blair Stone Road, Mail Station 3555
Tallahassee, FL 32399-2400
kevin.petrus@dep.state.fl.us
Phone: (850) 245-8459; Suncom: 205-8459
Fax: (850) 245-8536

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Web sites

Florida Department of Environmental Protection, Bureau of Watershed Management

TMDL Program

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Identification of Impaired Surface Waters Rule

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STORET Program

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

2002 305(b) Report

http://www.dep.state.fl.us/water/docs/2002_305b.pdf

Criteria for Surface Water Quality Classifications

http://www.dep.state.fl.us/legal/rules/shared/62-302t.pdf

Basin Status Report for the Tampa Bay Basin

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

Water Quality Assessment Report for the Tampa Bay Basin

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U.S. Environmental Protection Agency

Region 4: Total Maximum Daily Loads in Florida

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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 freshwater stream segment of Delaney Creek in the Tampa Bay Basin. The stream was verified as impaired for fecal and total coliform, and was included on the Verified List of impaired waters for the Tampa Bay Basin that was adopted by Secretarial Order on August 28, 2002. The TMDL process quantifies the amount of a pollutant that can be assimilated in a waterbody, identifies the sources of the pollutant, and recommends regulatory or other actions to be taken to achieve compliance with applicable water quality standards based on the relationship between pollution sources and instream water quality conditions. The TMDL establishes the allowable loadings to the freshwater stream segment of Delaney Creek that would restore the waterbody so that it meets its applicable water quality criteria for total and fecal coliform.

1.2 Identification of Waterbody

The Delaney Creek watershed is located in Hillsborough County, with a 22.6-square-mile drainage area flowing into the southeastern portion of East Bay **(Figure 1.1).** The Delaney Creek freshwater stream segment is a third-order stream, and, along its length, it exhibits characteristics associated with riverine aquatic environments. The watershed includes a large area of Brandon, a rapidly expanding urban area in central Hillsborough County. In its headwaters, east of Interstate 75, the creek consists of a series of stormwater ponds. West of the interstate, the creek flows through a channel for approximately 6.5 miles before it enters East Bay. One industrial facility, Nitram, Inc., a producer of ammonia nitrate, has a permitted discharge to Delaney Creek of 0.41 million gallons per day (mgd). There are six additional small individual permitted facilities in the watershed. **Figure 1.2** shows the Delaney Creek watershed and its long-term water quality stations and flow gages. Additional information about the river's hydrology and geology are available in the Basin Status Report for the Tampa Bay Basin (Florida Department of Environmental Protection, November 2001).

For assessment purposes, the Florida Department of Environmental Protection (the Department) has divided the Tampa Bay Basin into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed or stream reach. Delaney Creek has been divided into the six segments listed below (and shown in **Figure 1.2);** this TMDL addresses the main freshwater stream segment only, WBID 1605.

- 1605 Delaney Creek
- 1605A Lake Tenmile
- 1605A1 Lake Tenmile Drain
- 1605B Gornto Lake
- 1605C Mead Lake
- 1605D Delaney Creek Tidal

Figure 1.1. Location of the Delaney Creek Watershed and Major Geopolitical Features in the Tampa Bay Basin

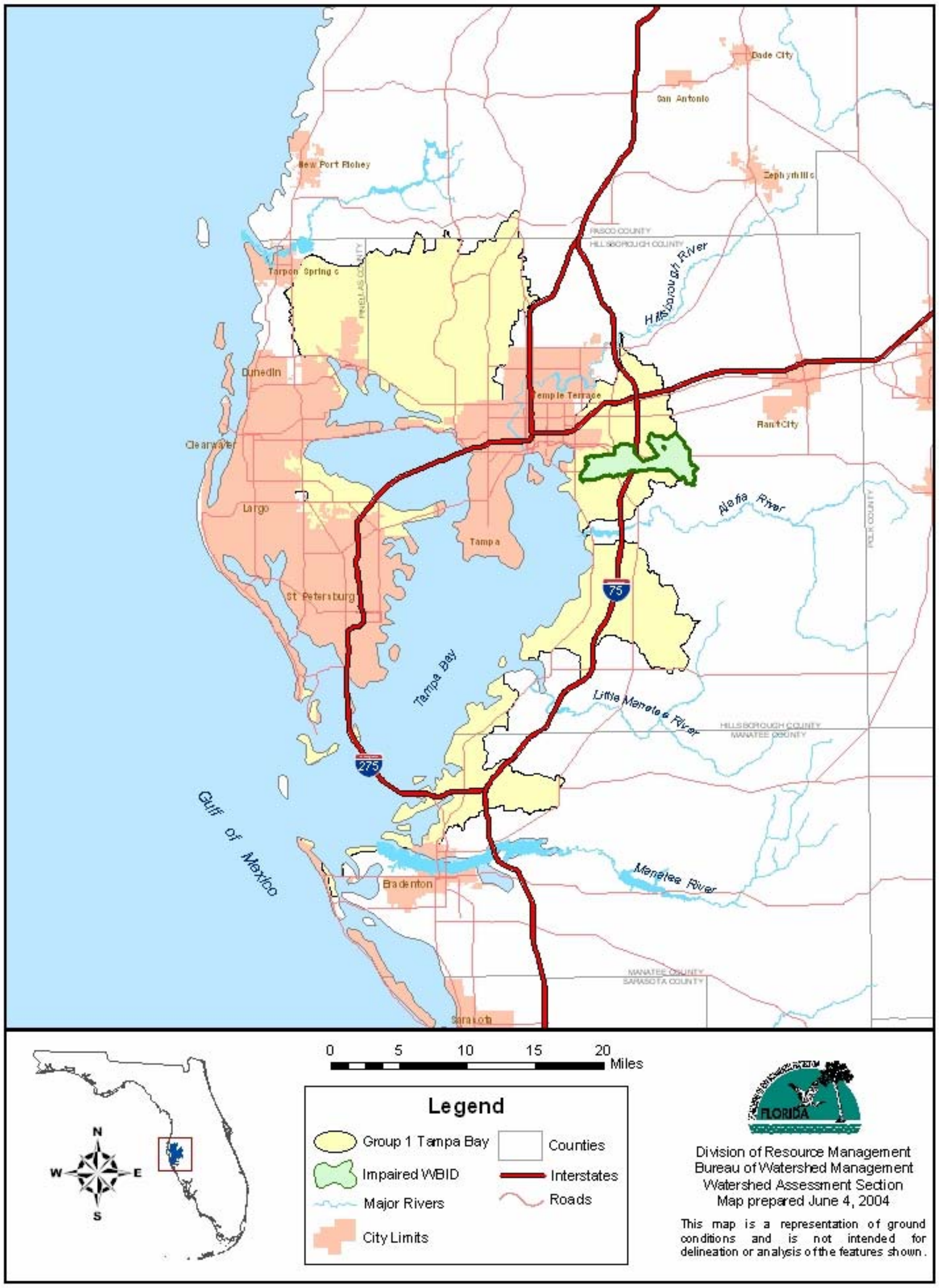
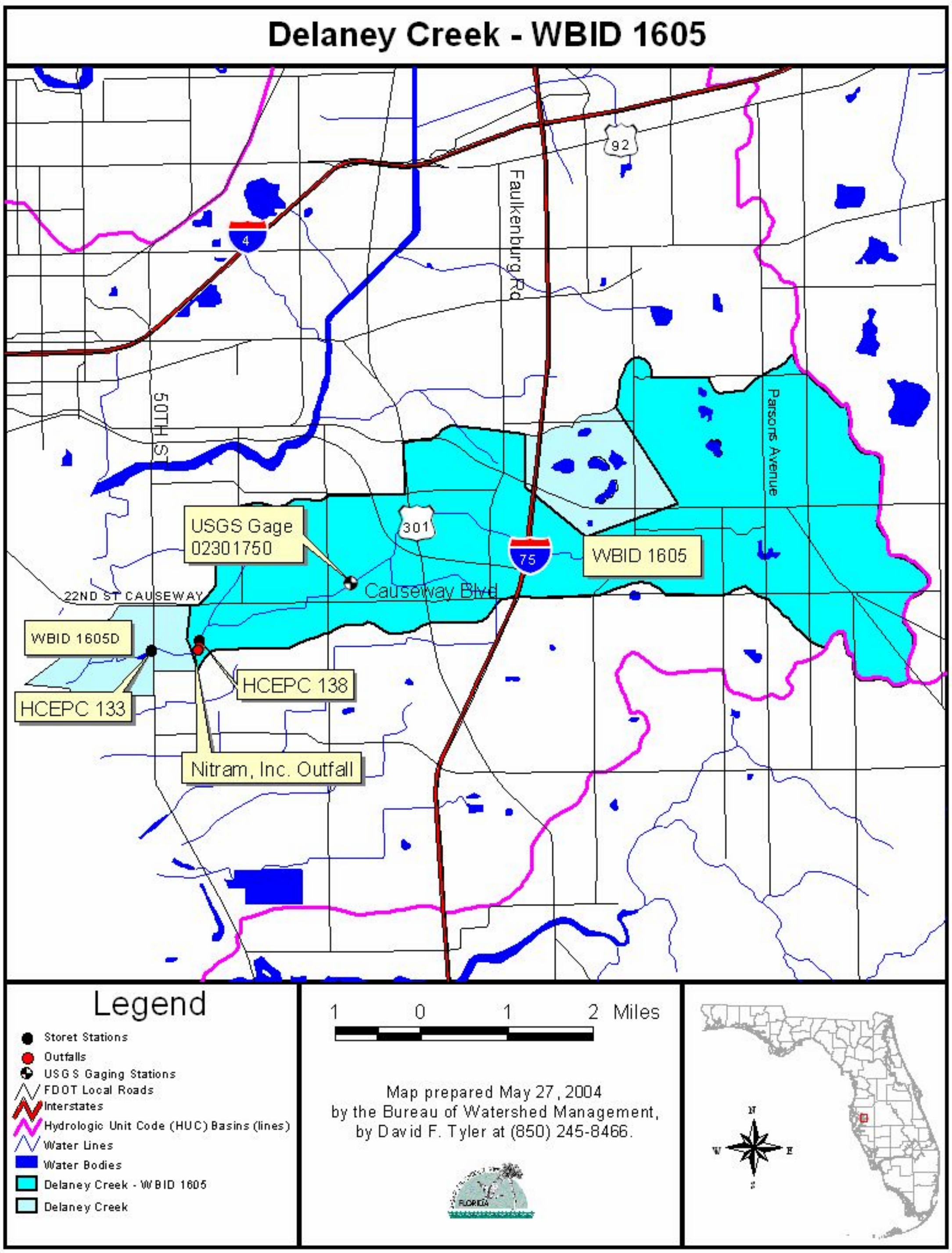


