

FINAL

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Water Resource Management, Bureau of Watershed Management

SOUTHWEST DISTRICT

TAMPA BAY TRIBUTARIES BASIN

**TMDL Report
Fecal and Total Coliform TMDLs
for Flint Creek
(WBID 1522A)**

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September 2004

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Web sites

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

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

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 Tributaries Basin

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

Water Quality Assessment Report for the Tampa Bay Tributaries Basin

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

Allocation Technical Advisory Committee (ATAC) Report

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

U.S. Environmental Protection Agency

Region 4: Total Maximum Daily Loads in Florida
<http://www.epa.gov/region4/water/tmdl/florida/>

National STORET Program
<http://www.epa.gov/storet/>

Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Loads (TMDLs) for fecal and total coliforms for Flint Creek in the Hillsborough River watershed, within the Tampa Bay Tributaries Basin. The river was verified as impaired for fecal and total coliforms, and was included on the Verified List of impaired waters for the Tampa Bay Tributaries Basin that was adopted by Secretarial Order on May 27, 2004. Flint Creek is located in western Hillsborough County near Lake Thonotosassa (**Figure 1.1**). The TMDL establishes the allowable loadings to Flint Creek that would restore the waterbody so that it meets its applicable water quality criteria for fecal and total coliforms.

1.2 Identification of Waterbody

For assessment purposes, the Florida Department of Environmental Protection (the Department) has divided the Tampa Bay Tributaries Basin into water assessment polygons with a unique **waterbody identification** (WBID) number for each watershed or stream reach. The Tampa Bay Tributaries Basin has been divided into 277 segments, as shown in **Figure 1.1**, and this TMDL addresses the following WBID:

WBID 1522A, Flint Creek – for fecal and total coliforms.

The Flint Creek segment (WBID 1522A) is located in Hillsborough County, has a surface area of 4.2 square miles, and an overall drainage area of 60 square miles that reaches into Lake Thonotosassa, Campbell Branch, and Hollomans Branch (**Figure 1.2**). The river is 2.3 miles in length and flows from Lake Thonotosassa to the Hillsborough River. Tampa, a city of 303,447 (2000 U.S. Census) is approximately 14 miles southwest, and Plant City, a city of 29,915 (2000 U.S. Census), is approximately 8 miles southeast of Flint Creek. Along its length, Flint Creek exhibits characteristics associated with riverine aquatic environments. Additional information about the river's hydrology and geology are available in the Basin Status Report for the Tampa Bay Tributaries Basin (Florida Department of Environmental Protection, March 2003).

Figure 1.2. Location of the Tampa Bay Tributaries Basin and Major Geopolitical Features

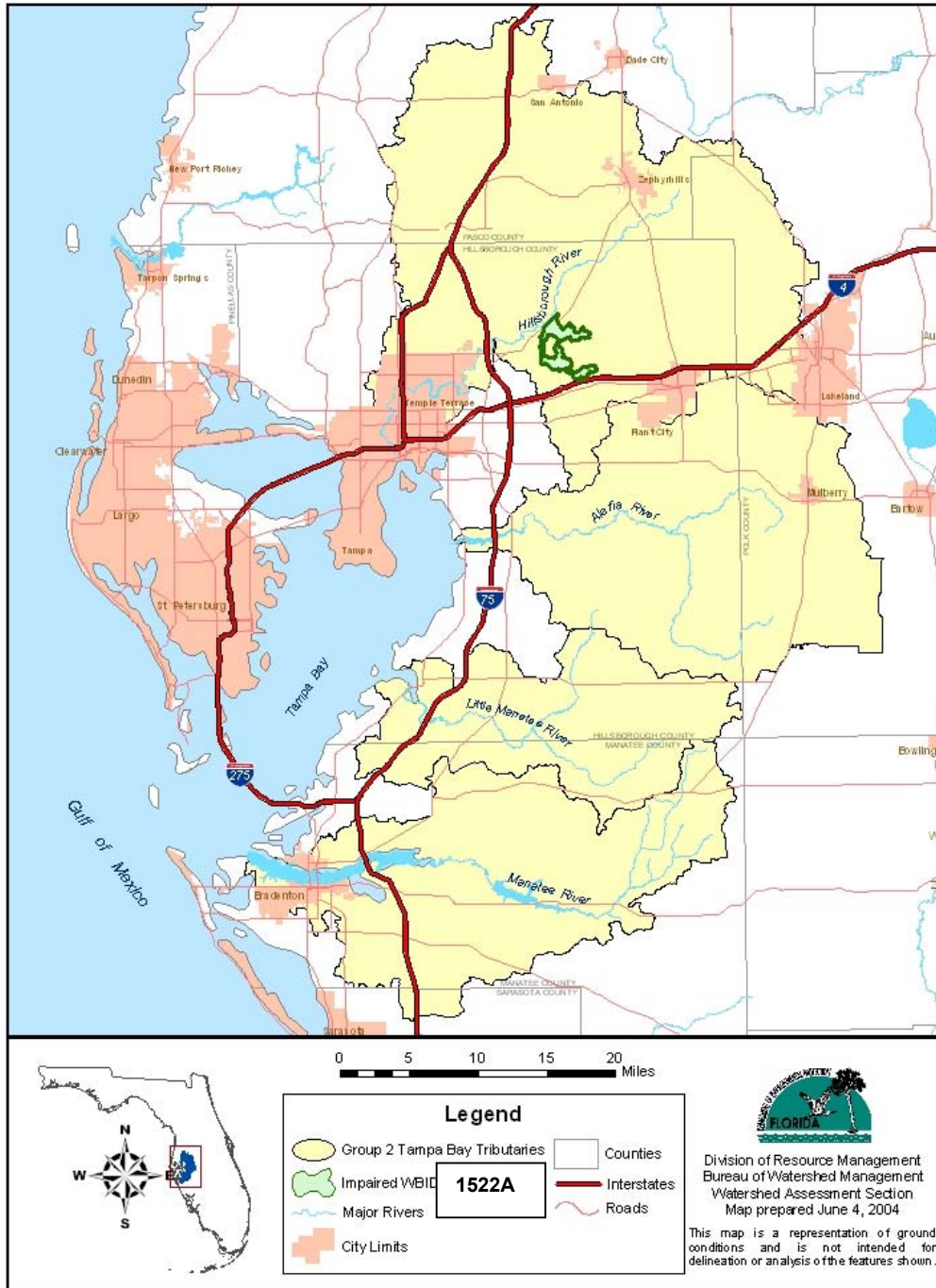
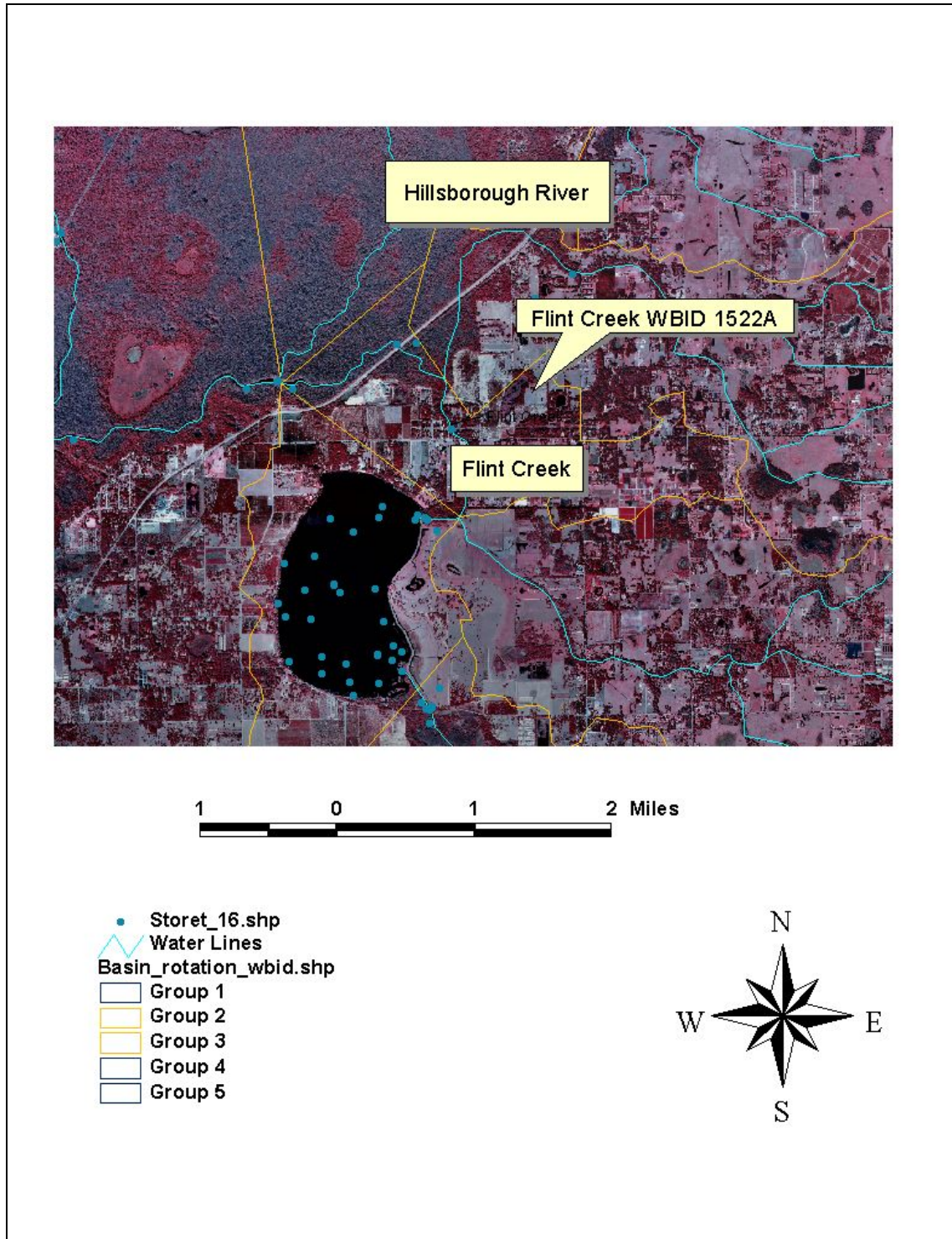


