

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Water Resource Management, Bureau of Watershed Management

SOUTH DISTRICT • EVERGLADES WEST COAST BASIN

TMDL Report
Fecal Coliform TMDL for
Hendry Creek (Marine),
WBID 3258B1

Rhonda Peets
Nathan Bailey, Ph.D.



August 19, 2008

Acknowledgments

This TMDL analysis could not have been accomplished without significant contributions from staff in the Florida Department of Environmental Protection's South District Office and Watershed Assessment Section. Special thanks to Dave Tyler for assisting in map creation and data review.

Editorial assistance provided by Nathan Bailey, Dave Tyler, Jan Mandrup-Poulsen, and Linda Lord.

For additional information on the watershed management approach and impaired waters in the Everglades West Coast Basin, contact:

Pat Fricano
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
Email: pat.fricano@dep.state.fl.us
Phone: (850) 245-8559
Fax: (850) 245-8434

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

Nathan Bailey
Florida Department of Environmental Protection
Bureau of Watershed Management
Watershed Assessment Section
2600 Blair Stone Road, Mail Station 3555
Tallahassee, FL 32399-2400
Email: nathaniel.bailey@dep.state.fl.us
Phone: (850) 245-8465
Fax: (850) 245-8536

Contents

Chapter 1: INTRODUCTION	1
1.1 Purpose of Report	1
1.2 Identification of Waterbody	1
1.3 Background	5
1.3.1 Development of TMDL	6
Chapter 2: DESCRIPTION OF WATER QUALITY PROBLEM	7
2.1 Statutory Requirements and Rulemaking History	7
2.2 Information on Verified Impairment	7
Chapter 3. WATER QUALITY STANDARDS AND TARGETS	12
3.1 Classification of the Waterbody and Criterion Applicable to the TMDL	12
3.2 Applicable Water Quality Standards and Numeric Water Quality Target	12
3.2.1 Fecal Coliform Criterion	12
Chapter 4: ASSESSMENT OF SOURCES	13
4.1 Types of Sources	13
4.2 Potential Sources of Coliform in the Hendry Creek Watershed	13
4.2.1 Point Sources	13
4.2.2 Land Uses and Nonpoint Sources	14
4.2.3 Source Summary	20
Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY	21
5.1 Overall Approach	21
5.1.1 Data Used in the Determination of the TMDL	21
5.1.2 TMDL Development Process	21
5.2.3 Critical Conditions/Seasonality	22
Chapter 6: DETERMINATION OF THE TMDL	24
6.1 Expression and Allocation of the TMDL	24
6.2 Load Allocation	25
6.3 Wasteload Allocation	25
6.3.1 NPDES Wastewater Discharges	25

6.3.2 NPDES Stormwater Discharges	25
6.4 Margin of Safety	25
Chapter 7: NEXT STEPS: IMPLEMENTATION PLAN DEVELOPMENT AND BEYOND	26
7.1 Basin Management Action Plan	26
References	27
Appendices	28
Appendix A: Background Information on Federal and State Stormwater Programs	28
Appendix B: Level 2 Land Uses for Hendry Creek, WBID 3258B1	29
Appendix C: Fecal Coliform Data for Hendry Creek, WBID 3258B1, 2000–07	30
Appendix D: Public Comments and FDEP Responses	31
D.1 Comments from Molly Meadows/SFWMD	32
D.2 Comments from Karen Bickford/Lee County	34

List of Tables

Table 1.1.	WBIDs in the Estero Bay Planning Unit, Including Verified Impairments for Hendry Creek, WBID 3258B1	5
Table 2.1.	Summary of Fecal Coliform Data by Year for the Cycle 1 Verified Period (January 1, 1995–June 30, 2002)	9
Table 2.2.	Summary of Fecal Coliform Data by Month for the Cycle 1 Verified Period (January 1, 1995–June 30, 2002)	10
Table 2.3.	Summary of Fecal Coliform Data by Season for the Cycle 1 Verified Period (January 1, 1995–June 30, 2002)	10
Table 2.4.	Summary of Fecal Coliform Data by Year for the Cycle 2 Verified Period (January 1, 2000–June 30, 2007)	10
Table 2.5.	Summary of Fecal Coliform Data by Month for the Cycle 2 Verified Period (January 1, 2000–June 30, 2007)	11
Table 2.6.	Summary of Fecal Coliform Data by Season for the Cycle 2 Verified Period (January 1, 2000–June 30, 2007)	11
Table 4.1.	Classification of Land Use Categories in the Hendry Creek Watershed	15
Table 4.2.	Failed and Newly Installed Septic Systems in Lee County, 2000–06	18
Table 4.3.	Estimation of Daily Fecal Coliform Load from Failed Septic Tanks in the Hendry Creek Watershed	18

Table 4.4.	<i>Estimated Loading From Dogs in the Hendry Creek Watershed</i>	20
Table 4.5.	<i>Estimated Loading from Cats in the Hendry Creek Watershed</i>	20
Table 5.1.	<i>Summary of Fecal Coliform Stations in Hendry Creek, WBID 3258B1</i>	21
Table 5.2.	<i>Fecal Coliform Percent Reduction for Hendry Creek, WBID 3258B1</i>	22
Table 5.3.	<i>Statistical Table of Observed Historical Data by Month and Season for Hendry Creek, WBID 3258B1</i>	23
Table 6.1.	<i>TMDL Components for Hendry Creek, WBID 3258B1</i>	25

List of Figures

Figure 1.1.	<i>Location of the Hendry Creek Watershed within the Estero Bay Planning Unit</i>	2
Figure 1.2.	<i>Hendry Creek Watershed with Cities in Region</i>	3
Figure 1.3.	<i>Populated Areas around and within the Hendry Creek Watershed</i>	4
Figure 2.1.	<i>Sample Stations in Hendry Creek, WBID 3258B1</i>	8
Figure 4.1.	<i>Wastewater Facilities near the Hendry Creek Watershed</i>	14
Figure 4.2.	<i>Land Use Coverage in the Hendry Creek Watershed</i>	16
Figure 4.3.	<i>Distribution of On-site Sewage Systems (Septic Tanks) in the Hendry Creek Watershed</i>	19

Websites

Florida Department of Environmental Protection, Bureau of Watershed Management

TMDL Program

<http://www.dep.state.fl.us/water/tmdl/index.htm>

Identification of Impaired Surface Waters Rule

<https://www.flrules.org/gateway/ChapterHome.asp?Chapter=62-303>

STORET Program

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

2006 305(b) Report

http://www.dep.state.fl.us/water/tmdl/docs/2006_Integrated_Report.pdf

Criteria for Surface Water Quality Classifications

<http://www.dep.state.fl.us/water/wqssp/classes.htm>

Basin Status Report for the Everglades West Coast Basin

<http://www.dep.state.fl.us/water/basin411/everwest/status.htm>

Water Quality Assessment Report for the Everglades West Coast Basin

<http://www.dep.state.fl.us/water/basin411/everwest/assessment.htm>

U.S. Environmental Protection Agency, National STORET Program

Region 4: Total Maximum Daily Loads in Florida

<http://www.epa.gov/region4/water/tmdl/florida/>

National STORET Program

<http://www.epa.gov/storet/>

Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Load (TMDL) for fecal coliform for Hendry Creek, which is located in the Estero Bay Planning Unit, within the Everglades West Coast Basin. The creek was verified as impaired for fecal coliform based on the results of sampling and analysis carried out between 1995 and 2007. The marine segment of the creek was subsequently included on the Verified List of impaired waters (impaired for fecal coliform) that was adopted by Secretarial Order on June 3, 2008. The TMDL for Hendry Creek establishes the allowable loadings that would restore the waterbody so that it meets its applicable water quality criterion for fecal coliform.

1.2 Identification of Waterbody

The Hendry Creek watershed, located in the Estero Bay Planning Unit, within the Everglades West Coast Basin in southwest Florida, covers approximately 14.3 square miles of land area (Lee County Hendry Creek website, 2005). **Figure 1.1** shows the watershed's location within the planning unit.

The predominantly marine portion of Hendry Creek covers an area approximately 6 miles long and 2.5 miles wide, located in the west-central portion of Lee County. Bordered by Estero Bay to the southwest, Hendry Creek lies south of Fort Myers and Cape Coral, east of the city of Sanibel, and north of the city of Bonita Springs (**Figure 1.2**). The populated area of Harlem Heights is located west of Hendry Creek, and populated areas in the watershed include Cypress Lake and Biggar in the north and Forest Island Park in the east-central portion (**Figure 1.3**).

Hendry Creek, the main waterbody in the Hendry Creek watershed, drains the area of Lakes Park discharging to Estero Bay, a Florida Aquatic Preserve. The western boundary of the watershed begins in Estero Bay, with Cypress Lake Drive and Ten Mile Canal to the north, and Mullock and Hendry Creeks to the south. The watershed is highly urbanized in the northern reaches, and development is increasing. The northwestern portions of the watershed include existing residential and commercial uses.

Additional information about the river's hydrology and geology is available in the Basin Assessment Report for the Everglades West Coast Basin (Florida Department of Environmental Protection [Department], 2003). For assessment purposes, the Department has divided the Everglades West Coast Basin into water assessment polygons with a unique **waterbody identification (WBID)** number for each watershed or stream reach. Although there are several impairments in the Estero Bay Planning Unit (**Table 1.1**), this TMDL addresses only the fecal coliform exceedances in the marine portion of Hendry Creek (WBID 3258B1).