Figure 1.2. WBIDs in the Delaney Creek Watershed



1.3 Background

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

A TMDL represents the maximum amount of a given pollutant that a waterbody can assimilate and still meet water quality standards, including its applicable water quality criteria and its designated uses. TMDLs are developed for waterbodies that are verified as not meeting their water quality standards. TMDLs 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 coliform that caused the verified impairment of the freshwater stream segment of Delaney Creek. These activities will depend heavily on the active participation of the Southwest Florida Water Management District (SWFWMD), Hillsborough County's Environmental Protection Commission (HEPC), local governments, businesses, and other stakeholders. The Department will work with these organizations and individuals to undertake or continue reductions in the discharge of pollutants and achieve the established TMDLs for impaired waterbodies.

Chapter 2: DESCRIPTION OF WATER QUALITY PROBLEM

2.1 Statutory Requirements and Rulemaking History

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

Florida's 1998 303(d) list included 47 waterbodies in the Tampa Bay Basin. However, the FWRA (Section 403.067, F.S.) stated that all previous Florida 303(d) lists were for planning purposes only and directed the Department to develop, and adopt by rule, a new science-based methodology to identify impaired waters. After a long rulemaking process, the Environmental Regulation Commission adopted the new methodology as 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 to assess water quality impairments in Delaney Creek and has verified the impairments listed in **Table 2.1**. **Table 2.2** summarizes the sampling events for the verification period. The stream was verified as impaired for fecal coliform and total coliform because greater than 10 percent of assessed values for the Delaney Creek samples exceeded the Class III freshwater criteria of 400 counts per 100 milliliters (mL) for fecal coliform and 2,400 counts per 100 mL for total coliform.

The verified impairments were based on data received from the HEPC for Station 21FLHILL138 **(Figure 1.2). Figures 2.1** and **2.2** display the assessed fecal and total coliform data collected from 1995 through 2003 at the long-term monitoring station (see **Appendix A** for the raw data).

Table 2.1. Verified Impaired Segment in Delaney Creek, WBID 1605

Parameters Causing Impairment	Priority for TMDL Development	Projected Year for TMDL Development
Fecal Coliform	High	2003
Total Coliform	High	2003
Dissolved Oxygen	High	2003
Lead	High	2003

Note: The parameters listed in **Table 2.1** provide a complete picture of the impairment in the river, but this TMDL only addresses bacterial impairment.

Table 2.2. Summary of Fecal and Total Coliform Assessed Data (1995 – June 2002) for Delaney Creek, WBID 1605

Parameter	Station ID	Number of Samples	Minimum (counts/day)	Mean (counts/day)	Median (counts/day)	Maximum (counts/day)	Number of Exceedances
Fecal Coliform	21FHILL054	90	20	998	400	20000	40
Total Coliform	21FHILL054	84	200	4420	1950	27700	38

Figure 2.1. Fecal Coliform Measurements of the Long-Term Monitoring Station for Delaney Creek, WBID 1605