Figure 1.2. Location of Flint Creek, WBID 1522A, and Major Surface and Water Features in the Watershed



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 coliforms that caused the verified impairment of the Flint Creek waterbody segment WBID 1522A. These activities will depend heavily on the active participation of the Southwest Florida Water Management District, 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 source in each of these impaired waters on a schedule. The Department has developed such lists, commonly referred to as 303(d) lists, since 1992. The list of impaired waters in each basin, referred to as the Verified List, is also required by the FWRA (Subsection 403.067[4], Florida Statutes [F.S.]).

Florida's 1998 303(d) list included 43 waterbodies in the Tampa Bay Tributaries Basin. However, the FWRA (Section 403.067, F.S.) stated that all previous Florida 303(d) lists were for planning purposes only and directed the Department to develop, and adopt by rule, a new science-based methodology to identify impaired waters. After a long rule-making process, the Environmental Regulation Commission adopted the new methodology as Chapter 62-303, Florida Administrative Code (F.A.C.) (Identification of Impaired Surface Waters Rule, or IWR), in April 2001.

2.2 Information on Verified Impairment

Table 2.1 summarizes fecal and coliform measurements for the Flint Creek WBID during the planning and verified periods (Planning Period 1/1/1991 – 12/31/2000; Verified Period 1/1/1996 – 6/30/2003). Fecal and total coliform observations over the 1991 – 2002 period are plotted in **Figures 2.1** and **2.2**, respectively. The thresholds for impairment for both fecal and total coliforms were exceeded during both the planning and verified periods.

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 Tampa were also obtained and included in the analysis. **Tables 2.2** and **2.3**, respectively, present summary statistics by month and season for fecal and total coliform measurements. Historically (and during the period of this analysis), July through September are the months with the highest rainfall; July and September had the largest percent exceedance for fecal coliforms, while June and September had the largest percent exceedance for total coliforms. With respect to the seasonal statistics, summer (July – September) had the largest exceedance level for both fecal and total coliforms. This information is also shown graphically in **Figure 2.3**. Linear regression with the coliform exceedance percentage versus rainfall and/or month (or season) was not statistically significant at the 0.05 alpha level.

Table 2.1. Verified Fecal and Total Coliform Impairments for Flint Creek, WBID 1522A

| Type | Class | 1998 303(d) Parameters of Concern | Parameters Assessed Using the Impaired Surface Waters Rule | EPA's Integrated Report Category | Comment (# Exceedances/# Samples); PP=Planning Period, VP=Verified Period ⁽¹⁾ |
|--------|-------|-----------------------------------|--|----------------------------------|--|
| Stream | IIIF | Coliforms | Coliforms (Fecal Coliform) | Cat. 5 | PP - 38/113 Potentially impaired; VP - 18/77 Verified impaired |
| Stream | IIIF | Coliforms | Coliforms (Total Coliform) | Cat. 5 | PP - 34/119 Potentially impaired; VP - 21/71 Verified impaired |

(1) Planning Period (PP) – January 1, 1991 to December 31, 2000; Verified Period (VP) – January 1, 1996 to June 30, 2003.