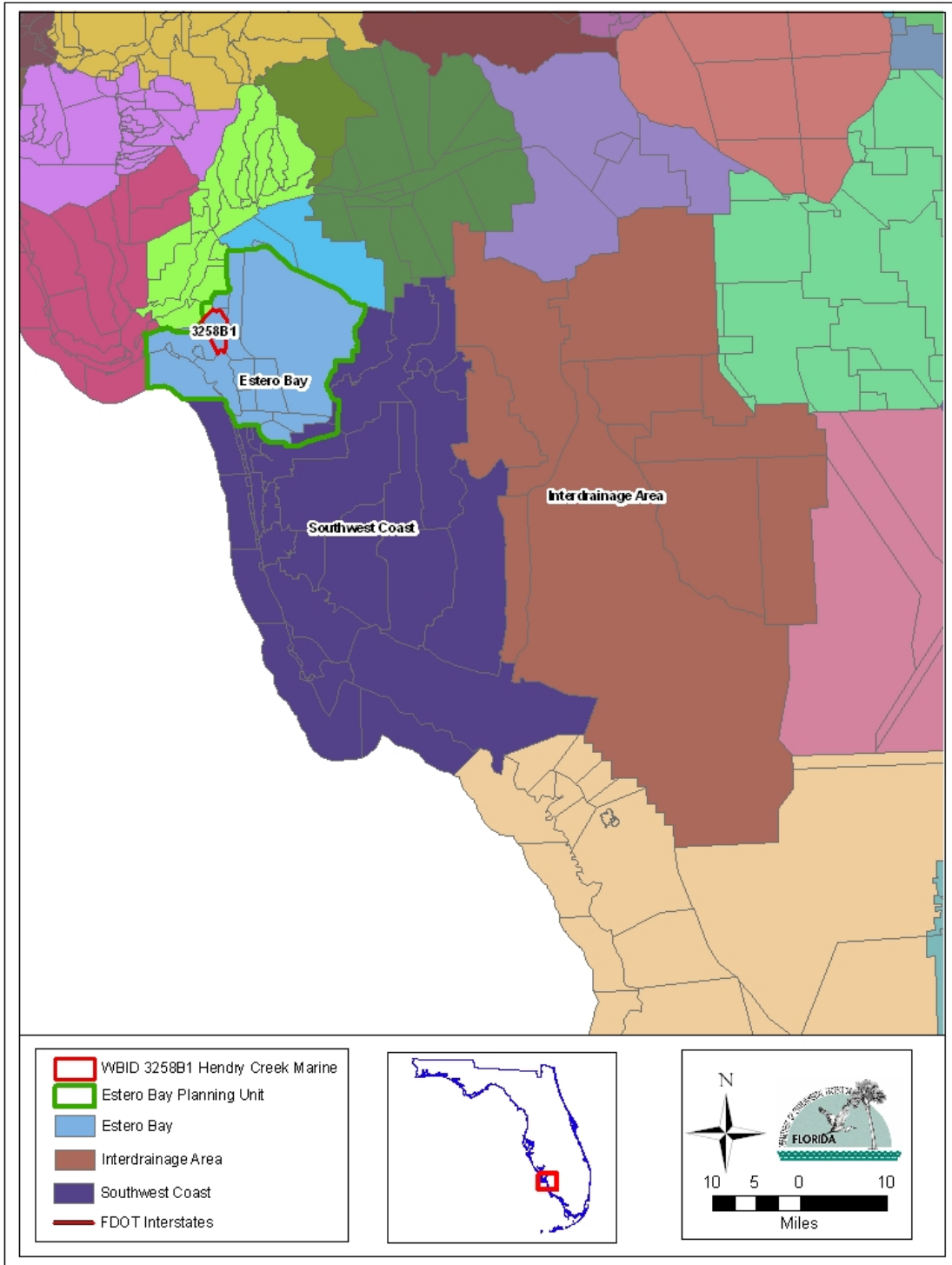


Figure 1.1. Location of the Hendry Creek Watershed within the Estero Bay Planning Unit

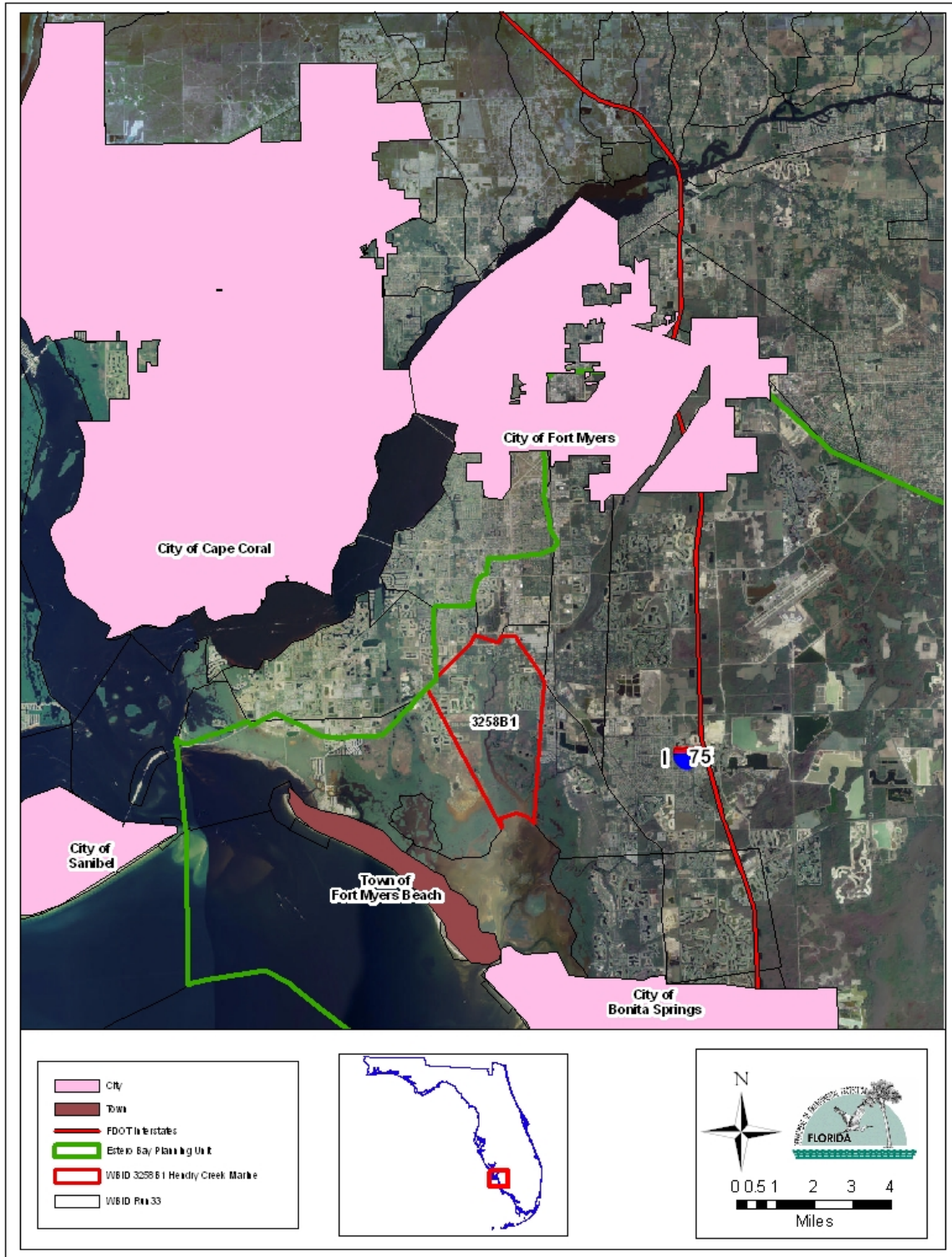


Figure 1.2. Hendry Creek Watershed with Cities in Region

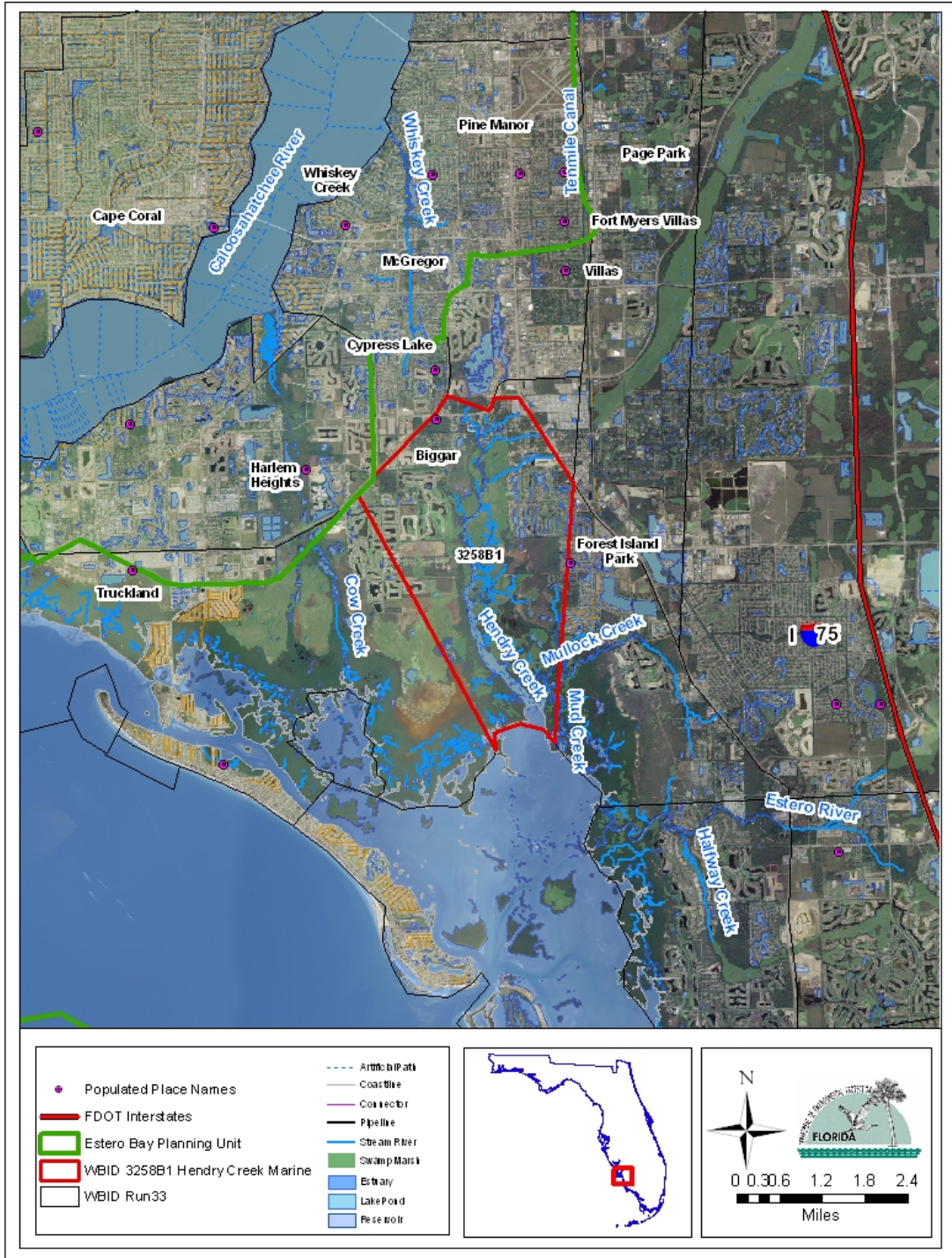


Figure 1.3. Populated Areas around and within the Hendry Creek Watershed

Table 1.1. WBIDs in the Estero Bay Planning Unit, Including Verified Impairments for Hendry Creek, WBID 3258B1

WBID	Waterbody Segment	Parameters of Concern
3258A	Estero Bay Wetlands	Nutrients and Dissolved Oxygen (DO)
3258B	Hendry Creek	Nutrients and DO
3258B1	Hendry Creek	DO and Fecal Coliform
3258C	Estero Bay Drainage	DO and Fecal Coliform
3258C1	Estero Bay Drainage	DO
3258D	Estero River	DO and Fecal Coliform
3258D1	Estero River	Nutrients and DO
3258E	Imperial River	Nutrients and DO
3258E1	Imperial River	Nutrients and DO
3258F	Oak Creek	DO and Hg in Fish Tissue
3258G	Ten Mile Canal	DO
3258H	Spring Creek	DO
3258H1	Spring Creek	DO and Hg in Fish Tissue
3258I	Estero Bay	Hg in Fish Tissue
3258J	Hell Peckney Bay	Hg in Fish Tissue
8060	Estero Bay Gulf	Hg in Fish Tissue

Hg – Mercury

1.3 Background

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

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

This TMDL report will be followed by the development and implementation of a Basin Management Action Plan, or BMAP, to decrease the fecal coliform impairment of Hendry Creek (WBID 3258B1). These activities will depend heavily on the active participation of the South Florida Water Management District (SFWMD), local governments, businesses, and other stakeholders. The Department will work with these organizations and individuals to undertake and continue reductions in the discharge of pollutants and achieve the established TMDL for this waterbody.