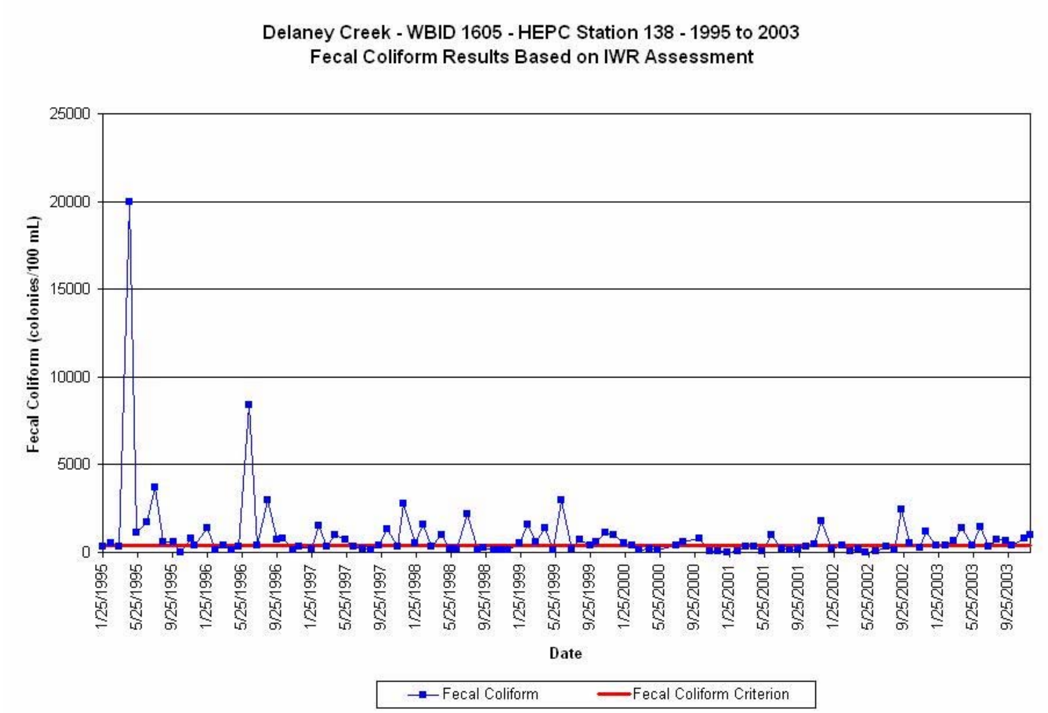
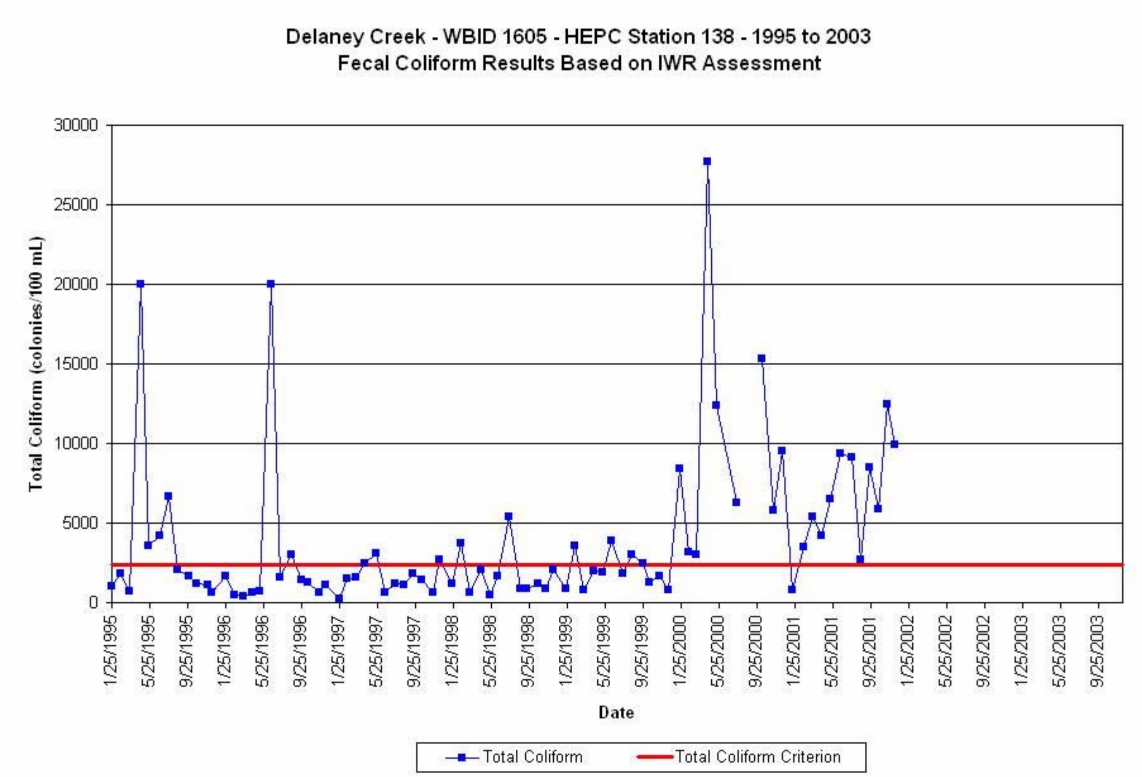


Figure 2.2. Total Coliform Measurements of the Long-term Monitoring Station for Delaney Creek, WBID 1605



Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criteria Applicable to the TMDL

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

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

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

3.2 Applicable Water Quality Standards and Numeric Water Quality Target

3.2.1 Fecal Coliform Criterion

Numeric criteria for bacterial quality are expressed in terms of fecal coliform bacteria and total 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.*

For both parameters, the criteria state that monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period.

During the development of load curves for the impaired stream (as described in subsequent chapters), there were insufficient data (fewer than 10 samples in a given month) available to evaluate the geometric mean criterion for either fecal coliform or total coliform bacteria.

Therefore, the criterion selected for the TMDL for fecal coliform was not to exceed 400 counts/100 mL in 10 percent of the samples and, for total coliform, not to exceed 2,400 counts/100 mL at any time. Note that the 10 percent exceedance allowed by the water quality criterion was not used directly in estimating the target load for each parameter, but was included in the margin of safety (described in subsequent chapters).

Chapter 4: ASSESSMENT OF SOURCES

4.1 Types of Sources

An important part of the TMDL analysis is the identification of pollutant source categories, source subcategories, or individual sources of the pollutant of concern 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 (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 B** for background information on the federal and state stormwater programs).

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

4.2 Potential Sources of Fecal and Total Coliform in the Delaney Creek Watershed

4.2.1 Point Sources

There is one NPDES permitted facility, Nitram, Inc., in the Delaney Creek watershed. However, the Nitram permit (FL0001643) was inactivated in the latter part of 2003, and Nitram is now seeking to update its permit to allow for stormwater discharges only. While active, the routine monitoring did not require sampling for coliform bacteria, and therefore no coliform data were available. As a producer of the fertilizer product, ammonium nitrate, the effluent discharge from Nitram would not be an expected source of bacteria.

Municipal Separate Storm Sewer System Permittees

Within the Tampa Bay Basin, the stormwater collection systems owned and operated by Plant City, Hillsborough County, and the Florida Department of Transportation for Hillsborough County are covered by an NPDES municipal separate storm sewer system (MS4) permit, FLS000006. Hillsborough County is the lead copermittee for the Delaney Creek watershed. In October 2000, Hillsborough County drafted a watershed management plan involving berm construction, channel improvements, and structural upgrades for flood control and some water quality treatment. Other recommendations for the Delaney Creek watershed included beginning a study to identify areas or sources that discharge pathogens, and beginning to provide treatment through the implementation of best management practices (BMPs) to reduce the loadings. The Hillsborough Planning and Growth Management Department is in the process of carrying out a septic tank study for the watershed that identifies the location of septic tanks, assesses their impacts on water quality, and recommends management techniques to improve their efficiency.

4.2.2 Land Uses and Nonpoint Sources

Because no point source dischargers were identified in the Delaney Creek watershed, the primary loadings of total and fecal coliform appear to be generated from nonpoint sources. Nonpoint sources of coliform bacteria typically involve the accumulation of coliform bacteria on land surfaces that wash off as a result of storm events. Additional contributions may come from ground water, due to sources such as flooding, failed septic tanks, and the improper land application of domestic wastewater residuals. For coliforms, an extended dry period followed by a storm event is usually the critical period when coliform levels in waterbodies exceed water quality criteria. Typical nonpoint sources of coliform bacteria include the following:

- Wildlife,
- Agricultural animals,
- Pets in residential areas,
- Onsite sewage treatment and disposal systems (septic tanks),
- Land application of domestic wastewater residuals, and
- Urban development (outside of Phase I or II MS4 discharges).

Land Uses

The spatial distribution and acreage of different land use categories were identified using the 1999 Florida Land Use and Cover Classification System (FLUCCS) coverage (scale 1:40,000) contained in the Department's geographic information system (GIS) library. Land use categories in the watershed were aggregated using the simplified Level 1 and Level 3 codes tabulated in **Table 4.1.** As part of the central Hillsborough County area, the Delaney Creek watershed has undergone extensive urbanization with high- and medium-density residential, urban land, and commercial areas accounting for the majority of land use (see **Figure 4.1**). As noted in **Section 4.2.2,** these categories account for 68 percent of the land use in the watershed. Low-density residential, agriculture, and rangeland comprise the majority of the remaining land uses. **Figure 4.2** shows the acreage of the principal land uses in the watershed.