F – Fresh water.

Figure 2.1. Fecal Coliform Observations in Flint Creek, WBID 1522A, January 1991 – December 2002

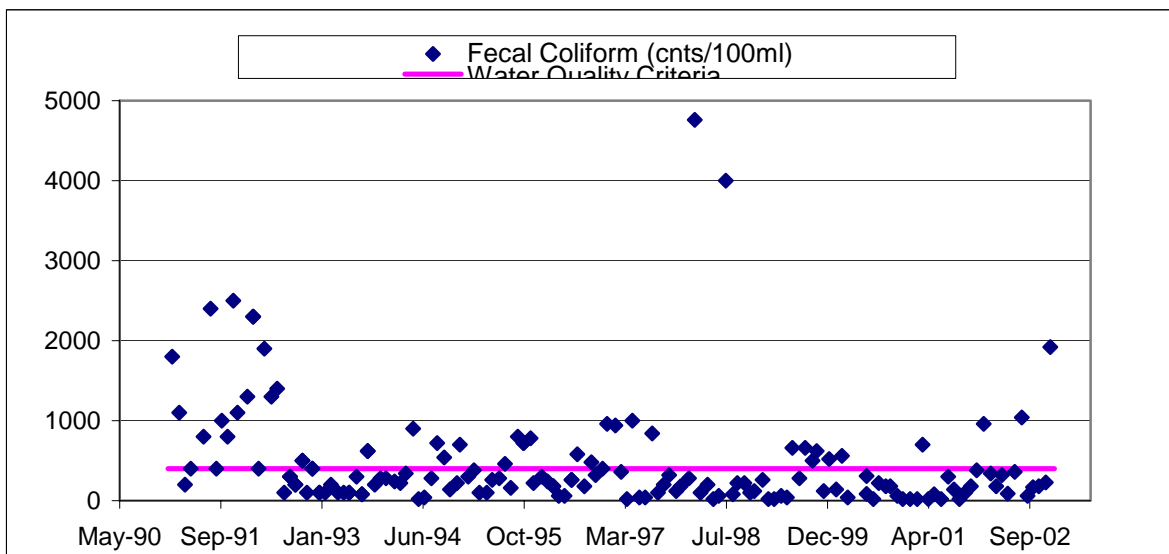


Figure 2.2. Total Coliform Observations in Flint Creek, WBID 1522A, January 1991 – December 2002

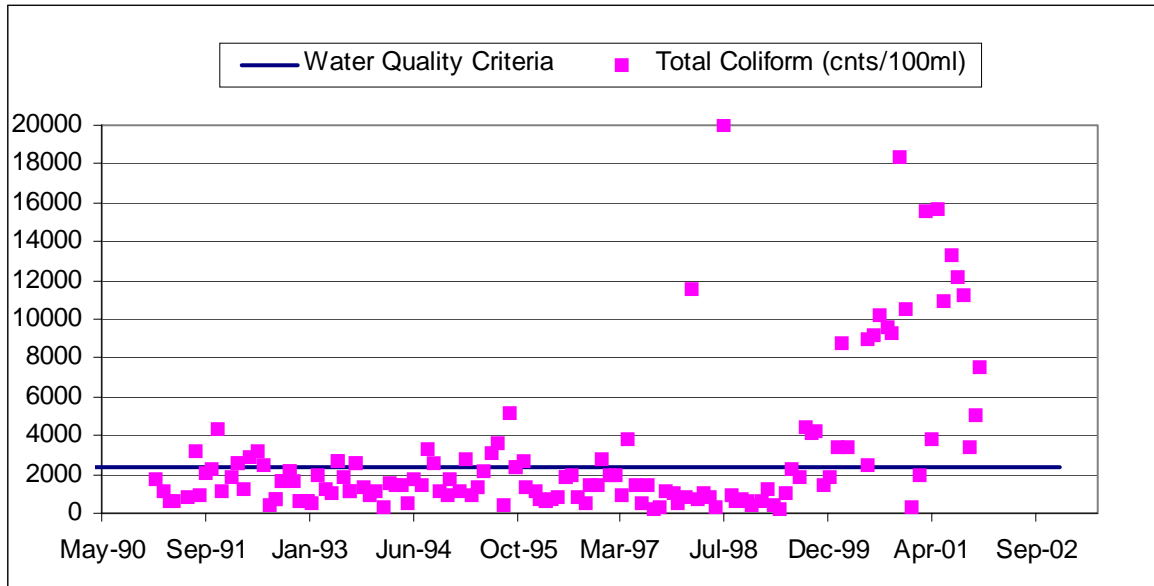


Table 2.2. Summary Statistics of Fecal Coliform Data for Flint Creek, WBID1522A, by Month and Season

| Month | No. of Cases | Minimum | Maximum | Median | Mean | # Exceedances | % Exceedances | Rainfall Mean |
|--------|--------------|---------|---------|--------|---------|---------------|---------------|---------------|
| 1 | 13 | 20 | 1800 | 280 | 518.46 | 4 | 30.77 | 2.95 |
| 2 | 13 | 20 | 4760 | 360 | 976.92 | 1 | 7.69 | 2.43 |
| 3 | 13 | 20 | 700 | 180 | 204.62 | 1 | 7.69 | 2.81 |
| 4 | 11 | 20 | 1900 | 200 | 460.00 | 3 | 27.27 | 2.60 |
| 5 | 11 | 20 | 30000 | 80 | 2910.00 | 2 | 18.18 | 1.65 |
| 6 | 15 | 20 | 1400 | 260 | 318.27 | 3 | 20.00 | 5.80 |
| 7 | 12 | 20 | 4000 | 380 | 883.33 | 6 | 50.00 | 7.05 |
| 8 | 14 | 60 | 720 | 170 | 248.57 | 2 | 14.29 | 7.40 |
| 9 | 14 | 20 | 1000 | 350 | 410.71 | 7 | 50.00 | 6.48 |
| 10 | 14 | 100 | 800 | 320 | 394.29 | 6 | 42.86 | 2.67 |
| 11 | 12 | 60 | 2500 | 200 | 424.17 | 2 | 16.67 | 1.15 |
| 12 | 13 | 20 | 1920 | 400 | 553.85 | 5 | 38.46 | 3.27 |
| Season | No. of Cases | Minimum | Maximum | Median | Mean | # Exceedances | % Exceedances | Rainfall Mean |
| Winter | 39 | 20 | 4760 | 240 | 566.67 | 10 | 25.64 | 2.73 |
| Spring | 37 | 20 | 30000 | 100 | 1130.92 | 8 | 21.62 | 3.62 |
| Summer | 40 | 20 | 4000 | 290 | 495.75 | 15 | 37.50 | 6.97 |
| Fall | 39 | 20 | 2500 | 280 | 456.67 | 13 | 33.33 | 2.40 |