1.3.1 Development of TMDL

This TMDL was developed in cooperation with the SFWMD, Charlotte Harbor National Estuary Program (CHNEP), Collier County Pollution Control, Lee County Water Quality, and several others. There was also active coordination with a variety of local stakeholders throughout the TMDL development process, including meetings and teleconferences between Department staff, Collier and Lee County officials, environmental advocacy groups, consultants, and other stakeholders who volunteered to participate, or whose participation was requested.

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 these lists, commonly referred to as 303(d) lists, since 1992. The list of impaired waters in each basin is also required by the FWRA (Subsection 403.067[4], Florida Statutes [F.S.]), and the list is amended annually to include updates for each basin statewide.

Florida's 1998 303(d) list included 13 waterbodies in the Everglades West Coast Basin. However, the FWRA (Section 403.067, F.S.) stated that all previous Florida 303(d) lists were for planning purposes only and directed the Department to develop, and adopt by rule, a new science-based methodology to identify impaired waters. After a long rulemaking process, the Environmental Regulation Commission adopted the new methodology as Rule 62-303, Florida Administrative Code (F.A.C.) (Identification of Impaired Surface Waters Rule, or IWR), in April 2001; the rule was modified in 2006 and 2007. The list of waters for which impairments have been verified using the methodology in the IWR is referred to as the Verified List.

2.2 Information on Verified Impairment

The Department used the IWR to assess water quality impairments in Hendry Creek and verified the creek as impaired for fecal coliform based on data in the Department's IWR database. The projected year for the TMDL was 2007, but the Settlement Agreement between the EPA and Earthjustice that drives the TMDL development schedule for waters on the 1998 303(d) list allows an additional nine months to complete the TMDL. As such, this TMDL must be adopted and submitted to the EPA by September 30, 2008.

Figure 2.1 displays the locations of the sample stations in Hendry Creek (WBID 3258B1). Fecal coliform data from Stations 21FLEECOHEHENDR30 and 21FLEECOMULL01 are presented by month, season, and year to determine whether certain patterns are evident in the dataset. For example, this allows for an examination of whether coliform levels are elevated during certain months or seasons that are historically wetter periods of the year, or whether there is a trend over time.

As mentioned in **Section 1.3**, the watershed approach is implemented using a cyclical management process that rotates through the state's 52 river basins over a 5-year cycle. This waterbody was verified impaired for fecal coliform in Cycle 1, based on data from January 1, 1995, through June 30, 2002; and in Cycle 2 based on data from January 1, 2000, through June 30, 2007. Additional information on the rotating basin cycle is available on the Department website in the Everglades West Coast Basin Assessment Report (Department, 2003). **Tables 2.1 through 2.6** summarize water quality data from both cycles.

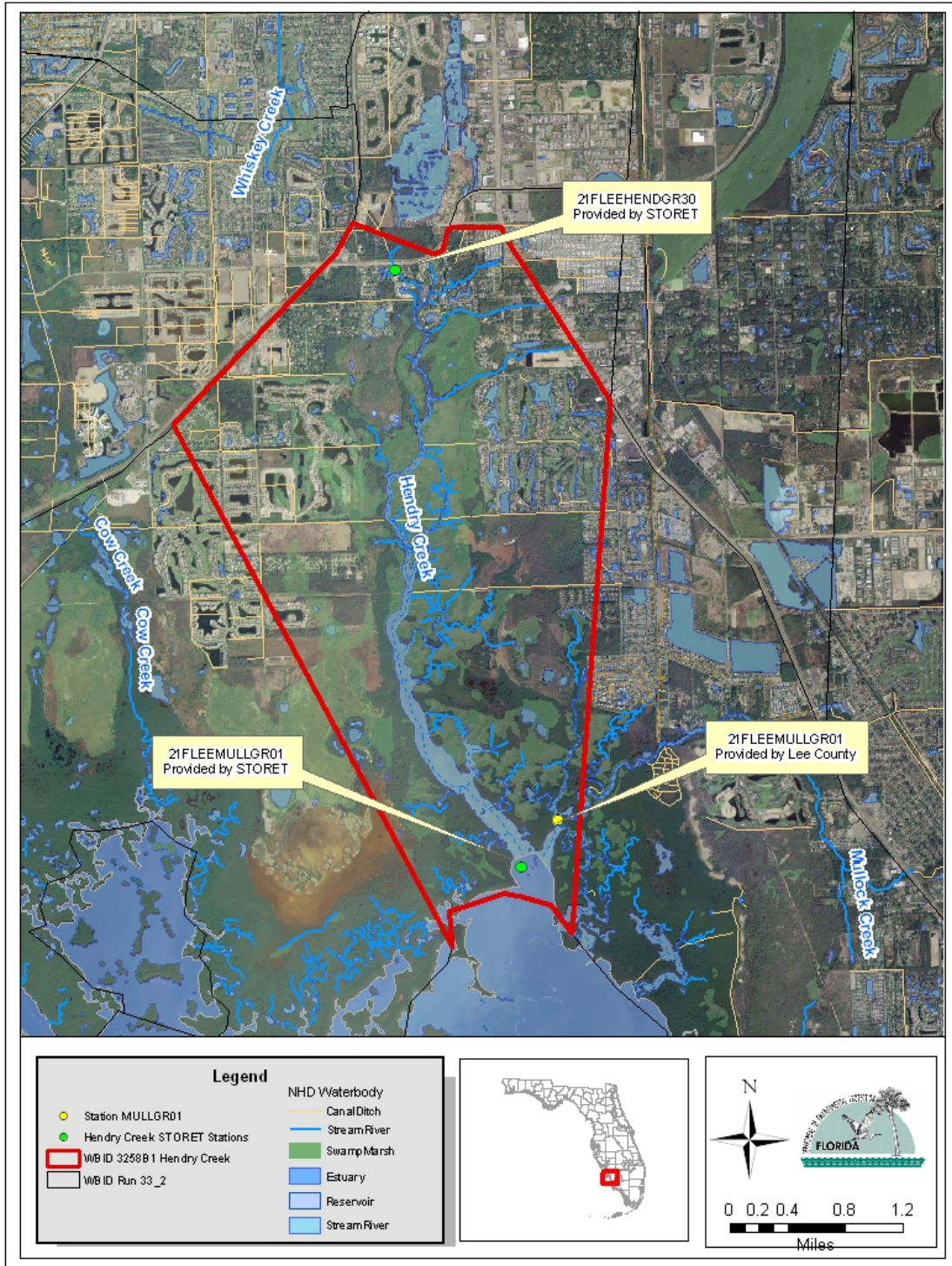


Figure 2.1. Sample Stations in Hendry Creek, WBID 3258B1

Tables 2.1, 2.2, and 2.3 summarize fecal coliform data by year, month, and season, respectively, for samples collected during the Cycle 1 verified period (January 1, 1995, through June 30, 2002). Between 1996 and 2002, the percent exceedance by year ranged from 8 to 43 percent.

Tables 2.4, 2.5, and 2.6 summarize the same data for the Cycle 2 verified period (January 1, 2000, through June 30, 2007). Between 2000 and 2007, the percent exceedance by year ranged from 4 to 28 percent. From 2000 to 2003, there was a relatively high exceedance rate above the criterion of 400 counts/100 milliliters (counts/100mL), but between 2004 and 2007 the exceedance rate decreased steadily, from 12 to 4 percent (**Table 2.4**). The monthly and seasonal trends (**Tables 2.2, 2.3, 2.5, and 2.6**) show that there was generally a higher exceedance rate during the wet months for both Cycles 1 and 2. This difference was more defined during Cycle 2.

Table 2.1. Summary of Fecal Coliform Data by Year for the Cycle 1 Verified Period (January 1, 1995–June 30, 2002)

Year	Median	Count	Maximum	Minimum	Number of Exceedances	% Exceedances by Year
1995	*	0	0	0	0	*
1996	86.5	10	2,500	10	1	10%
1997	130	12	650	10	1	8%
1998	205	12	2,000	110	4	33%
1999	130	12	790	40	2	17%
2000	285	12	2,000	10	3	25%
2001	115	16	2,000	10	4	25%
2002	250	7	1,110	70	3	43%

* Waterbody did not have any data available.
Coliform counts are #/100mL.

Table 2.2. Summary of Fecal Coliform Data by Month for the Cycle 1
Verified Period (January 1, 1995–June 30, 2002)

Year	Median	Count	Maximum	Minimum	Number of Exceedances	% Exceedances by Month
January	190	6	310	10	5	7%
February	275	6	1,520	110	6	9%
March	70	7	270	10	5	7%
April	50	8	680	10	4	6%
May	120	7	2,500	10	5	7%
June	375	8	2,000	100	8	12%
July	100	7	1,300	10	5	7%
August	130	8	2,000	10	7	10%
September	160	7	2,000	10	6	9%
October	150	7	2,000	20	6	9%
November	165	6	340	10	5	7%
December	520	6	1,080	80	6	9%

Coliform counts are #/100mL.

Table 2.3. Summary of Fecal Coliform Data by Season for the Cycle 1
Verified Period (January 1, 1995–June 30, 2002)

Year	Median	Count	Maximum	Minimum	Number of Exceedances	% Exceedances by Season
Feb - Apr	110	21	1,520	10	3	14%
May - Jul	160	22	2,500	10	7	32%
Aug - Oct	149	22	2,000	10	5	23%
Nov - Jan	180	9	650	10	1	11%

Coliform counts are #/100mL.