Table 4.1. Classification of Land Use Categories in the Delaney Creek Watershed

Code	Land Use	Acreage	Percent Distribution
1000	Urban open	2,784	27.38%
1100	Low-density residential	801	7.88%
1200	Medium-density residential	2,041	20.07%
1300	High-density residential	1,774	17.45%
2000	Agriculture	958	9.42%
3000/7000	Rangeland	158	1.55%
8000	Transportation, communication, and utilities	356	3.50%
4000	Forest/rural open	623	6.13%
5000/6000	Water/wetland	672	6.61%
	Total	10,167	100.00%

Figure 4.1. Delaney Creek Watershed Land Use Attributes (1999)

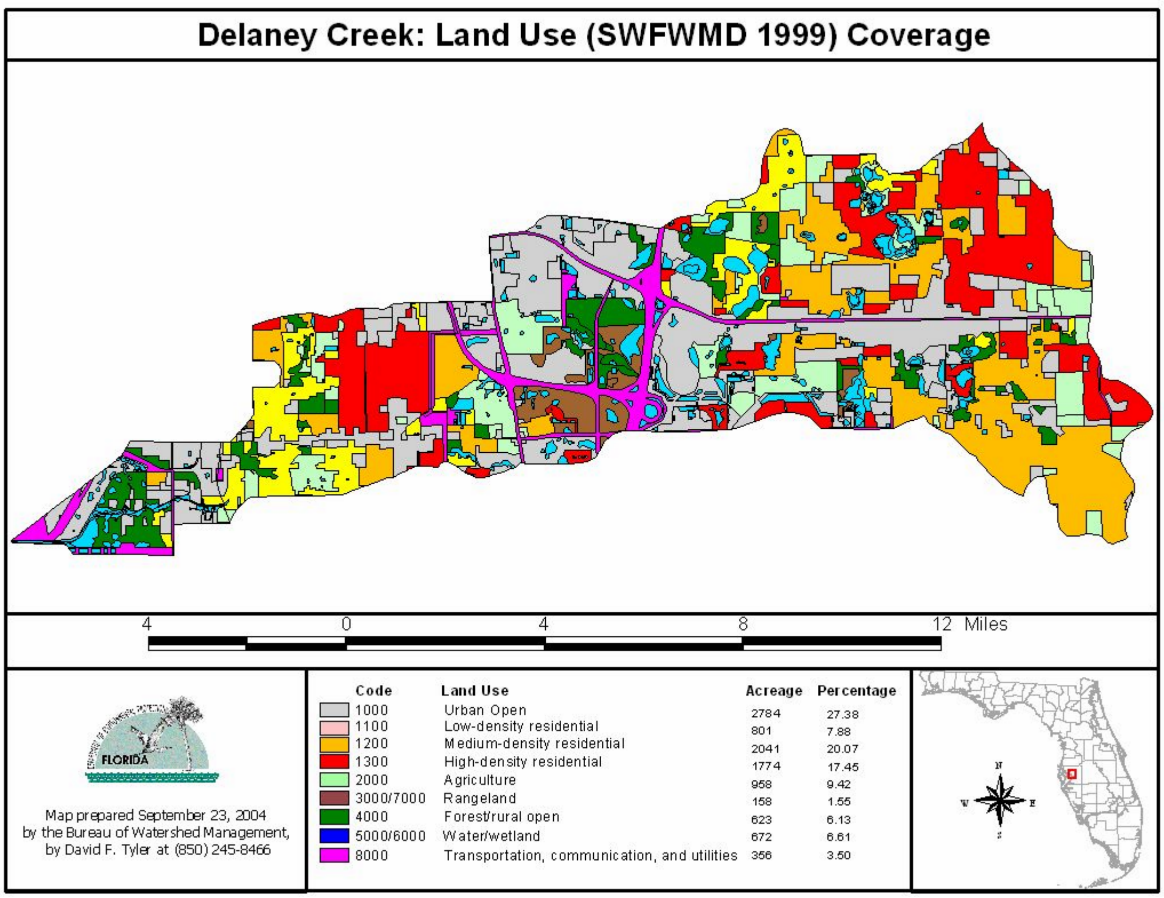
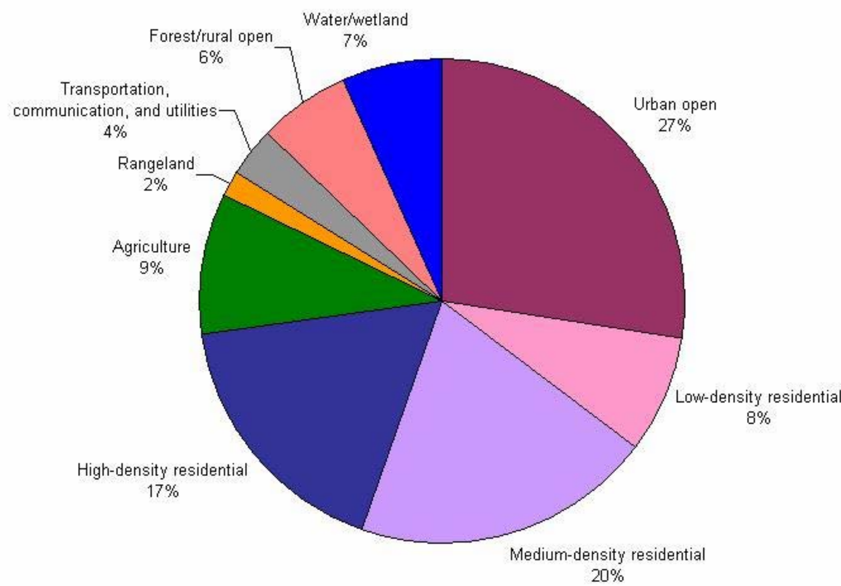


Figure 4.2. Principal Land Uses in the Delaney Creek Watershed



Population

According to the U.S Census Bureau, the population density in and around WBID 1605 in the year 2000 was at or less than 950 people per square mile. The Bureau reports that in Hillsborough County, which includes (but is not exclusive to) WBID 1605, the total population for 2000 was 998,948 with 425,962 housing units. For all of Hillsborough County, the Bureau reported a housing density of 405 houses per square mile. This places Hillsborough County among the middle in housing densities in Florida (U.S. Census Bureau Web site, 2004).

Septic Tanks

The Florida Department of Health (FDOH) reports that as of fiscal year 2001, there were 100,483 permitted septic tanks in Hillsborough County (Florida Department of Health, 2004). Data for septic tanks are based on 1970 – 2001 census results, with year-by-year additions based on new septic tank construction. The data do not reflect septic tanks that may have been removed. From fiscal years 1991 – 2001, 9,140 permits for repairs were issued (Florida Department of Health, 2004). Based on the number of permitted septic tanks and housing units located in the county, approximately 76 percent of the housing units in the county are connected to a wastewater treatment facility, with the remaining 24 percent utilizing septic tank systems.

The failure of septic tanks is not likely a significant source of coliform bacteria in the Delaney Creek watershed. The 1999 GIS land use coverage of the watershed shows that high- and medium-density residential, urban land, and commercial land uses account for about 68 percent of the total watershed area. However, the low-density residential areas, which are the residential areas most likely using septic tank systems, only account for about 8 percent of the total watershed area. High- and medium-density residential areas, as well as commercial enterprises, are typically connected to a central sewer system leading to a wastewater treatment facility. Leaking sewer systems are a potential source of coliform loadings.