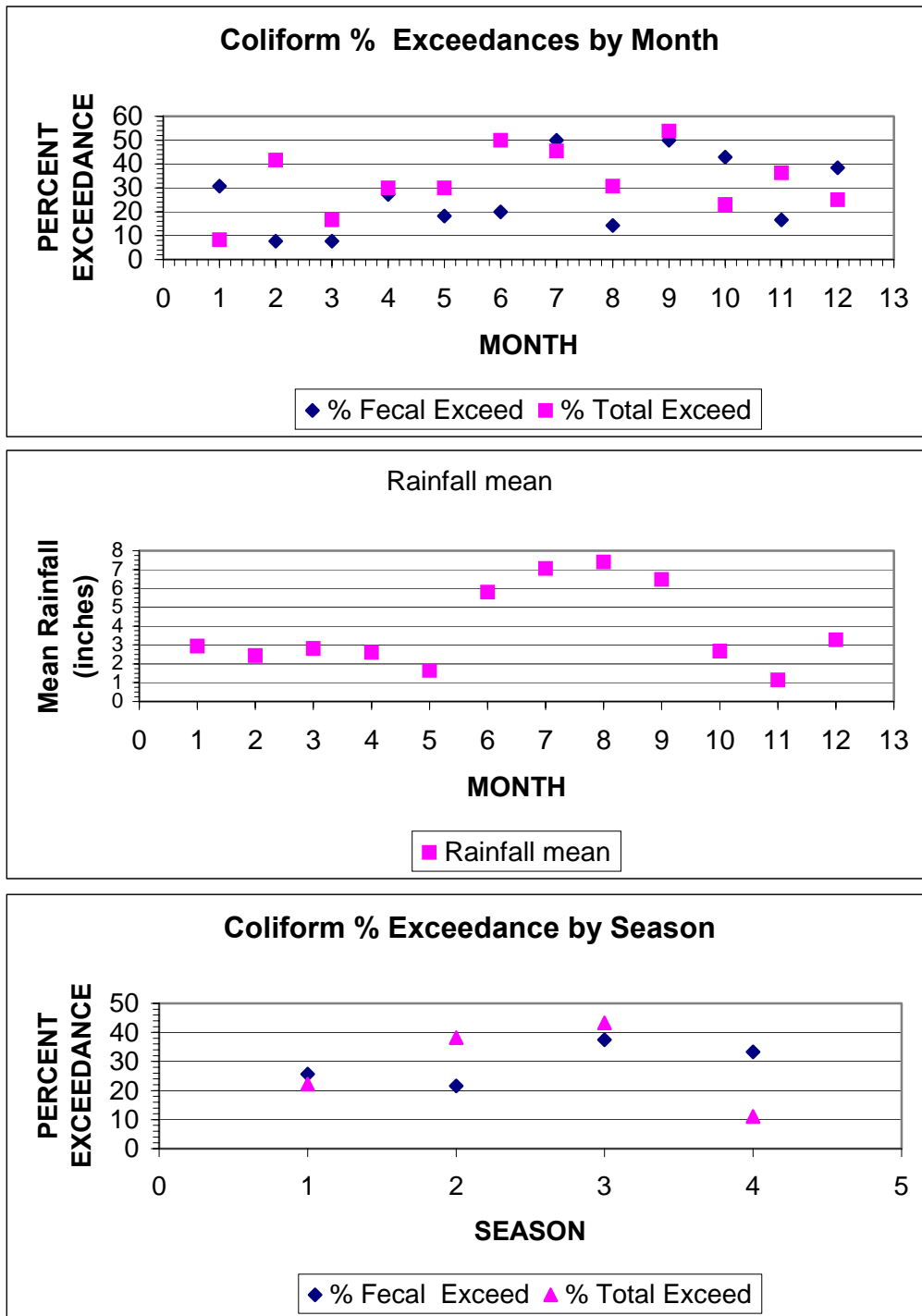
Fecal coliform units are colonies/100 mL. Rainfall units are inches per month.

Table 2.3. Summary Statistics of Total Coliform Data for Flint Creek, WBID 1522A, by Month and Season

| Month | No. of Cases | Minimum | Maximum | Median | Mean | # Exceedances | % Exceedances | Rainfall Mean |
|--------|--------------|---------|---------|--------|---------|---------------|---------------|---------------|
| 1 | 12 | 300 | 3400 | 3400 | 1208.33 | 1 | 8.33 | 2.95 |
| 2 | 12 | 500 | 11500 | 2000 | 3108.33 | 5 | 41.67 | 2.43 |
| 3 | 12 | 400 | 15600 | 900 | 2358.33 | 2 | 16.67 | 2.81 |
| 4 | 10 | 200 | 3800 | 1250 | 1690.00 | 3 | 30.00 | 2.60 |
| 5 | 10 | 500 | 30000 | 1200 | 5660.00 | 3 | 30.00 | 1.65 |
| 6 | 14 | 300 | 10900 | 2400 | 3064.29 | 7 | 50.00 | 5.80 |
| 7 | 11 | 400 | 20000 | 2000 | 5300.00 | 5 | 45.45 | 7.05 |
| 8 | 13 | 200 | 12200 | 900 | 2838.46 | 4 | 30.77 | 7.40 |
| 9 | 13 | 300 | 11200 | 2600 | 3446.15 | 7 | 53.85 | 6.48 |
| 10 | 13 | 700 | 9300 | 2200 | 2615.38 | 3 | 23.08 | 2.67 |
| 11 | 11 | 600 | 18400 | 1400 | 3481.82 | 4 | 36.36 | 1.15 |
| 12 | 12 | 400 | 10500 | 1200 | 2508.33 | 3 | 25.00 | 3.27 |
| Season | No. of Cases | Minimum | Maximum | Median | Mean | # Exceedances | % Exceedances | Rainfall Mean |
| Winter | 36 | 300 | 15600 | 1150 | 2225.00 | 8 | 22.22 | 2.73 |
| Spring | 34 | 200 | 30000 | 1850 | 3423.53 | 13 | 38.24 | 3.62 |
| Summer | 37 | 200 | 20000 | 1900 | 3783.78 | 16 | 43.24 | 6.97 |
| Fall | 36 | 400 | 18400 | 1500 | 2844.44 | 4 | 11.11 | 2.40 |

Total coliform units are colonies/100 mL. Rainfall units are inches per month.