Table 2.4. Summary of Fecal Coliform Data by Year for the Cycle 2
Verified Period (January 1, 2000–June 30, 2007)

Year	Median	Count	Maximum	Minimum	Number of Exceedances	% Exceedances by Year
2000	285	12	2,001	10	3	25%
2001	115	16	2,001	10	4	16%
2002	250	15	2,001	70	7	28%
2003	70	21	710	10	3	12%
2004	54	24	2,360	2	3	12%
2005	110	23	780	2	2	8%
2006	74	24	1,160	2	2	8%
2007	128	6	850	6	1	4%

Coliform counts are #/100mL.

Table 2.5. Summary of Fecal Coliform Data by Month for the Cycle 2
Verified Period (January 1, 2000–June 30, 2007)

Year	Median	Count	Maximum	Minimum	Number of Exceedances	% Exceedance by Month
January	120	12	350	20	0	0
February	185	12	1,520	6	4	16%
March	70	13	270	2	0	0
April	64	10	680	4	1	4%
May	100	11	780	2	1	4%
June	200	12	2,360	2	5	20%
July	100	13	590	10	1	4%
August	350	12	2,001	10	6	24%
September	150	13	2,001	10	4	16%
October	120	11	2,000	10	1	4%
November	170	11	340	8	0	0
December	90	11	1,080	20	2	8%

Coliform counts are #/100mL.

Table 2.6. Summary of Fecal Coliform Data by Season for the Cycle 2
Verified Period (January 1, 2000–June 30, 2007)

Year	Median	Count	Maximum	Minimum	Number of Exceedances	% Exceedances by Season
Feb – Apr	80	35	1,520	2	5	21%
May – Jul	105	36	2,360	2	7	29%
Aug – Oct	155	36	2,001	10	11	46%
Nov – Jan	210	10	1,080	110	1	4%

Coliform counts are #/100mL.

Observations at individual stations were too limited to determine any spatial trends or patterns along the creek. Some of the correlations with rainfall totals over longer periods may be associated with the large fraction of the WBID that is wetland and forested. These areas can help attenuate increased flows from storm events and result in a longer and more gradual flow response.

Chapter 3. WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criterion Applicable to the TMDL

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

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

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

3.2 Applicable Water Quality Standards and Numeric Water Quality Target

3.2.1 Fecal Coliform Criterion

Numeric criteria for bacterial quality are expressed in terms of fecal coliform bacteria concentrations. The water quality criterion for the protection of Class III waters, as established by Rule 62-302, F.A.C., states the following:

Fecal Coliform Bacteria:

The Most Probable Number (MPN) or Membrane Filter (MF) counts shall not exceed a monthly average of 200, nor exceed 400 in 10% of the samples, nor exceed 800 on any one day. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period.

The criterion states that monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period. However, there were insufficient data (fewer than 10 samples in a given month) available to evaluate the geometric mean criterion for fecal coliform bacteria. Therefore, the criterion selected for the TMDL was not to exceed 400 counts/100mL.

Chapter 4: ASSESSMENT OF SOURCES

4.1 Types of Sources

An important part of the TMDL analysis is the identification of pollutant source categories, source subcategories, or individual sources of pollutants in the watershed and the amount of pollutant loading contributed by each of these sources. Sources are broadly classified as either “point sources” or “nonpoint sources.” Historically, the term “point 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 urban stormwater discharges, including those from local government master drainage systems, construction sites over five acres, wastewater treatment facilities, and a wide variety of industries (see **Appendix A** for background information on the federal and state stormwater programs).

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

4.2 Potential Sources of Coliform in the Hendry Creek Watershed

4.2.1 Point Sources

There are no NPDES wastewater facilities authorized to discharge into Hendry Creek. This includes industrial wastewater facilities, such as meat packing plants and food packaging plants. However, several wastewater facilities within the WBIDs surrounding the Hendry Creek WBID have NPDES discharge permits (**Figure 4.1**).

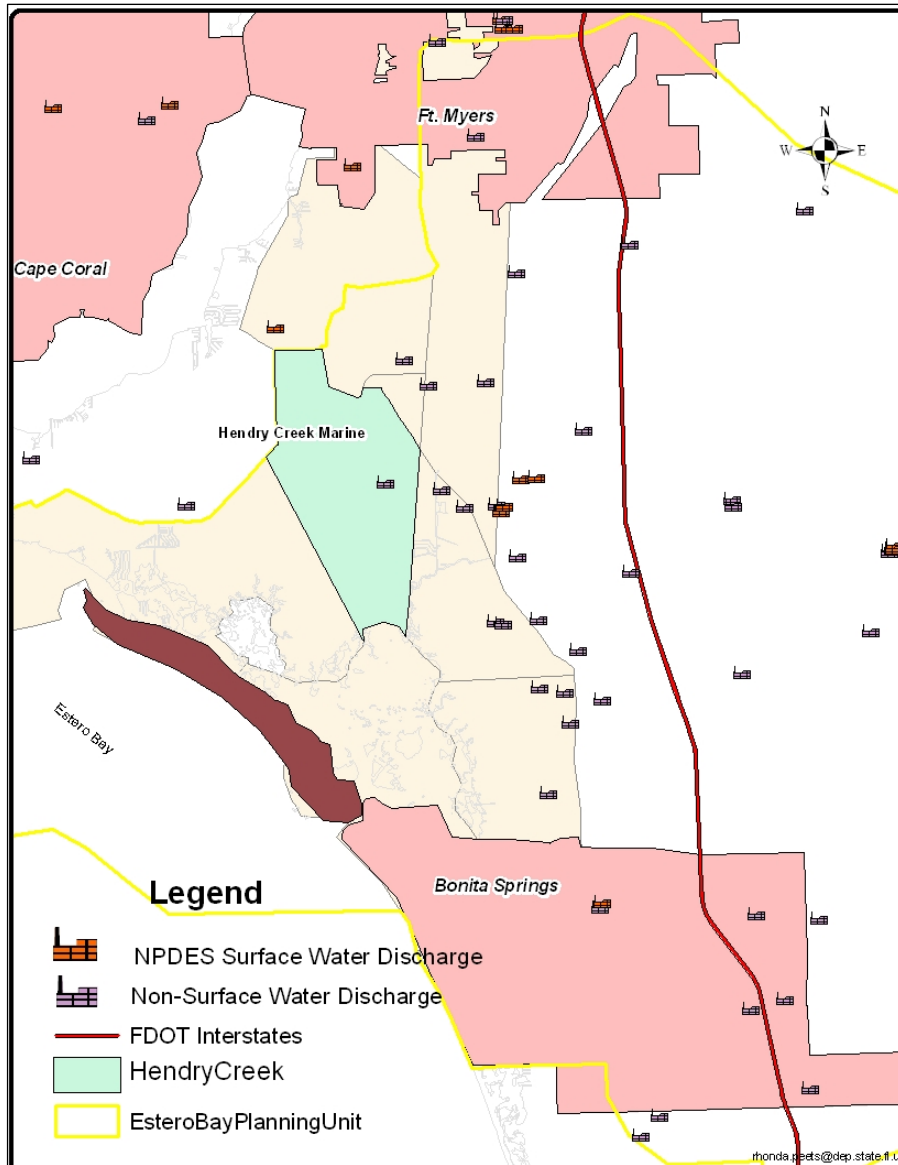


Figure 4.1. Wastewater Facilities near the Hendry Creek Watershed

Municipal Separate Storm Sewer System Permittees

Lee County and the Florida Department of Transportation (FDOT) District 1 are copermitttees for a Phase I NPDES municipal separate storm sewer system (MS4) permit (Permit FLS000035) that covers the Hendry Creek watershed.

4.2.2 Land Uses and Nonpoint Sources

Additional coliform loadings to Hendry Creek are generated from nonpoint sources in the watershed. Potential nonpoint sources of coliform include loadings from surface runoff, wildlife, pets, leaking or overflowing sewage lines, and leaking septic tanks. Several communities in the Hendry Creek watershed use on-site sewage treatment and disposal systems (OSTDS's).

However, a database is not maintained to identify those homeowners with OSTDS's, or to identify the age/type of systems that are likely to exhibit higher OSTDS failure rates.

Land Uses

The spatial distribution and acreage of different land use categories were identified using the 2004–05 land use coverage contained in the Department's geographic information system (GIS) library, initially provided by the SFWMD (see **Figure 4.2**). Land use categories and acreages in the watershed were aggregated using the Level 1 codes, as illustrated in **Table 4.1**. **Appendix B** presents a more detailed breakdown of Level 2 land uses.

The Hendry Creek watershed is a small, moderately developed area. **Table 4.1** shows that nearly half of the land consists of wetlands (41.6 percent), followed by urban and built-up (35.9 percent), while agriculture and rangeland (rural) cover less than 3 percent. Wetlands, water, and rural open forest areas comprise almost 60% of the watershed.

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

Level 1	Land Use	Acreage	% of Total
1000	Urban and built-up	853	12.3
	Low-density residential	493	7.1
	Medium-density residential	726	10.5
	High-density residential	414	6.0
2000	Agriculture	98	1.4
3000	Rangeland	83	1.2
4000	Forest/rural open	659	9.5
5000	Water	611	8.8
6000	Wetland	2,877	41.6
8000	Transportation, communication, and utilities	99	1.4
Total:		6,913	100

Wildlife

Wildlife deposit coliform bacteria with their feces onto land surfaces, where they can be transported during storm events to nearby streams and lakes. Some wildlife (such as otters, beavers, raccoons, and birds) deposit their feces directly into the water. The bacterial load from naturally occurring wildlife is assumed to be background. In addition, any strategy employed to control this source would probably have a negligible impact on attaining water quality standards. The Department is in the process of attaining local information from Lee County and other state agencies on the assessment of bird rookeries in the Hendry Creek watershed.