Approximately 11 percent of the watershed is pasture or rangeland. Contributions from livestock could be another important source of coliforms. In addition, fecal matter from wildlife in some of the open land, wetlands, and wooded areas in the watershed may also be contributing to the elevated coliform levels.

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

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

1. Develop the flow duration curve
2. Develop the load duration curve for both the allowable load and existing loading
3. Define the critical condition(s)
4. Establish the needed load reduction by comparing the existing loading to the allowable load under critical conditions

5.1.1 Data Used in the Determination of the TMDL

Fecal coliform concentrations, total coliform concentrations, and flow measurements were required to estimate both the allowable pollutant load and existing loading. The primary data collector of water quality data is the HEPC, which maintained a routine sampling site at what is commonly referred to as Site 138 (STORET ID: 21FLHILL24030048/21FLHILL138). The site was sampled on a monthly basis for the entire TMDL analysis period, 1995 – 2003. **Figure 1.2** shows the locations of these sites, while **Table 2.2** provides a brief statistical overview of the observed data. **Figures 2.1** and **2.2** show the data over time, and **Appendix A** contains the historical observations from these sites.

Flow measurements for this report were obtained from a U.S. Geological Survey gaging station located on Delaney Creek (USGS 0231750, Delaney Creek near Tampa, Florida, Latitude: $27^{0}55^{'}32^{''}$, Longitude: $82^{0}21^{'}52^{''}$) **(Figure 1.2).**

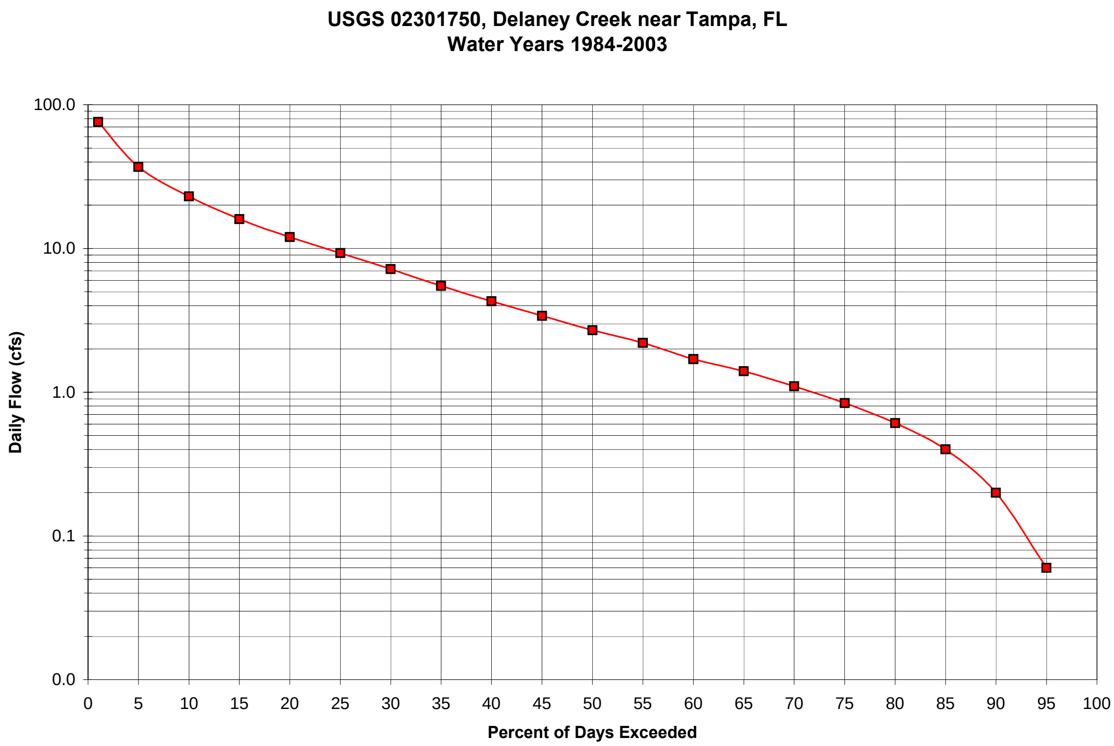
5.1.2 TMDL Development Process

Develop the Flow Duration Curve

The first step in the development of load duration curves is to create flow duration curves. A flow duration curve displays the cumulative frequency distribution of daily flow data over the period of record. The duration curve relates flow values measured at a monitoring station to the percent of time the flow values were equaled or exceeded. Flows are ranked from low, which are exceeded nearly 100 percent of the time, to high, which are exceeded less than 1 percent of the time.

The flow duration curve for the TMDL was created by using the percentile function and the flow record to generate the flow at a given duration interval. For example, at the 90th duration interval, the percentile function calculates the flow that is equal or exceeded 90 percent of the time. **Figure 5.1** shows the flow duration curve for Delaney Creek generated from the U.S> Geological Survey (USGS) flow record. Flows toward the right side of the plot are flows exceeded in greater frequency and are indicative of low-flow conditions. Flows on the left side of the plot represent high flows and occur less frequently.

Figure 5.1. Flow Duration Curve for USGS Gage 0231750 (1995 – 2003)



Develop the Load Duration Curves for Both the Allowable Load and Existing Loading

Flow duration curves are transformed into load duration curves by multiplying the flow values along the flow duration curve by the coliform concentration and the appropriate conversion factors. The final result of the load is typically expressed as counts per day. The following equations were used to calculate the allowable loads and the existing loading:

(1) Allowable load = (observed flow) x (conversion factor) x (state criteria)

(2) Existing loading = (observed flow) x (conversion factor) x (bacteria measurement)

On the load duration curve, allowable and existing loads are plotted against the flow duration ranking. The allowable load is based on the water quality numeric criterion and flow values from the flow duration curve, and the line drawn through the data points representing the allowable load is called the target line. The existing loads are based on the instream coliform concentrations measured during ambient monitoring and an estimate of flow in the stream at the time of sampling. As noted previously, because insufficient data were collected to evaluate the geometric mean, 400 counts/100 mL was used as the target criterion for fecal coliform and 2,400 counts/100 mL for total coliform in this TMDL. **Figures 5.2** and **5.3** show both the allowable load and the existing load over the flow duration ranking for fecal coliform and total coliform, respectively, in Delaney Creek. The points of the existing loading that were higher than the allowable load at a given flow duration ranking were considered an exceedance of the criteria.

As shown in **Figures 5.2** and **5.3**, the exceedance of coliform bacteria in Delaney Creek appeared during all flow regimes. In general, exceedances on the right side of the curve typically occur during low-flow events, which implies a contribution from either point sources or baseflow. In contrast, exceedances on the left side of the curve usually represent the potential sources accumulated on the land surface, which could result from the land application of biosolids, wildlife, livestock, and pets. Because there are no point sources of coliforms in the Delaney Creek watershed, the exceedances under the low-flow condition imply a contribution from baseflow, which could result from leaking septic tanks or sewer lines, or the improper application of biosolids on the land surface.