Figure 2.3. Coliform Exceedances for Flint Creek, by Month and Season, and Corresponding Monthly Mean Rainfall, 1991 – 2002



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) |

The Flint 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 fecal and total coliforms.

3.2 Applicable Water Quality Standards and Numeric Water Quality Target

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., are as follows:

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 the TMDLs (as described in subsequent sections), 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 TMDLs was not to exceed 400 in 10 percent of the samples.

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 nutrients in the Flint Creek watershed and the amount of pollutant loading contributed by each of these sources. Sources are broadly classified as either “point sources” or “nonpoint sources.” Historically, the term point sources has meant discharges to surface waters that typically have a continuous flow via a discernable, confined, and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) are examples of traditional point sources. In contrast, the term “nonpoint sources” was used to describe intermittent, rainfall driven, diffuse sources of pollution associated with everyday human activities, including runoff from urban land uses, agriculture, silviculture, and mining; discharges from failing septic systems; and atmospheric deposition.

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

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

4.2 Potential Sources of Coliform Bacteria in the Flint Creek Watershed

4.2.1 Point Sources

No permitted wastewater treatment facilities discharge bacterial loads either directly or indirectly into the Flint Creek watershed.

Municipal Separate Storm Sewer System Permittees

Phase 1 or Phase 2 MS4s. Within Hillsborough County, the stormwater collection systems owned and operated by Hillsborough County Public Works, the city of Plant City, and the Florida

Department of Transportation) District 7 are covered by an NPDES Municipal Separate Storm Sewer System (MS4) permit (Phase I Permit Number FLS000006).

4.2.2 Land Uses and Nonpoint Sources

Additional coliform bacteria loadings to Flint Creek are generated from nonpoint sources in the watershed. Potential nonpoint sources of coliforms include loadings from surface runoff, wildlife, livestock, pets, and leaking septic tanks.

Land Uses

The spatial distribution and acreage of different land use categories were identified using the 1999 land use 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 codes tabulated in **Table 4.1a** (**Table 4.1b** lists land use aggregated to Level 3). **Figure 4.1** shows the acreage of the principal land uses in the watershed. At the Level 1 aggregation, over 47 percent of the WBID was in cropland and pastureland, followed by nearly 27 percent in low-density residential. Approximately 18 percent of the land use was categorized as stream and lake swamps. At Level 3, the cropland and pastureland category is represented by three primary uses: tree crops (24 percent), cropland and pastureland (18 percent), and nurseries and vineyards (3.8 percent).

Table 4.1a. Level 1 Land Use Summary for Flint Creek, WBID 1522A

WBID 1522A, Level 1 Land Use, 1999

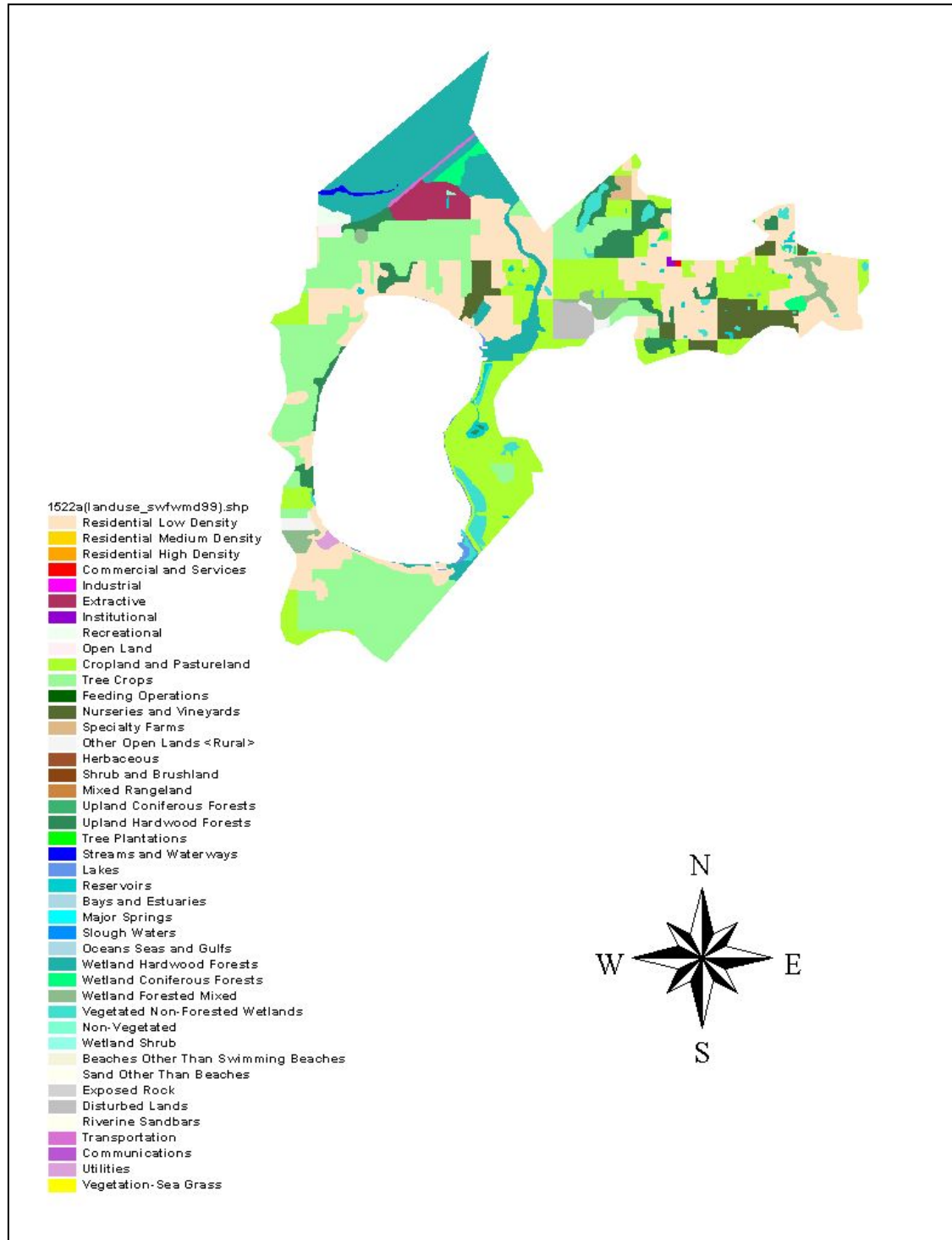
| Level 1 | Count (polygons) | Attribute | Perimeter (meters) | Area (square meters) | Area (acres) | Area (square miles) | Percentage |
|---------|------------------|--|--------------------|----------------------|---------------|---------------------|---------------|
| 1000 | 22 | Residential Low Density < 2 Dwelling Units | 51,426.75 | 2,906,391.85 | 717.9 | 1.1213 | 26.62 |
| 2000 | 41 | Cropland and Pastureland | 73,555.12 | 5,169,101.05 | 1,276.8 | 1.9943 | 47.35 |
| 4000 | 13 | Hardwood Conifer Mixed | 16,362.15 | 509,984.09 | 126.0 | 0.1968 | 4.67 |
| 5000 | 48 | Streams and Waterways | 15,815.44 | 137,025.56 | 33.8 | 0.0529 | 1.26 |
| 6000 | 47 | Stream and Lake Swamps (bottomland) | 39,204.17 | 1,998,322.39 | 493.6 | 0.7710 | 18.30 |
| 7000 | 1 | Disturbed Land | 1,451.05 | 136,146.96 | 33.6 | 0.0525 | 1.25 |
| 8000 | 2 | Transportation | 2,972.85 | 60,424.34 | 14.9 | 0.0233 | 0.55 |
| | | TOTAL | 200787.52 | 10917396.24 | 2696.6 | 4.2121 | 100.00 |