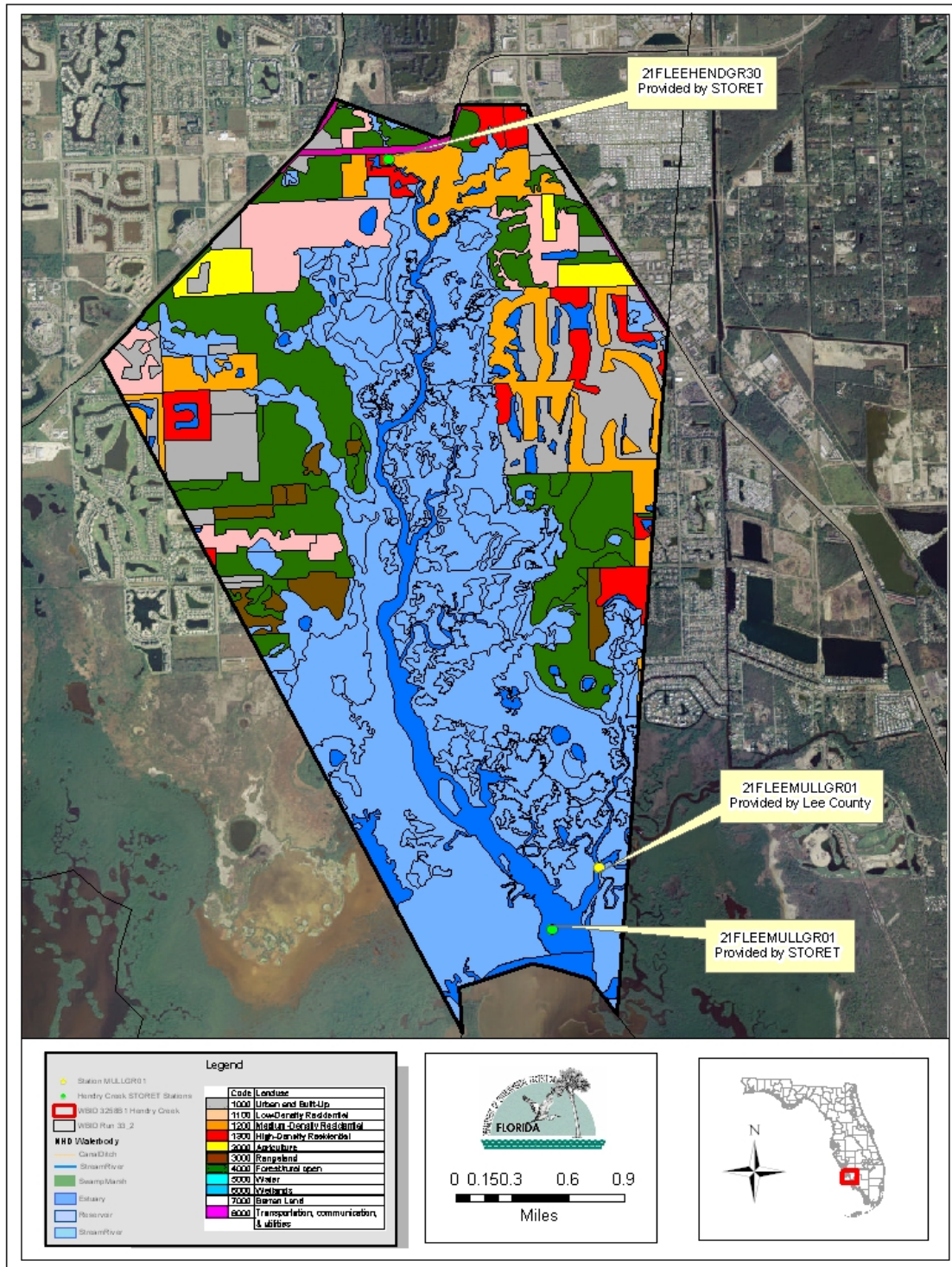


Figure 4.2. Land Use Coverage in the Hendry Creek Watershed

Population

In 2005, the U.S. Census Bureau estimated the population of Lee County, which includes the cities of Ft. Myers and Cape Coral, at 571,344. The average household size was 2.31 people per household, and the average family size was 2.73 people (U.S. Census Bureau Website, 2007).

Based on the land use map and Census population estimates, 17,600 people live in the Hendry Creek watershed. Using Lee County's average household size of 2.31, this equates to 7,619 households in the watershed.

Septic Tanks

The EPA lists failing septic systems as one of the top three sources of nonpoint source nutrient and bacterial pollution in the United States. The Charlotte Harbor National Estuary Program's (CHNEP) Comprehensive Conservation and Management Plan (CHNEP, 2008) also recognizes septic systems as a potential threat to water quality in southwest Florida.

The Florida Department of Health (FDOH) is the regulatory agency responsible for prescribing the criteria that must be met for the design and installation of on-site systems. The Lee County Health Department (LCHD) is the local branch of the FDOH and is responsible for reviewing permits for new installations, repairs, and removal of on-site systems. In addition, the LCHD issues operating permits for commercial systems and aerobic treatment units, which require regular maintenance. **Figure 4.3** shows the distribution of OSTDS's in the Hendry Creek watershed.

In 1983, FDOH changed the requirements for OSTDS's, requiring a two-foot separation between the drainfield and the water table. The current standards, described in Section 381.0065, F.S., are considered to be protective of environmental resources. However, upgrades of systems permitted prior to 1983 have not been required.

No measured septic tank failure rate data were available for the watershed when this TMDL analysis was conducted. Therefore the failure rate was derived from the number of septic tank and septic tank repair permits for the county published by FDOH (<http://www.doh.state.fl.us/environment/OSTDS/statistics/ostdsstatistics.htm>). The number of septic tanks in the county was calculated assuming that none of the installed septic tanks will be removed after being installed. The reported number of septic tank repair permits was also obtained from the FDOH website (**Table 4.2**).

Based on this information, a discovery rate of failed septic tanks for each year between 2000 and 2006 was calculated and listed in **Table 4.2**. The table shows that the average annual septic tank failure discovery rate for Lee County is about 0.24 percent. Assuming that failed septic tanks are not discovered for about 5 years, the estimated annual septic tank failure rate is about 5 times the discovery rate, or 1.18 percent.

The Department is in the process of acquiring Lee County's GIS coverage of manhole covers and the sewer utility service. Once the coverage has been obtained, the number of septic tanks in the Hendry Creek watershed will be revised.

Table 4.2. Failed and Newly Installed Septic Systems in Lee County, 2000-06

	2000	2001	2002	2003	2004	2005	2006	Average
New installation (septic tanks)	2,220	2,254	3,149	4,180	5,883	9,672	12,588	5,707
Accumulated installation	89,355	91,609	94,758	98,938	104,821	114,493	127,081	103,008
Repair permit (septic tanks)	319	368	253	219	122	110	243	233
Failure discovery rate (%)	0.36	0.40	0.27	0.22	0.12	0.10	0.19	0.24
Failure rate (%)*	1.79	2.01	1.33	1.11	0.58	0.48	0.96	1.18

Source: FDOH website.

With a population of 571,344 in Lee County, with 2.31 persons per household, the total number of households equals 234,355. On average, 0.133 percent of Lee County households require repair permits annually. Thus for Hendry Creek, with 7,620 households, there are 10.2 repair permits annually, which are assumed to be 10 failed septic tanks. **Table 4.3** provides a estimation of loads resulting from failed septic tanks.

Table 4.3. Estimation of Daily Fecal Coliform Load from Failed Septic Tanks in the Hendry Creek Watershed

Estimated Number of Households in WBID 3258B1	Estimated Number of Tank Failures	Estimated Load from Failed Tanks	Gallons Per Person Per Day	Estimated Number of Persons Per Household	Estimated Daily Load from Failing Tanks	Estimated Annual Load from Failing Tanks
7,620	10	10,000 fecal colonies/mL	70	2.31	6.33E+10	2.31E+13

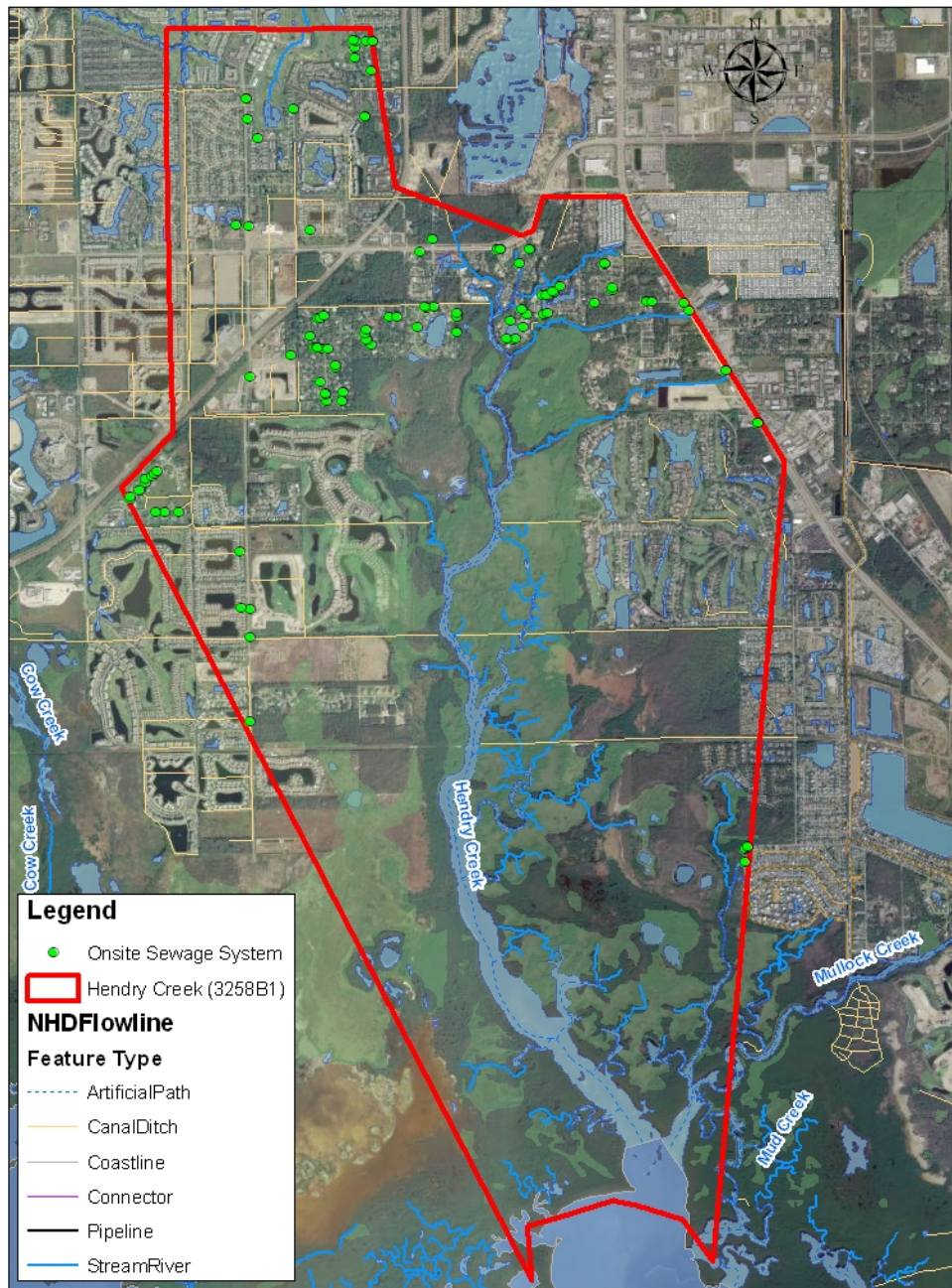


Figure 4.3. Distribution of On-site Sewage Systems (Septic Tanks) in the Hendry Creek Watershed

Pets

Tables 4.4 and 4.5 provide an estimate of the fecal coliform loads from dogs and cats, respectively, in the watershed.