Figure 5.2. Load Duration Curve for Fecal Coliform in Delaney Creek, WBID 1605 (1995 – 2003)

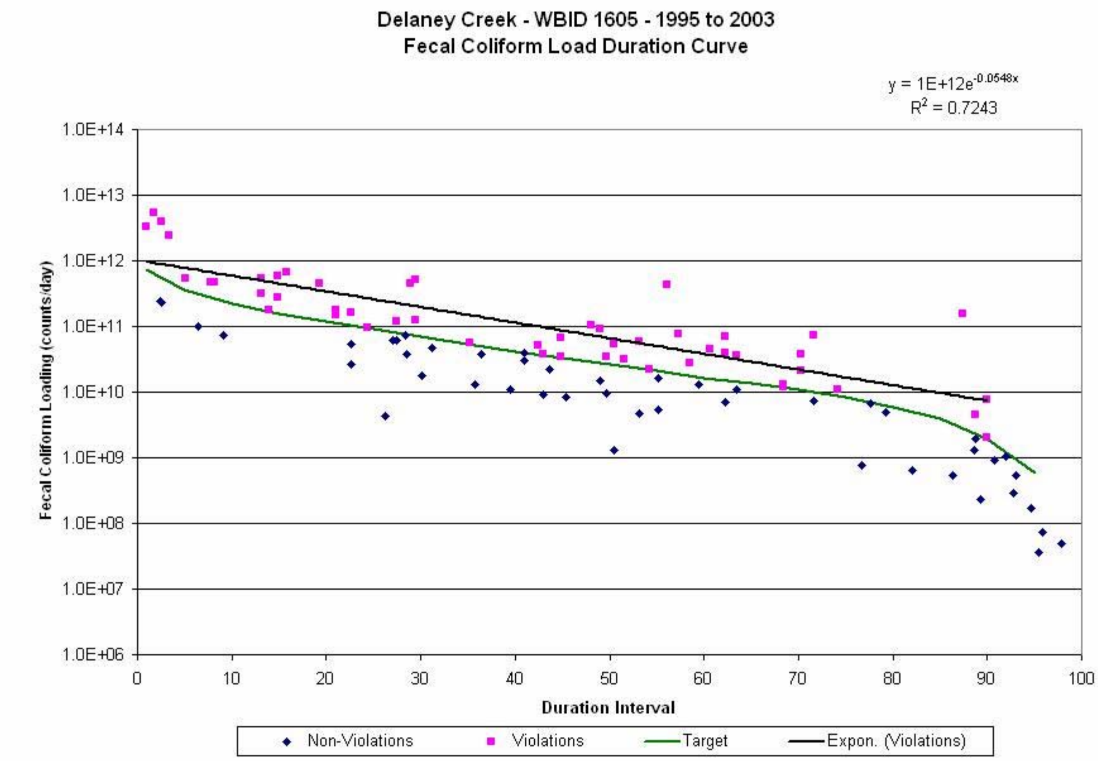
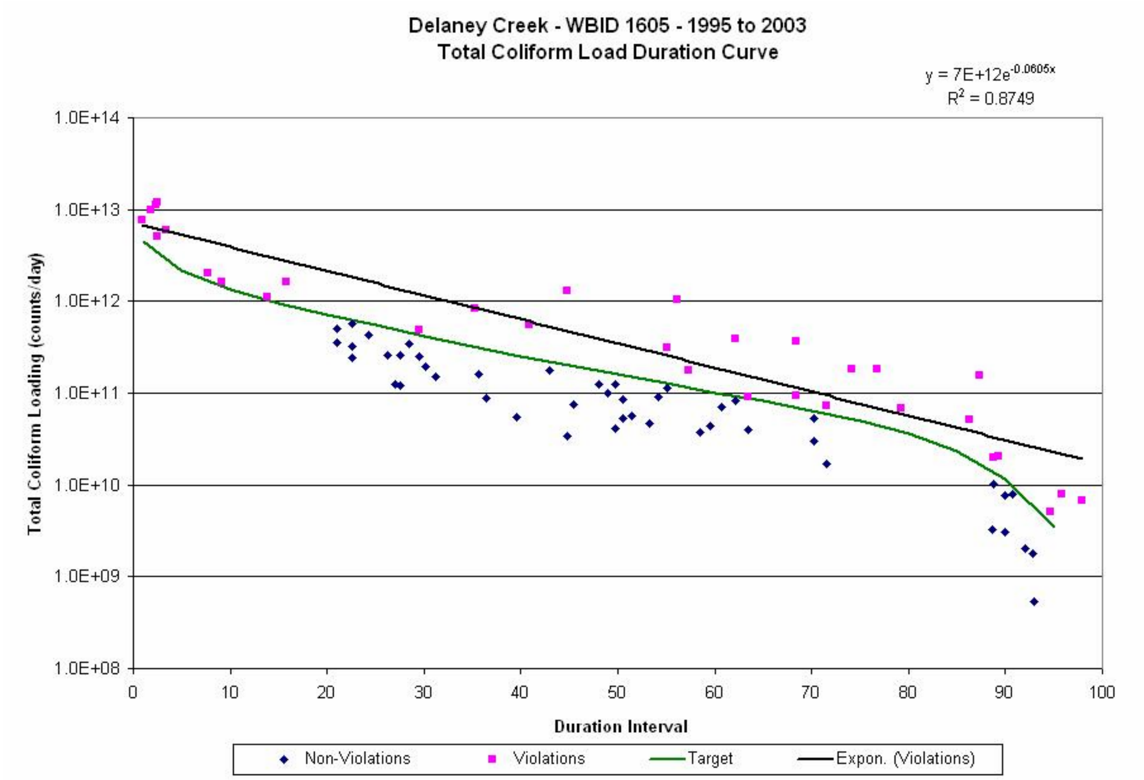


Figure 5.3. Load Duration Curve for Total Coliform in Delaney Creek, WBID 1605(1995 – 2003)



Define the Critical Conditions/Seasonality

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

For the Delaney Creek watershed, exceedances occurred during all flow conditions. Because no major point source was identified in the watershed, exceedances appearing in all these intervals were considered to be from nonpoint sources. Critical conditions are accounted for in the load curve analysis by using the flow records and water quality data available between the 10^{th} and 95^{th} intervals.

Establish the Needed Load Reduction by Comparing the Existing Loading with the Allowable Load

The fecal coliform and total coliform load reductions required to achieve water quality criteria was established by comparing the existing loading with the allowable load under the critical conditions defined in the previous section. The actual needed load reduction was calculated using the following equation:

(3)

$$\text{Load Reduction} = \frac{\text{Existing Loading} - \text{Allowable Loading}}{\text{Existing Loading}} \times 100\%$$

On the load duration curve, all points higher than the allowable load were considered an exceedance of the coliform criteria. A regression analysis was performed to determine the best correlation for the exceedances. The existing loading of a given flow duration interval was calculated using the regression equation and a given flow duration interval between the 10th and 90th percentile, in 5th percentile increments. The allowable loading of a given flow duration interval was calculated using **Equation (1)**, within the flow duration interval with 5th percentile increments. Using **Equation (3)**, the load reduction was determined for each flow interval. **Tables 5.1a** and **5.1b** list the flow duration intervals, allowable loadings, existing loadings, and needed load reductions for fecal coliform and total coliform, respectively.