Table 4.1b. Level 3 Land Use Summary for Flint Creek, WBID 1522A

WBID 1522A, Level 3 Land Use, 1999

| Level 3 | Count (polygons) | Attribute | Perimeter (meters) | Area (square meters) | Area (acres) | Area (square miles) | Percentage |
|---------|------------------|--|--------------------|----------------------|----------------|---------------------|---------------|
| 1100 | 16 | Residential Low Density < 2 Dwelling Units | 46,501.52 | 2,577,948.42 | 636.8 | 0.9946 | 23.61 |
| 1400 | 1 | Commercial and Services | 250.53 | 3,895.80 | 1.0 | 0.0015 | 0.04 |
| 1600 | 2 | Extractive | 2,615.78 | 241,363.32 | 59.6 | 0.0931 | 2.21 |
| 1700 | 1 | Institutional | 337.94 | 6,324.17 | 1.6 | 0.0024 | 0.06 |
| 1800 | 1 | Recreational | 986.13 | 48,176.40 | 11.9 | 0.0186 | 0.44 |
| 1900 | 1 | Open Land | 734.85 | 28,683.74 | 7.1 | 0.0111 | 0.26 |
| 2100 | 16 | Cropland and Pastureland | 35,295.97 | 1,965,956.08 | 485.6 | 0.7585 | 18.01 |
| 2140 | 2 | Row Crops | 1,566.34 | 55,693.18 | 13.8 | 0.0215 | 0.51 |
| 2200 | 14 | Tree Crops | 25,853.31 | 2,626,704.55 | 648.8 | 1.0134 | 24.06 |
| 2400 | 5 | Nurseries and Vineyards | 7,762.67 | 416,357.48 | 102.8 | 0.1606 | 3.81 |
| 2500 | 1 | Specialty Farms | 1,004.28 | 39,583.84 | 9.8 | 0.0153 | 0.36 |
| 2600 | 3 | Other Open Lands <rural> | 2,072.56 | 64,805.92 | 16.0 | 0.0250 | 0.59 |
| 4340 | 12 | Hardwood Conifer Mixed | 16,260.23 | 509,530.84 | 125.9 | 0.1966 | 4.67 |
| 4400 | 1 | Tree Plantations | 101.92 | 453.25 | 0.1 | 0.0002 | 0.00 |
| 5100 | 1 | Streams and Waterways | 1,739.82 | 26,677.05 | 6.6 | 0.0103 | 0.24 |
| 5200 | 26 | Lakes | 8,067.25 | 35,229.48 | 8.7 | 0.0136 | 0.32 |
| 5300 | 21 | Reservoirs | 6,008.37 | 75,119.03 | 18.6 | 0.0290 | 0.69 |
| 6150 | 7 | Stream and Lake Swamps (bottomland) | 17,540.92 | 1,421,889.02 | 351.2 | 0.5486 | 13.02 |
| 6200 | 3 | Wetland Coniferous Forests | 663.63 | 7,304.61 | 1.8 | 0.0028 | 0.07 |
| 6210 | 3 | Cypress | 2,531.29 | 98,562.00 | 24.3 | 0.0380 | 0.90 |
| 6300 | 4 | Wetland Forested Mixed | 5,841.34 | 219,392.66 | 54.2 | 0.0846 | 2.01 |
| 6410 | 15 | Freshwater Marshes | 6,397.80 | 164,389.65 | 40.6 | 0.0634 | 1.51 |
| 6430 | 1 | Wet Prairies | 151.49 | 1,622.34 | 0.4 | 0.0006 | 0.01 |
| 6440 | 13 | Emergent Aquatic Vegetation | 5,828.58 | 81,724.04 | 20.2 | 0.0315 | 0.75 |
| 6530 | 1 | Intermittent Ponds | 249.12 | 3,438.07 | 0.8 | 0.0013 | 0.03 |
| 7400 | 1 | Disturbed Land | 1,451.05 | 136,146.96 | 33.6 | 0.0525 | 1.25 |
| 8100 | 1 | Transportation | 2,300.60 | 35,347.71 | 8.7 | 0.0136 | 0.32 |
| 8300 | 1 | Utilities | 672.25 | 25,076.64 | 6.2 | 0.0097 | 0.23 |
| | | TOTAL | 200,787.52 | 10,917,396.24 | 2,696.6 | 4.2121 | 100.00 |

Figure 4.1. Principal Land Uses in the Flint Creek Watershed



Population

According to the U.S Census Bureau, the population density in and around WBID 1522A in the year 2000 ranged between 289 and 444 people per square mile (10 person/mi² is the minimum used by the Census Bureau) (U.S. Census Bureau, 2004) (**Figure 4.2**). The Bureau reports that, in the area of WBID 1522A, the number of people per household ranged between 2.62 and 2.85 (**Figure 4.3**). Based on these statistics, the density of homes was between 101 and 169 homes per square mile. According to the 1999 land use summary, approximately 27 percent of the area in WBID 1522A was in the residential category.