Table 4.4. Estimated Loading From Dogs in the Hendry Creek Watershed

Estimated Number of Households in WBID 3258B1	Estimated No. of Households Owning Dogs*	Estimated No of Dogs Per Dog-owning Household	Total Number of Dogs Owned	Fecal Load in CFU Per Day Per Dog	Estimated Daily Load from Dogs	Estimated Annual Load from Dogs
7,620	2,476.5	1.6	3,962.4	4.09E+09	1.62E+13	5.91E+15

* Based on a 32.5% ownership rate for Florida (American Veterinary Medical Association [AVMA] Pet Ownership Sourcebook).
CFU – Colony-forming units

Table 4.5. Estimated Loading from Cats in the Hendry Creek Watershed

Estimated Number of Households in WBID 3258B1	Estimated No. of Households Owning Cats*	Estimated No of Cats Per Cat-owning Household	Total Number of Cats Owned	Fecal Load in CFU Per Day Per Cat	Estimated Daily Load from Cats	Estimated Annual Load from Cats
7,620	2,225.04	2	4,450.08	5.04E+02	2.24E+06	8.18E+08

* Based on a 29.2% ownership rate for Florida (AVMA Pet Ownership Sourcebook).

4.2.3 Source Summary

It is important to note that the sources listed here are not a complete list and that more information and monitoring are necessary and recommended to permit a more detailed understanding of the relative contributions from various sources. Sources not quantified here because of a lack of information include contributions from wildlife, sewer line leaks, and septic systems that are operational and continue to be used but contribute to the fecal coliform load.

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Overall Approach

Typically, continuous flow measurements in a watershed can be used to develop a bacteria TMDL. Instead, this fecal coliform TMDL was developed using the “percent reduction” approach. For this method, the percent reduction needed to meet the applicable criterion is calculated for each value above the criterion, and then a median percent reduction is calculated.

5.1.1 Data Used in the Determination of the TMDL

There are two sampling stations in Hendry Creek that have fecal coliform observations. The data used to develop this TMDL were provided by Lee County, which maintains routine sampling sites at Hendry Creek Stations 21FLEECOMULLGR01 and 21FLEECOHEHENDGR30. **Table 5.1** summarizes the number of fecal coliform samples collected for each station used in this analysis. **Appendix C** summarizes the data collected in Hendry Creek between 2000 and 2007.

Table 5.1. Summary of Fecal Coliform Stations in Hendry Creek, WBID 3258B1

STORET ID	Station Location	Years of Data	Number of Samples
21FLEECOMULLGR01	Hendry Creek	2003–07	47
21FLEECOHEHENDGR30	Hendry Creek– Gladiolus West	2000–07	96

5.1.2 TMDL Development Process

As described in **Section 5.1**, the percent reduction needed to meet the fecal coliform criterion was determined for each individual exceedance using the following equation:

$$\frac{[\text{measured exceedance} - \text{criterion}] * 100}{\text{measured exceedance}}$$

The fecal coliform TMDL was calculated as the median of the percent reductions needed over the data range where exceedances occurred (see **Table 5.2** for data). As noted in the next section, all of the exceedances occurred throughout the calendar year, and the median percent reduction for this period was 57.4 percent.

Table 5.2. Fecal Coliform Percent Reduction for Hendry Creek, WBID 3258B1

Sample Date	Sample	Observed Value	Fecal Coliform Criterion	Required Reduction (%)
July 27, 2000	21FLEECOHENDGR30	590	400	32.2
August 22, 2000	21FLEECOHENDGR30	1,280	400	68.8
September 7, 2000	21FLEECOHENDGR30	2,001	400	80.0
February 8, 2001	21FLEECOHENDGR30	1,520	400	73.7
June 7, 2001	21FLEECOHENDGR30	2,001	400	80.0
August 21, 2001	21FLEECOHENDGR30	2,001	400	80.0
December 20, 2001	21FLEECOHENDGR30	1,080	400	63.0
April 18, 2002	21FLEECOHENDGR30	680	400	41.2
June 11, 2002	21FLEECOHENDGR30	1,110	400	64.0
June 26, 2002	21FLEECOHENDGR30	520	400	23.1
August 8, 2002	21FLEECOHENDGR30	450	400	11.1
August 28, 2002	21FLEECOHENDGR30	2,001	400	80.0
September 19, 2002	21FLEECOHENDGR30	2,001	400	80.0
October 9, 2002	21FLEECOHENDGR30	2,000	400	80.0
February 13, 2003	21FLEECOHENDGR30	480	400	16.7
June 5, 2003	21FLEECOHENDGR30	490	400	18.4
August 5, 2003	21FLEECOHENDGR30	710	400	43.7
June 3, 2004	21FLEECOHENDGR30	2,360	400	83.1
August 9, 2004	21FLEECOMULLGR01	1,050	400	61.9
August 29, 2004	21FLEECOHENDGR30	740	400	45.9
September 2, 2004	21FLEECOHENDGR30	760	400	47.4
May 31, 2005	21FLEECOHENDGR30	780	400	48.7
September 29, 2005	21FLEECOHENDGR30	670	400	40.3
February 20, 2006	21FLEECOHENDGR30	1,160	400	65.5
December 22, 2006	21FLEECOHENDGR30	570	400	29.8
February 8, 2007	21FLEECOHENDGR30	850	400	52.9
Median Percent Reduction =				57.4

5.2.3 Critical Conditions/Seasonality

The critical conditions for coliform loadings in a given watershed depend 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 that have 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.

The critical condition for point source loading typically occurs during periods of low stream flow, when dilution is minimized.

Measurements were sorted by month and season (the calendar year was divided into quarters) to determine whether there was a temporal pattern of exceedances. Monthly rainfall data from the Lee County rain gage at Lakes Park were obtained and included in the analysis. **Table 5.3** presents summary statistics by month and season, respectively, for fecal coliform measurements (Winter: January–March; Spring: April–June; Summer: July–September; Fall: October–December). The highest exceedance frequency is observed during the summer, which is consistent with the highest rainfall observed during the summer. This implies that the exceedance may be mainly related to nonpoint source contributions through surface runoff.

Table 5.3. Statistical Table of Observed Historical Data by Month and Season for Hendry Creek, WBID 3258B1

Season	N	Minimum	Maximum	Median	Mean	No. of Exceedances	% Exceedance	Mean Precipitation
Winter	35	6	1,520	120	267.37	6	17	2.06
Spring	28	2	780	75	164.5	2	7.1	3.19
Summer	37	2	2,001	200	481.97	12	32.4	10.45
Fall	32	8	2,000	140	249.7	5	15.6	5.26
Month	N	Minimum	Maximum	Median	Mean	No. of Exceedances	% Exceedance	Mean Precipitation
January	12	20	350	120	138.8	0	0	2.04
February	12	6	1,520	185	409.5	4	33	2.26
March	12	2	270	75	104.3	0	0	3.47
April	9	4	680	80	149.1	1	11	2.91
May	7	100	780	135	240	1	14.2	3.19
June	12	2	2,360	200	583.9	4	33	11.43
July	14	10	590	125	161.14	1	7.1	9.92
August	11	18	2,001	710	779	7	63	10.39
September	12	10	2,001	160	514.16	4	33	9.23
October	10	10	2,000	140	309	1	10	4.00
November	10	8	340	170	187.8	0	0	2.39
December	11	20	1,080	90	252.5	2	18	1.88

Coliform counts are #/100mL.

Exceedances represent values above 43 counts/100mL for fecal coliform.

Mean precipitation is from the Lee County rain gage at Lakes Park, available at the following websites:

http://www.lee-county.com/naturalresources/hydromonitor/Autopage_T27_R20.htm and

http://www.lee-county.com/naturalresources/hydromonitor/Autopage_T27_R297.htm.

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:

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

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

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

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[1]), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or **other appropriate measure**. The TMDL for Hendry Creek is expressed in terms of counts/100mL and percent reduction, and represents the maximum daily fecal coliform load the creek can assimilate and maintain the coliform criterion (**Table 6.1**).

Table 6.1. TMDL Components for Hendry Creek, WBID 3258B1

WBID	Parameter	TMDL (counts/day)	WLA		LA (% Reduction)	MOS
			Wastewater (counts/day)	NPDES Stormwater (% reduction)		
3258B1	Fecal Coliform	400/100mL	NA	57.4 %	57.4 %	Implicit

NA – Not applicable.

6.2 Load Allocation

Fecal coliform reductions of 57.4 percent are required from nonpoint sources. It should be noted that the load allocation includes loading from stormwater discharges that are not part of the NPDES Stormwater Program.

6.3 Wasteload Allocation

6.3.1 NPDES Wastewater Discharges

As mentioned previously, there are no permitted wastewater facilities with a discharge permit in the Hendry Creek watershed. Any new potential dischargers would be expected to comply with the Class III criterion for coliform bacteria.

6.3.2 NPDES Stormwater Discharges

Lee County and FDOT District 1 are copermittees for a Phase I NPDES MS4 permit (Permit FLS000035) that covers the Hendry Creek watershed. The WLA for stormwater discharges with an MS4 permit is a 57.4 percent reduction in current anthropogenic fecal coliform loading from the MS4. It should be noted that any MS4 permittee is only responsible for reducing the loads associated with stormwater outfalls that it owns or otherwise has responsible control over, and it is not responsible for reducing other nonpoint source loads in its jurisdiction.

6.4 Margin of Safety

Consistent with the recommendations of the Allocation Technical Advisory Committee (Department, 2001), an implicit MOS was used in the development of this TMDL. An MOS was included in the TMDL by not allowing any exceedances of the state criterion, even though intermittent natural exceedances of the criterion would be expected and would be taken into account when determining impairment. Additionally, the TMDL calculated for fecal coliform was based on meeting the water quality criterion of 400 counts/100mL with no exceedances, while the actual 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 this TMDL by rule, the next step in the TMDL process is to develop an implementation plan for the TMDL, referred to as the BMAP. This document will be developed over the next year 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 TMDL,
- 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.