Table 5.1a. Table for Calculating Needed Reduction of Fecal Coliform

Flow Ranking (percent)	Allowable Load for Fecal Coliform (counts/day)	Existing Load for Fecal Coliform (counts/day)	Percent Reduction Required
10	2.25E+11	5.78E+11	61.1
15	1.57E+11	4.40E+11	64.4
20	1.17E+11	3.34E+11	64.9
25	9.10E+10	2.54E+11	64.2
30	7.05E+10	1.93E+11	63.5
35	5.38E+10	1.47E+11	63.4
40	4.21E+10	1.12E+11	62.3
45	3.33E+10	8.49E+10	60.8
50	2.64E+10	6.46E+10	59.1
55	2.15E+10	4.91E+10	56.1
60	1.66E+10	3.73E+10	55.4
65	1.37E+10	2.84E+10	51.7
70	1.08E+10	2.16E+10	50.1
75	8.22E+09	1.64E+10	49.9
80	5.97E+09	1.25E+10	52.1
85	3.91E+09	9.49E+09	58.7
90	1.96E+09	7.21E+09	72.9

Table 5.1b. Table for Calculating Needed Reduction of Total Coliform

Flow Ranking (percent)	Allowable Load for Total Coliform (counts/day)	Existing Load for Total Coliform (counts/day)	Percent Reduction Required
10	1.35E+12	3.82E+12	64.7
15	9.39E+11	2.82E+12	66.7
20	7.05E+11	2.09E+12	66.2
25	5.46E+11	1.54E+12	64.6
30	4.23E+11	1.14E+12	62.9
35	3.23E+11	8.42E+11	61.7
40	2.52E+11	6.22E+11	59.4
45	2.00E+11	4.60E+11	56.6
50	1.59E+11	3.40E+11	53.4
55	1.29E+11	2.51E+11	48.6
60	9.98E+10	1.86E+11	46.2
65	8.22E+10	1.37E+11	40.1
70	6.46E+10	1.01E+11	36.3
75	4.93E+10	7.49E+10	34.1
80	3.58E+10	5.53E+10	35.3
85	2.35E+10	4.09E+10	42.6
90	1.17E+10	3.02E+10	61.1

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 (Waste Load 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**. TMDLs for Delaney Creek are expressed in terms of counts/day and percent reduction, and represent the maximum annual fecal coliform and total coliform loads the stream can assimilate and maintain the fecal coliform and total coliform criteria **(Table 6.1).**

Table 6.1. TMDL Components for Delaney Creek

WBID	Parameter	TMDL (colonies/day)	WLA		LA (Percent Reduction)*	MOS
			Wastewater (colonies/day)	NPDES Stormwater		
1605	Fecal Coliform	8.49×10^{10}	NA	60.8%	60.8%	Implicit
1605	Total Coliform	4.60×10^{11}	NA	56.6%	56.6%	Implicit

* The percent reduction is based on 10th – 90th percentile median value of recurrence intervals minus the WLA (see **Table 5.1**).

6.2 Load Allocation (LA)

Based on a loading duration curve approach similar to that developed by Kansas (Stiles, 2002), a fecal coliform reduction of 65.1 percent and total coliform reduction of 44.4 percent are needed from nonpoint sources. It should be noted that the LA includes loading from stormwater discharges regulated by the Department and the water management districts that are not part of the NPDES Stormwater Program (see **Appendix B**).

6.3 Wasteload Allocation (WLA)

6.3.1 NPDES Wastewater Discharges

There are no NPDES-permitted facilities that discharge coliform bacteria to surface waters in the Delaney Creek watershed. Thus, the wasteload allocation for wastewater facilities is zero. Any future wastewater facility permitted to discharge coliform bacteria in the Long Branch watershed will be required to meet permit limits and must not exceed the established TMDL values.

6.3.2 NPDES Stormwater Discharges

The WLA for stormwater discharges with an MS4 permit is a 65.1 percent reduction for fecal coliform and a 44.4 percent reduction for total coliform. It should be noted that any MS4 permittee will only be responsible for reducing the loads associated with stormwater outfalls that it owns or otherwise has responsible control over, and it is not responsible for reducing other nonpoint source loads in its jurisdiction.

6.4 Margin of Safety

There are two methods for incorporating a margin of safety (MOS) in the Delaney Creek TMDL analysis: (1) by implicitly incorporating the MOS using conservative model assumptions to develop allocations, or (2) by explicitly specifying a portion of the TMDL as the MOS and using the remainder for allocations. Consistent with the recommendations of the Allocation Technical Advisory Committee (Florida Department of Environmental Protection, February 2001), an implicit MOS was used in the development of this TMDL. An implicit MOS was provided by the conservative decisions associated with modeling assumptions and the development of assimilative capacity.

The percent reduction necessary to achieve water quality standards is based on the monitoring stations having the largest number of samples and the highest water quality exceedances. Due to dilution and decay, not all stations require the same reduction to meet standards. By selecting the highest reduction, an implicit MOS is incorporated into the analysis. An additional MOS is included in the TMDL by not allowing any exceedances of state criteria, even though intermittent natural exceedances of the criteria would be expected and would be taken into account when determining impairment.

Chapter 7: NEXT STEPS: IMPLEMENTATION PLAN DEVELOPMENT AND BEYOND

7.1 Basin Management Action Plan

Following the adoption of this TMDL by rule, the next step in the TMDL process is to develop an implementation plan for the TMDL, which will be a component of the Basin Management Action Plan (BMAP) for the Delaney Creek watershed. 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.

References

Florida Administrative Code. *Chapter 62-302, Surface Water Quality Standards.*

Florida Administrative Code. *Chapter 62-303, Identification of Impaired Surface Waters.*

Florida Department of Environmental Protection. February 2001. *A Report to the Governor and the Legislature on the Allocation of Total Maximum Daily Loads in Florida.* Tallahassee, Florida: Bureau of Watershed Management.

Florida Department of Environmental Protection. November 2001. *Tampa Bay Basin Status Report.* Tallahassee, Florida. Available at http://www.dep.state.fl.us/water/tmdl/stat_rep.htm

Florida Department of Health. 2004. Web site at http://www.doh.state.fl.us/.

Florida Watershed Restoration Act. *Chapter 99-223, Laws of Florida.*

Hillsborough County Stormwater Management Section. October 2000. *Delaney Creek Area Watershed Management Plan (Draft).* Hillsborough County, Florida.

Roehl, J. W. 1962. "Sediment Source Areas, Delivery Ratios, and Influencing Morphological Factors." *International Association of Scientific Hydrology.* 59: 202-213. Symposium of Bari, October 1-8, 1962.

U. S. Census Bureau. 2004. Web site at http://www.census.gov/.

Appendices

Appendix A: Delaney Creek Bacteria Raw Data

WBID	Station	Date	Fecal Coliform	Total Coliform
1605	21FLHILL24030048	1/25/1995	300	1000
1605	21FLHILL24030048	2/22/1995	500	1800
1605	21FLHILL24030048	3/22/1995	300	700
1605	21FLHILL24030048	4/26/1995	20000	20000
1605	21FLHILL24030048	5/24/1995	1100	3600
1605	21FLHILL24030048	6/28/1995	1700	4200
1605	21FLHILL24030048	7/26/1995	3700	6700
1605	21FLHILL24030048	8/23/1995	600	2100
1605	21FLHILL24030048	9/27/1995	600	1700
1605	21FLHILL24030048	10/25/1995	20	1200
1605	21FLHILL24030048	11/29/1995	800	1100
1605	21FLHILL24030048	12/13/1995	400	600
1605	21FLHILL24030048	1/24/1996	1400	1700
1605	21FLHILL24030048	2/21/1996	100	500
1605	21FLHILL24030048	3/20/1996	400	400
1605	21FLHILL24030048	4/17/1996	140	600
1605	21FLHILL24030048	5/15/1996	300	700
1605	21FLHILL24030048	6/19/1996	8400	20000
1605	21FLHILL24030048	7/17/1996	400	1600
1605	21FLHILL24030048	8/21/1996	3000	3000
1605	21FLHILL24030048	9/25/1996	700	1400
1605	21FLHILL24030048	10/16/1996	800	1300
1605	21FLHILL24030048	11/20/1996	100	600
1605	21FLHILL24030048	12/11/1996	300	1100
1605	21FLHILL24030048	1/22/1997	200	200
1605	21FLHILL24030048	2/19/1997	1500	1500
1605	21FLHILL24030048	3/19/1997	300	1600
1605	21FLHILL24030048	4/16/1997	1000	2500
1605	21FLHILL24030048	5/21/1997	700	3100
1605	21FLHILL24030048	6/18/1997	300	600
1605	21FLHILL24030048	7/23/1997	200	1200
1605	21FLHILL24030048	8/20/1997	100	1100
1605	21FLHILL24030048	9/17/1997	400	1800
1605	21FLHILL24030048	10/15/1997	1300	1400
1605	21FLHILL24030048	11/19/1997	300	600
1605	21FLHILL24030048	12/10/1997	2800	2700
1605	21FLHILL24030048	1/21/1998	500	1200
1605	21FLHILL24030048	2/18/1998	1600	3700
1605	21FLHILL24030048	3/18/1998	300	600