Figure 4.2. Population Density in the Flint Creek Area, Based on the 2000 U.S. Census

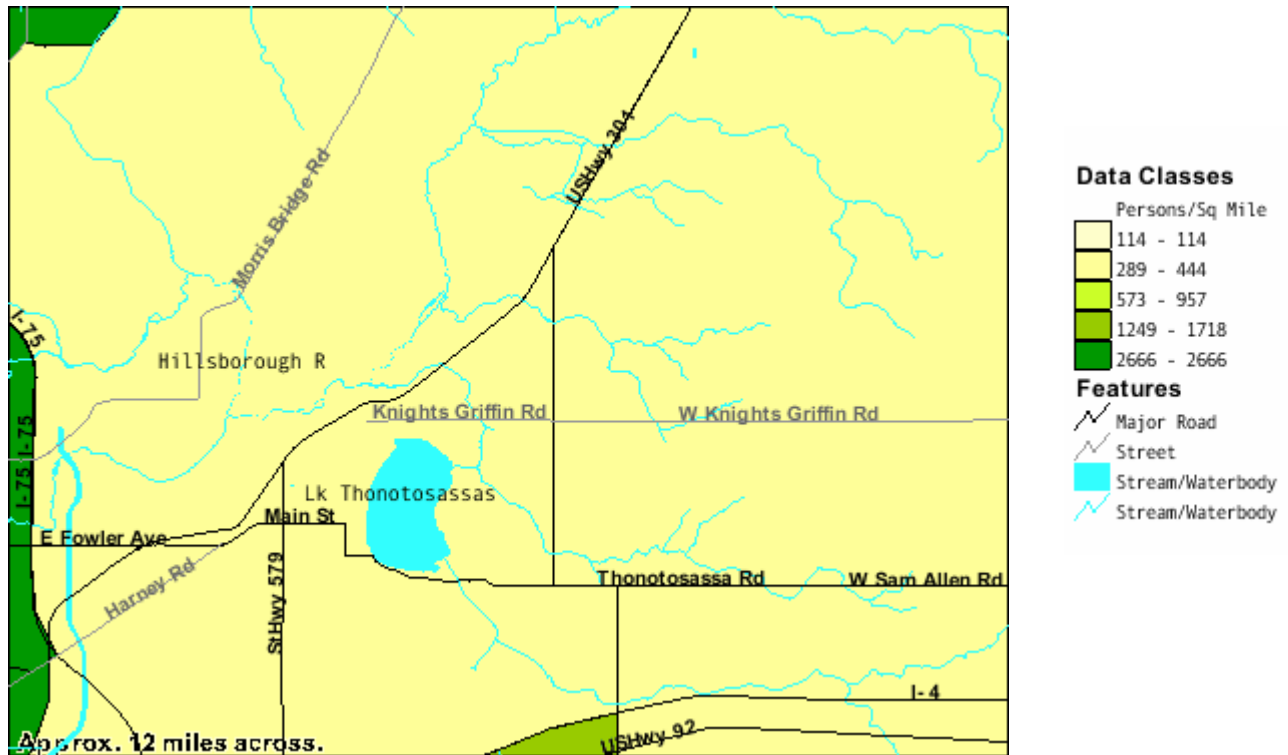
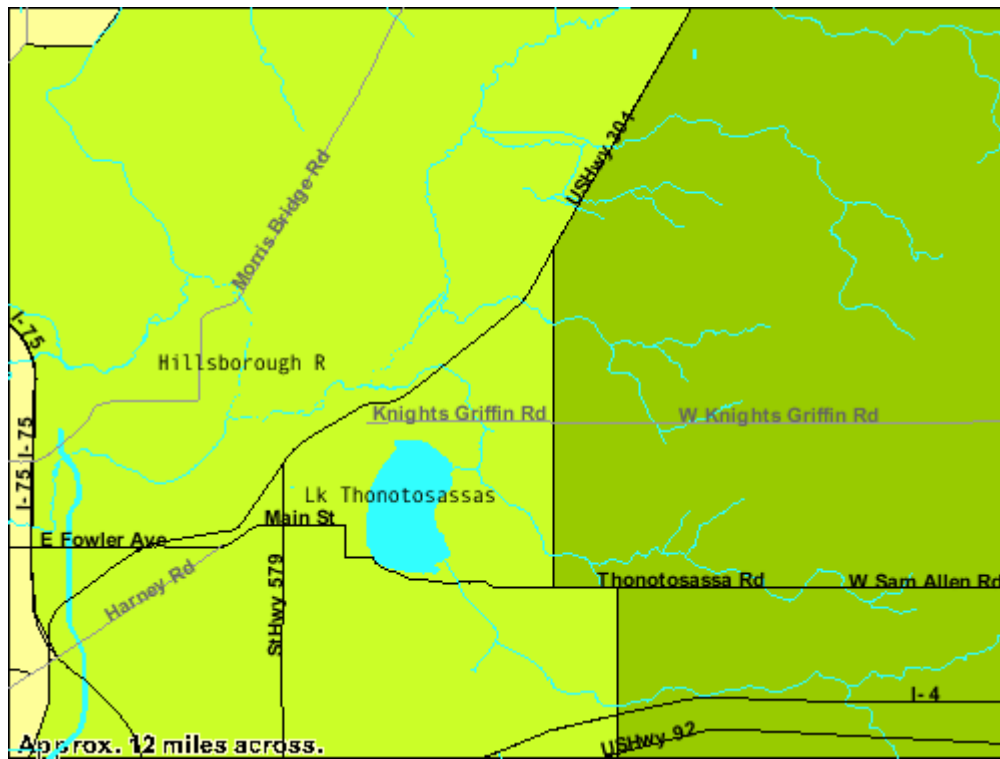


Figure 4.3. Persons Per Household in the Flint Creek Area, Based on the 2000 U.S. Census



Data Classes

Persons

| | |
|-----------------|-------------|
| Lightest Yellow | 2.07 - 2.07 |
| Light Yellow | 2.38 - 2.38 |
| Yellow-Green | 2.62 - 2.73 |
| Green | 2.77 - 2.85 |
| Darkest Green | 3.09 - 3.09 |

Features

- Major Road
- Street
- Stream/Waterbody
- Stream/Waterbody

Septic Tanks

The Florida Department of Health (FDOH) reports that as of fiscal year 2002, there were potentially as many as 100,483 permitted septic tanks in Hillsborough County (Florida Department of Health Web site, 2004) (**Table 4.2**). The word potential is used, since the total starts with the 1970 census (51,500) and does not incorporate reductions in septic tank numbers as a result of connections to centralized sewer systems. From 1993 – 2002, 9,140 permits for repairs were issued (Florida Department of Health Web site, 2004) (**Table 4.2**).