References

- American Veterinary Medical Association Website. 2007. *Pet ownership sourcebook*. Available: <http://www.avma.org/reference/marketstats/sourcebook.asp>.
- Charlotte Harbor National Estuary Program. 2008. *Comprehensive conservation and management plan update*. Available: <http://www.chnep.org/CCMP/CCMP.htm>.
- Fawn Immokalee Station. 2008. Available: <http://fawn.ifas.ufl.edu/>.
- Florida Administrative Code. *Rule 62-302, Surface water quality standards*.
- Florida Administrative Code. *Rule 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.
- . 2003. *Basin Assessment Report: Everglades West Coast*. Tallahassee, Florida: Bureau of Watershed Management. Available: <ftp://ftp.dep.state.fl.us/pub/water/basin411/everwest/assessment/EvergladesWEBX.pdf>.
- Florida Department of Health Website. 2008. Available: <http://www.doh.state.fl.us/environment/OSTDS/statistics/ostdsstatistics.htm>.
- Florida Watershed Restoration Act. *Chapter 99-223, Laws of Florida*.
- Lee County Hendry Creek Website. 2005. Available: http://www.lee-county.com/NaturalResources/HydroMonitor/Autopage_T27_R63.htm.
- Lee County Rain Gauges Website. 2008. Available: http://www.lee-county.com/naturalresources/hydromonitor/Autopage_T27_R20.htm.
- Lee County Daily Rainfall Website. 2008. Available: http://www.lee-county.com/naturalresources/hydromonitor/Autopage_T27_R297.htm.
- U.S. Census Bureau Website. 2007. Available: <http://www.census.gov/>.
- U.S. Environmental Protection Agency. 1994. *Nonpoint source pollution: The nation's largest water quality problem*. Pointer No. 1. EPA-841-F-94-005. Available: <http://www.epa.gov/owow/nps/facts/point1.htm>.
- . January 2001. *Protocol for developing pathogen TMDLs*. 1st ed. EPA 841-R-00-002. Assessment and Watershed Protection Division.

Appendices

Appendix A: Background Information on Federal and State Stormwater Programs

In 1982, Florida became the first state in the country to implement statewide regulations to address the issue of nonpoint source pollution by requiring new development and redevelopment to treat stormwater before it is discharged. The Stormwater Rule, as authorized in Chapter 403, F.S., was established as a technology-based program that relies on the implementation of BMPs that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Rule 62-40, F.A.C. In 1994, the Department's stormwater treatment requirements were integrated with the stormwater flood control requirements of the water management districts, along with wetland protection requirements, into the Environmental Resource Permit regulations.

Rule 62-40 also requires the state's water management districts to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a Surface Water Improvement and Management (SWIM) plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL. To date, stormwater PLRGs have been established for Tampa Bay, Lake Thonotosassa, the Winter Haven Chain of Lakes, the Everglades, Lake Okeechobee, and Lake Apopka.

In 1987, the U.S. Congress established Section 402(p) as part of the federal Clean Water Act Reauthorization. This section of the law amended the scope of the federal NPDES permitting program to designate certain stormwater discharges as "point sources" of pollution. The EPA promulgated regulations and began implementing the Phase I NPDES Stormwater Program in 1990. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific standard industrial classification (SIC) codes, construction sites disturbing 5 or more acres of land, and 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 FDOT throughout the 15 counties meeting the population criteria. The Department received authorization to implement the NPDES Stormwater Program in 2000.

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

Appendix B: Level 2 Land Uses for Hendry Creek, WBID 3258B1

Level 2 Land Use Code and Description	Acres	% Total
6120 - Mangrove Swamp	1,623.1	23.46%
6420 - Saltwater Marshes / Halophytic Herbaceous	854.8	12.35%
4110 - Pine Flatwoods	704.1	10.18%
1210 - Medium Density: Fixed Single Family Units	575.1	8.31%
1820 - Golf Course	337.1	4.87%
5110 - Natural River, Stream, Waterway	319.0	4.61%
1110 - Low Density: Fixed Single Family Units	317.7	4.59%
4240 - Melaleuca	285.3	4.12%
6191 - Wet Melaleuca	271.5	3.92%
1330 - Multiple Dwelling Units, Low Rise	236.8	3.42%
3100 - Herbaceous (Dry Prairie)	172.9	2.50%
2140 - Row Crops	140.8	2.03%
2110 - Improved Pastures	115.8	1.67%
5300 - Reservoirs	114.0	1.65%
3200 - Upland Shrub and Brush Land	94.5	1.37%
6172 - Mixed Shrubs	87.2	1.26%
8140 - Roads and Highways	84.8	1.23%
1340 - Multiple Dwelling Units, High Rise	73.6	1.06%
1400 - Commercial and Services	59.8	0.86%
5200 - Lakes	56.6	0.82%
4220 - Brazilian Pepper	40.9	0.59%
6250 - Wet Pinelands Hydric Pine	39.0	0.56%
1390 - High Density: Under Construction	38.9	0.56%
6410 - Freshwater Marshes / Graminoid Prairie-Marsh	35.2	0.51%
5410 - Embayments Opening Directly to Gulf or Ocean	35.0	0.51%
1411 - Shopping Centers	27.1	0.39%
4340 - Hardwood / Coniferous Mixed	25.8	0.37%
7400 - Disturbed Land	18.9	0.27%
6510 - Tidal Flats	18.8	0.27%
1320 - High Density: Mobile Home Units	17.1	0.25%
8320 - Electrical Power Transmission Lines	13.6	0.20%
1190 - Low Density: Under Construction	13.6	0.20%
1310 - High Density: Fixed Single Family Units	13.1	0.19%
1700 - Institutional	12.8	0.19%
6300 - Wetland Forested Mixed	11.3	0.16%
2430 - Ornamentals	10.6	0.15%
1550 - Other Light Industry	8.0	0.12%
5430 - Enclosed Salt Water Ponds within Salt Marsh	6.5	0.09%
6500 - Nonvegetated Wetland	6.3	0.09%
6216 - Cypress - Mixed Hardwoods	2.3	0.03%
5120 - Channelized Waterways, Canals	0.1	0.00%

Appendix C: Fecal Coliform Data for Hendry Creek, WBID 3258B1, 2000–07

WBID	Station	Date	Fecal Coliform (counts/100mL)
3258B1	21FLEECOHENDGR30	1/13/2000	170
3258B1	21FLEECOHENDGR30	2/15/2000	340
3258B1	21FLEECOHENDGR30	3/21/2000	10
3258B1	21FLEECOHENDGR30	4/20/2000	240
3258B1	21FLEECOHENDGR30	5/8/2000	320
3258B1	21FLEECOHENDGR30	6/13/2000	100
3258B1	21FLEECOHENDGR30	7/27/2000	590
3258B1	21FLEECOHENDGR30	8/22/2000	1280
3258B1	21FLEECOHENDGR30	9/7/2000	2001
3258B1	21FLEECOHENDGR30	10/11/2000	160
3258B1	21FLEECOHENDGR30	11/7/2000	250
3258B1	21FLEECOHENDGR30	12/19/2000	390
3258B1	21FLEECOHENDGR30	1/10/2001	110
3258B1	21FLEECOHENDGR30	2/8/2001	1520
3258B1	21FLEECOHENDGR30	3/15/2001	270
3258B1	21FLEECOHENDGR30	4/12/2001	10
3258B1	21FLEECOHENDGR30	5/8/2001	100
3258B1	21FLEECOHENDGR30	6/7/2001	2001
3258B1	21FLEECOHENDGR30	7/12/2001	10
3258B1	21FLEECOHENDGR30	7/19/2001	10
3258B1	21FLEECOHENDGR30	8/1/2001	10
3258B1	21FLEECOHENDGR30	8/21/2001	2001
3258B1	21FLEECOHENDGR30	9/13/2001	250
3258B1	21FLEECOHENDGR30	9/25/2001	10
3258B1	21FLEECOHENDGR30	10/3/2001	20
3258B1	21FLEECOHENDGR30	10/24/2001	120
3258B1	21FLEECOHENDGR30	11/1/2001	340
3258B1	21FLEECOHENDGR30	12/20/2001	1080
3258B1	21FLEECOHENDGR30	1/10/2002	250
3258B1	21FLEECOHENDGR30	2/6/2002	210
3258B1	21FLEECOHENDGR30	3/7/2002	70
3258B1	21FLEECOHENDGR30	4/18/2002	680
3258B1	21FLEECOHENDGR30	5/22/2002	120
3258B1	21FLEECOHENDGR30	6/11/2002	1110
3258B1	21FLEECOHENDGR30	6/26/2002	520
3258B1	21FLEECOHENDGR30	7/10/2002	150
3258B1	21FLEECOHENDGR30	7/24/2002	150
3258B1	21FLEECOHENDGR30	8/8/2002	450
3258B1	21FLEECOHENDGR30	8/28/2002	2001
3258B1	21FLEECOHENDGR30	9/19/2002	2001
3258B1	21FLEECOHENDGR30	10/9/2002	2000

WBID	Station	Date	Fecal Coliform (counts/100mL)
3258B1	21FLEECOHENDGR30	11/13/2002	170
3258B1	21FLEECOHENDGR30	12/17/2002	170
3258B1	21FLEECOHENDGR30	1/14/2003	170
3258B1	21FLEECOHENDGR30	2/13/2003	480
3258B1	21FLEECOMULLGR01	3/4/2003	10
3258B1	21FLEECOHENDGR30	3/11/2003	100
3258B1	21FLEECOHENDGR30	4/17/2003	80
3258B1	21FLEECOMULLGR01	5/5/2003	10
3258B1	21FLEECOHENDGR30	5/14/2003	150
3258B1	21FLEECOMULLGR01	6/5/2003	10
3258B1	21FLEECOHENDGR30	6/5/2003	490
3258B1	21FLEECOMULLGR01	7/2/2003	20
3258B1	21FLEECOHENDGR30	7/29/2003	150
3258B1	21FLEECOHENDGR30	8/5/2003	710
3258B1	21FLEECOMULLGR01	8/11/2003	20
3258B1	21FLEECOHENDGR30	9/10/2003	10
3258B1	21FLEECOMULLGR01	9/15/2003	50
3258B1	21FLEECOMULLGR01	10/2/2003	70
3258B1	21FLEECOHENDGR30	10/22/2003	10
3258B1	21FLEECOMULLGR01	11/19/2003	10
3258B1	21FLEECOHENDGR30	11/24/2003	170
3258B1	21FLEECOHENDGR30	12/9/2003	20
3258B1	21FLEECOMULLGR01	12/9/2003	70
3258B1	21FLEECOMULLGR01	1/15/2004	60
3258B1	21FLEECOHENDGR30	1/28/2004	130
3258B1	21FLEECOMULLGR01	2/16/2004	10
3258B1	21FLEECOHENDGR30	2/24/2004	160
3258B1	21FLEECOHENDGR30	3/1/2004	140
3258B1	21FLEECOMULLGR01	3/15/2004	32
3258B1	21FLEECOMULLGR01	4/7/2004	48
3258B1	21FLEECOHENDGR30	4/26/2004	20
3258B1	21FLEECOMULLGR01	5/19/2004	2
3258B1	21FLEECOHENDGR30	5/26/2004	100
3258B1	21FLEECOHENDGR30	6/3/2004	2360
3258B1	21FLEECOMULLGR01	6/15/2004	2
3258B1	21FLEECOMULLGR01	7/8/2004	22
3258B1	21FLEECOHENDGR30	7/14/2004	350
3258B1	21FLEECOHENDGR30	7/18/2004	380
3258B1	21FLEECOMULLGR01	8/9/2004	1050
3258B1	21FLEECOHENDGR30	8/29/2004	740
3258B1	21FLEECOHENDGR30	9/2/2004	760
3258B1	21FLEECOHENDGR30	9/13/2004	40
3258B1	21FLEECOMULLGR01	9/29/2004	10
3258B1	21FLEECOHENDGR30	10/7/2004	180
3258B1	21FLEECOMULLGR01	10/11/2004	10