WBID	Station	Date	Fecal Coliform	Total Coliform
1605	21FLHILL24030048	4/22/1998	1000	2100
1605	21FLHILL24030048	5/20/1998	200	500
1605	21FLHILL24030048	6/17/1998	200	1700
1605	21FLHILL24030048	7/22/1998	2200	5400
1605	21FLHILL24030048	8/26/1998	100	900
1605	21FLHILL24030048	9/16/1998	280	900
1605	21FLHILL24030048	10/21/1998	100	1200
1605	21FLHILL24030048	11/18/1998	100	900
1605	21FLHILL24030048	12/9/1998	100	2100
1605	21FLHILL138	1/20/1999	500	900
1605	21FLHILL138	2/17/1999	1600	3600
1605	21FLHILL138	3/17/1999	600	800
1605	21FLHILL138	4/21/1999	1400	2000
1605	21FLHILL138	5/19/1999	100	1900
1605	21FLHILL138	6/16/1999	3000	3900
1605	21FLHILL138	7/21/1999	200	1800
1605	21FLHILL138	8/18/1999	700	3000
1605	21FLHILL138	9/23/1999	400	2500
1605	21FLHILL138	10/13/1999	600	1300
1605	21FLHILL138	11/17/1999	1100	1700
1605	21FLHILL138	12/15/1999	1000	800
1605	21FLHILL138	1/19/2000	500	8400
1605	21FLHILL138	2/16/2000	400	3200
1605	21FLHILL138	3/15/2000	100	3000
1605	21FLHILL138	4/19/2000	200	27700
1605	21FLHILL138	5/16/2000	100	12400
1605	21FLHILL138	7/19/2000	420	6300
1605	21FLHILL138	8/16/2000	600	
1605	21FLHILL138	10/11/2000	800	15300
1605	21FLHILL138	11/15/2000	60	5800
1605	21FLHILL138	12/13/2000	40	9500
1605	21FLHILL138	1/17/2001	20	800
1605	21FLHILL138	2/21/2001	40	3500
1605	21FLHILL138	3/21/2001	300	5400
1605	21FLHILL138	4/18/2001	300	4200
1605	21FLHILL138	5/16/2001	60	6500
1605	21FLHILL138	6/20/2001	960	9400
1605	21FLHILL138	7/25/2001	180	9100
1605	21FLHILL138	8/22/2001	120	2700
1605	21FLHILL138	9/19/2001	180	8500
1605	21FLHILL138	10/17/2001	300	5900
1605	21FLHILL138	11/14/2001	440	12500
1605	21FLHILL138	12/12/2001	1760	9900
1605	21FLHILL138	1/16/2002	180	
1605	21FLHILL138	2/20/2002	380	
1605	21FLHILL138	3/20/2002	50	
1605	21FLHILL138	4/17/2002	210	

WBID	Station	Date	Fecal Coliform	Total Coliform
1605	21FLHILL138	5/15/2002	25	
1605	21FLHILL138	6/19/2002	80	
1605	21FLHILL138	7/24/2002	300	
1605	21FLHILL138	8/21/2002	130	
1605	21FLHILL138	9/18/2002	2460	
1605	21FLHILL138	10/16/2002	530	
1605	21FLHILL138	11/20/2002	250	
1605	21FLHILL138	12/11/2002	1160	
1605	21FLHILL138	1/15/2003	410	
1605	21FLHILL138	2/19/2003	380	
1605	21FLHILL138	3/19/2003	670	
1605	21FLHILL138	4/16/2003	1400	
1605	21FLHILL138	5/21/2003	380	
1605	21FLHILL138	6/18/2003	1440	
1605	21FLHILL138	7/16/2003	300	
1605	21FLHILL138	8/13/2003	700	
1605	21FLHILL138	9/17/2003	680	
1605	21FLHILL138	10/8/2003	420	
1605	21FLHILL138	11/19/2003	800	
1605	21FLHILL138	12/10/2003	1020	

Appendix B: Background Information on Federal and State Stormwater Programs

In 1982, Florida became the first state in the country to implement statewide regulations to address the issue of nonpoint source pollution by requiring new development and redevelopment to treat stormwater before it is discharged. The Stormwater Rule, as authorized in Chapter 403, F.S., was established as a technology-based program that relies on the implementation of BMPs that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Chapter 62-40, F.A.C.

The rule requires the state's water management districts (WMDs) to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a 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 has been developed for Newnans Lake at the time this report was developed.

In 1987, the U.S. Congress established Section 402(p) as part of the federal Clean Water Act Reauthorization. This section of the law amended the scope of the federal NPDES stormwater permitting program to designate certain stormwater discharges as "point sources" of pollution. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific standard industrial classification (SIC) codes, construction sites disturbing 5 or more acres of land, and master drainage systems of local governments with a population above 100,000, which are better known as municipal separate storm sewer systems (MS4s). However, because the master drainage systems of most local governments in Florida are interconnected, the EPA has implemented Phase 1 of the MS4 permitting program on a countywide basis, which brings in all cities (incorporated areas), Chapter 298 urban water control districts, and the Florida Department of Transportation throughout the 15 counties meeting the population criteria.

An important difference between the federal and state stormwater permitting programs is that the federal program covers both new and existing discharges, while the state program focuses on new discharges. Additionally, Phase II of the NPDES Program will expand the need for these permits to construction sites between one and five acres, and to local governments with as few as 10,000 people. These revised rules require that these additional activities obtain permits by 2003. While these urban stormwater discharges are now technically referred to as "point sources" for the purpose of regulation, they are still diffuse sources of pollution that cannot be easily collected and treated by a central treatment facility similar to other point sources of pollution, such as domestic and industrial wastewater discharges. The Department recently accepted delegation from the EPA for the stormwater part of the NPDES Program. It should be noted that most MS4 permits issued in Florida include a re-opener clause that allows permit revisions to implement TMDLs once they are formally adopted by rule.

Appendix C: Response to comments

Comment 1: The Natural Resources Conservation Service (NRCS) commented, "The watershed proximity to development and speed at which development has surrounded that area means that probably the cattle that are present are only there to hold the agriculture tax rates until the right offer is given for the property. The TMDL development plant should spend little to no effort to control agricultural water quality effects unless there is a need for very short-term practices to address a known pollutant source. As far as non-point source impairments resulting from agriculture, based on current development trends, we do not expect the agricultural operations in the Delaney Creek watershed to exist long term."

Response: The Department acknowledges NRCS' concerns and recognizes the limited overall influence that agriculture has within the Delaney Creek watershed. As noted on pages 11-12 of the TMDL document, agricultural land use occupies 9.4% of the overall watershed. As discussed in Chapter 5, specifically pages 17-19, Delaney Creek experiences exceedances during all flow regimes suggesting that all nonpoint pollutant sources may be contributing to the coliform problem. Given that the main land uses in the watershed are anthropogenic, mainly involving residential and urban areas (over 72%), much of the implementation effort will focus those sources causing the greatest impact.

Florida Department of Environmental Protection
Division of Water Resource Management
Bureau of Watershed Management
2600 Blair Stone Road, Mail Station 3565
Tallahassee, Florida 32399-2400
(850) 245-8561
www2.dep.state.fl.us/water/