WBID	Station	Date	Fecal Coliform (counts/100mL)
3258B1	21FLEECOMULLGR01	11/8/2004	40
3258B1	21FLEECOHENDGR30	11/23/2004	320
3258B1	21FLEECOHENDGR30	12/1/2004	80
3258B1	21FLEECOMULLGR01	12/16/2004	32
3258B1	21FLEECOMULLGR01	1/18/2005	20
3258B1	21FLEECOHENDGR30	1/31/2005	110
3258B1	21FLEECOMULLGR01	2/2/2005	10
3258B1	21FLEECOHENDGR30	2/23/2005	160
3258B1	21FLEECOMULLGR01	3/16/2005	2
3258B1	21FLEECOHENDGR30	3/19/2005	80
3258B1	21FLEECOHENDGR30	4/7/2005	100
3258B1	21FLEECOMULLGR01	4/20/2005	10
3258B1	21FLEECOMULLGR01	5/19/2005	2
3258B1	21FLEECOHENDGR30	5/31/2005	780
3258B1	21FLEECOMULLGR01	6/16/2005	12
3258B1	21FLEECOHENDGR30	6/16/2005	140
3258B1	21FLEECOHENDGR30	7/8/2005	220
3258B1	21FLEECOMULLGR01	7/11/2005	70
3258B1	21FLEECOMULLGR01	8/2/2005	18
3258B1	21FLEECOHENDGR30	8/17/2005	250
3258B1	21FLEECOMULLGR01	9/27/2005	170
3258B1	21FLEECOHENDGR30	9/29/2005	670
3258B1	21FLEECOHENDGR30	10/18/2005	190
3258B1	21FLEECOHENDGR30	11/7/2005	110
3258B1	21FLEECOMULLGR01	11/16/2005	150
3258B1	21FLEECOHENDGR30	12/8/2005	220
3258B1	21FLEECOMULLGR01	12/28/2005	56
3258B1	21FLEECOMULLGR01	1/23/2006	40
3258B1	21FLEECOHENDGR30	1/31/2006	350
3258B1	21FLEECOMULLGR01	2/20/2006	8
3258B1	21FLEECOHENDGR30	2/20/2006	1160
3258B1	21FLEECOHENDGR30	3/14/2006	250
3258B1	21FLEECOMULLGR01	3/23/2006	6
3258B1	21FLEECOMULLGR01	4/4/2006	4
3258B1	21FLEECOHENDGR30	4/4/2006	160
3258B1	21FLEECOMULLGR01	5/10/2006	2
3258B1	21FLEECOHENDGR30	5/25/2006	110
3258B1	21FLEECOMULLGR01	6/7/2006	2
3258B1	21FLEECOHENDGR30	6/29/2006	260
3258B1	21FLEECOMULLGR01	7/19/2006	34
3258B1	21FLEECOHENDGR30	7/26/2006	100
3258B1	21FLEECOHENDGR30	8/21/2006	10
3258B1	21FLEECOMULLGR01	8/22/2006	50
3258B1	21FLEECOHENDGR30	9/5/2006	150
3258B1	21FLEECOMULLGR01	9/21/2006	58

WBID	Station	Date	Fecal Coliform (counts/100mL)
3258B1	21FLEECOMULLGR01	10/19/2006	14
3258B1	21FLEECOHENDGR30	10/25/2006	330
3258B1	21FLEECOHENDGR30	11/13/2006	320
3258B1	21FLEECOMULLGR01	11/30/2006	8
3258B1	21FLEECOMULLGR01	12/13/2006	90
3258B1	21FLEECOHENDGR30	12/22/2006	570
3258B1	21FLEECOHENDGR30	1/3/2007	190
3258B1	21FLEECOMULLGR01	1/25/2007	66
3258B1	21FLEECOHENDGR30	2/8/2007	850
3258B1	21FLEECOMULLGR01	2/12/2007	6
3258B1	21FLEECOHENDGR30	3/7/2007	240
3258B1	21FLEECOMULLGR01	3/21/2007	52

Appendix D: Public Comments and FDEP Responses

Appendix D.1

Public Comments, Molly Meadows/SFWMD

The below comments were received by email from Ms. Molly Meadows of the South Florida Water Management District (SFWMD) on July 14, 2008

Comment 1.

Chapter 1 Section 1.2 Identification of Waterbody, “CHNEP” is used but I do not see it listed with the References. “Florida Department of Environmental Protection, 2003” is used but not included in the Reference list.

The statement regarding location ...southwest of Cape Coral...is not making sense when I read it, please review location again—it may just be me, but the way this is stated it is throwing me off.

FDEP Response: The source information in the text from the CHNEP (Charlotte Harbor National Estuary Program) and FDEP will be corrected in the references list of the document, since it is used in several parts of the document. The source information for the approximate land area of Hendry Creek is incorrectly cited as CHNEP and will be changed to the Lee County Government website. The text description of Hendry Creek will be revised to better orient the creek with major geographic features and population centers.

Comment 2.

Section 1.3 Background; The 3rd paragraph has South West Florida Water Management District (SFWMD)

FDEP Response: The text will be corrected to read South Florida Water Management District (SFWMD).

Comment 3.

Chapter 2
Section 2.2 information on Verified Impairment
Earth justice (justice needs to be a capital)

Tables 2.1, 2.2, and 2.3 paragraph talks about the cycles--I understand the cycles, but I don't think that this document explains what they are. I think that it should be explained to the reader, or the reader should be told where to go to be able to see an explanation.

FDEP Response: The text for Earth justice will be corrected to read “Earthjustice”, so that it is consistent with other FDEP final TMDL documents. For Tables 2.1, 2.2, and 2.3 the text will be revised to explain the Rotating Basin Cycle process in more depth or a citation will be added for the reader to locate additional information.

Comment 4.

Chapter 4
Section Septic Tanks
CHNEP is listed, but I do not see it in the “References” section.

FDEP Response: The citation for CHNEP will be added to the reference list to be consistent with the text.

Comment 5.

Chapter 5
Section 5.2.3 Critical Conditions/Seasonality

Why are we using the Hendry County Landfill for monthly rainfall data that's a long ways off from the site? If this is an error please change, if not could you give the reader a brief explanation of why we are getting the data from that site.

FDEP Response: Rainfall data were not used from the Hendry County Landfill; this is an error in the text. The text for paragraph 2, sentence 2 will be corrected to read the Lee County rain gage at Lakes Park, which is cited at the bottom of Table 5.3.

Comment 6.

Chapter 6

Section 6.3 Wasteload Allocation (WLA)

Why is this left blank, if there is no WLA then state that or fill in the missing info?

FDEP Response: Section 6.3 Wasteload Allocation (WLA) is intentionally left blank, since it is a section heading. The sections that follow 6.3.1 NPDES Wastewater Discharges and 6.3.2 NPDES Stormwater Discharges describe the components of the wasteload allocation.

Comment 7.

References

As stated above CHNEP is used, but no reference are given

Florida Department of Environmental Protection, 2003 is used but no reference given

FDEP Response: The source information in the text from the CHNEP (Charlotte Harbor National Estuary Program) and FDEP will be corrected in the references list of the document.

Appendix D.2

Public Comments; Karen Bickford/Lee County

The below comments were received by email from Ms. Karen Bickford of the Lee County Division of Natural Resources on July 21, 2008

Comment:

Lee County staff agrees that the State adequately demonstrates that there is impairment in Hendry Creek for Fecal Coliforms. The concern we have is that there is proper allocation of load reductions and an accurate assessment of influences in the Hendry Creek Basin. The Department estimated the number of septic tanks in the Hendry Creek Basin based on Florida Department of Health and Census data only. Lee County's current estimate of septic tanks in the Hendry Creek Basin is about 4000. This verification was done not only by DOH records, but by counting manhole covers that are documented in the County's GIS coverage for sewer utility service. FDEP estimates 7000 septic tanks for this basin and we believe this to be too high.

In the future Lee County will be required to work on source reduction strategies. We have begun studying sources in the Hendry Creek Basin and various methods of determining how to identify appropriately sources of Fecal Coliform. Fecal Coliform is not limited to anthropogenic sources and we are concerned that the assessments for TMDL allocation in this basin may not include assessment of bird rookeries or accurate assessment of pet contribution that will allow the County to better direct resources to appropriate source reduction of this pollutant.

In addition, we would like to know the sources of data used to arrive at the values in Table 4.3. Many of the values seem questionable and could not be verified during review for comment on this TMDL. E.g. The Florida Department of Health estimates 100 gallons of water per person per day water use, but the author uses the figure 70 gpp/d. Table 4.4 contains data from the AVMA Pet Ownership Source Book that is out of date. The website has the most up to date statistics.

<http://www.avma.org/reference/marketstats/sourcebook.asp>

FDEP Response: The Department is appreciative of the high level of assistance and cooperation provided by the Lee County Division of Natural Resources to-date in it's development of the TMDL and looks forward to continuation of that good working relationship. The Department appreciates any additional information that Lee County can provide to better reflect accurate septic tank coverages within the Hendry Creek watershed. A list or map of manhole covers can be incorporated into the TMDL document for this basin. If there is information on bird rookeries within the Hendry Creek watershed, it would be greatly appreciated to review prior to finalizing the TMDL report. The sources of data used in Table 4.3 will be provided accordingly. Table 4.4 will be revised to include the most up to date statistics provided that they constitute a significant change to the current statistics used in the TMDL report.



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
www2.dep.state.fl.us/water/