Table 4.2. Hillsborough County Septic Tank Installation and Repair Statistics

| Years | Septic Tanks Installed | Years | Septic Tanks Repaired |
|---------------|------------------------|---------|-----------------------|
| 1970 (Census) | 51,500 | 1991–92 | 0 |
| 1971 | 1,391 | 1992–93 | |
| 1972 | 1,362 | 1993–94 | 986 |
| 1973 | 549 | 1994–95 | 994 |
| 1974 | 2,861 | 1995–96 | 1,009 |
| 1975 | 2,343 | 1996–97 | 1,129 |
| 1976 | 3,991 | 1997–98 | 1,110 |
| 1977 | 1,171 | 1998–99 | 1,138 |
| 1978 | 4,268 | 1999–00 | 934 |
| 1979 | 1,909 | 2000–01 | 927 |
| 1980 | 2,331 | 2001–02 | 913 |
| 1981 | 1,928 | | |
| 1982 | 1,198 | | |
| 1983 | 1,640 | | |
| 1984 | 1,840 | | |
| 1985 | 2,326 | | |
| 1986 | 1,515 | | |
| 1987 | 1,550 | | |
| 1988 | 1,546 | | |
| 1989 | 1,373 | | |
| 1990 | 947 | | |
| 1991 (1/2) | | | |
| 1991–92 | 866 | | |
| 1992–93 | 884 | | |
| 1993–94 | 898 | | |
| 1994–95 | 925 | | |
| 1995–96 | 894 | | |
| 1996–97 | 1,012 | | |
| 1997–98 | 918 | | |
| 1998–99 | 1,217 | | |
| 1999–00 | 1,203 | | |

| Years | Septic Tanks Installed | Years | Septic Tanks Repaired |
|-------------------|------------------------|-------|-----------------------|
| 2000-01 | 1,123 | | |
| 2001-02 | 1,004 | | |
| CUMULATIVE | 100,483 | | |

WBID 1522A comprises 4.2 square miles. Based on the earlier estimated housing density of 101 to 169 homes per square mile, this would yield an estimated 424 to 710 septic tanks in WBID 1522A (assuming that centralized sewer collection systems are not present in the WBID).

As a first attempt at estimating the number of failing septic tanks in the WBID, the number of septic tank repairs was divided by the number of permitted septic tanks (**Table 4.2**) to obtain a failure rate of 9.1 percent. An earlier comment noted that the sum of permitted septic tanks does not necessarily reflect the current number. Similarly, the previous calculation represented two different time periods and also assumed that repairs were equally distributed across the county (certain areas may have much higher failure rates due to the age of the system, soil types, or ground water table). Applying the 9.1 percent failure rate would result in an estimate of between 38 and 65 failing septic systems in the WBID. Using this number, and assuming water use of 70 gallons per day per person (U.S. Environmental Protection Agency, 2001), 2.75 persons per home, and a fecal coliform concentration of 1×10^6 colonies/100 mL, a loading of 2.77 to 4.74×10^{11} colonies/day is derived.

Livestock

Another potential nonpoint source of coliforms includes livestock and other agricultural animals. **Table 4.3a** summarizes cattle populations in Hillsborough County from 1993 to 2002, and **Table 4.3b** summarizes populations of other agricultural animals in the county in 1992 and 1997. Hillsborough County ranked as the ninth highest county in the state in terms of the number of cattle and calves and beef cows. Over 18 percent of WBID 1522A is specifically categorized as cropland and pastureland under the Level 3 land use system.

Table 4.3a. Summary of Cattle Populations in Hillsborough County, 1993 - 2002

| Year | Number of Milk Cows | Number of Cattle and Calves | Number of Beef Cows |
|------|---------------------|-----------------------------|---------------------|
| 1993 | 7,500 | 72,000 | 36,000 |
| 1994 | 7,200 | 75,000 | 35,000 |
| 1995 | 7,400 | 74,000 | 35,000 |
| 1996 | 6,500 | 76,000 | 37,000 |
| 1997 | 6,100 | 74,000 | 35,000 |
| 1998 | 4,400 | 68,000 | 35,000 |
| 1999 | 5,000 | 67,000 | 34,000 |
| 2000 | 4,500 | 68,000 | 36,000 |
| 2001 | 4,500 | 66,000 | 34,000 |

| Year | Number of Milk Cows | Number of Cattle and Calves | Number of Beef Cows |
|------|---------------------|-----------------------------|---------------------|
| 2002 | 4,500 | 66,000 | 32,000 |

Source: Florida Agricultural Fast Facts, 2003.

Table 4.3b. Summary of Agricultural Animal Populations (Excluding Cattle) in Hillsborough County, 1992 and 1997

| | Year | |
|---------------------------------------|-----------|-----------|
| | 1992 | 1997 |
| Hogs and Pigs | 5,143 | 3,567 |
| Poultry | | |
| Layers and pullets 13 weeks and older | 2,014,553 | 1,409,342 |
| Layers and pullets 20 weeks and older | 1,898,300 | 1,009,154 |
| Sheep and Lambs | 432 | 285 |
| Horses | | 2,754 |
| Milk Goats | | 47 |
| Goats, except Angora and Milk | | 970 |
| Ducks | | 163 |
| Geese | | 159 |
| Pheasants | | 47 |
| Other Poultry | | 344 |
| Mules, Burros, and Donkeys | | 94 |
| Rabbits | | 1,121 |

Source: U.S. Department of Agriculture, 1997.

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

A simple approach was used for this TMDL. The TMDL was based on analyzing observations that exceeded the fecal or total criterion, and for each exceedance, the percent reduction necessary to meet the respective criterion was calculated. The individual percent reductions were ranked, and the median became the TMDL target.

Although some flow information was available for this WBID (U.S. Geological Survey [USGS] Gage 02303300), the flow record was limited to the period from January 1, 1990, to September 30, 1991. Extending the flow record using another gauging station with a long period of record was considered inappropriate, because a large portion of the drainage area for the Flint Creek gage is Lake Thonotosassa and drainage to the lake. Hydrologically, the lake could significantly influence runoff events, and the resulting stream flow would not be represented by the use of another stream gauging station and the application of a drainage ratio to adjust flows.

5.1.1 Data Used in the Determination of the TMDLs

There are four sampling stations in WBID 1522A that have historical observations (**Figure 5.1**). The primary data collector is the Hillsborough County Environmental Protection Commission, which has maintained a routine sampling site at the U.S. 301 bridge crossing of Flint Creek (STORET ID: 21FLHILL 148, or 21FLHILL24030007). The site was sampled on a monthly basis from January 22, 1991, through December 10, 2002. **Table 5.1** provides a brief statistical overview of the observed data at these sites. **Appendix B** contains the historical observations and cumulative frequency plots from the sites.

Figure 5.1. Historical Monitoring Sites in Flint Creek, WBID 1522A

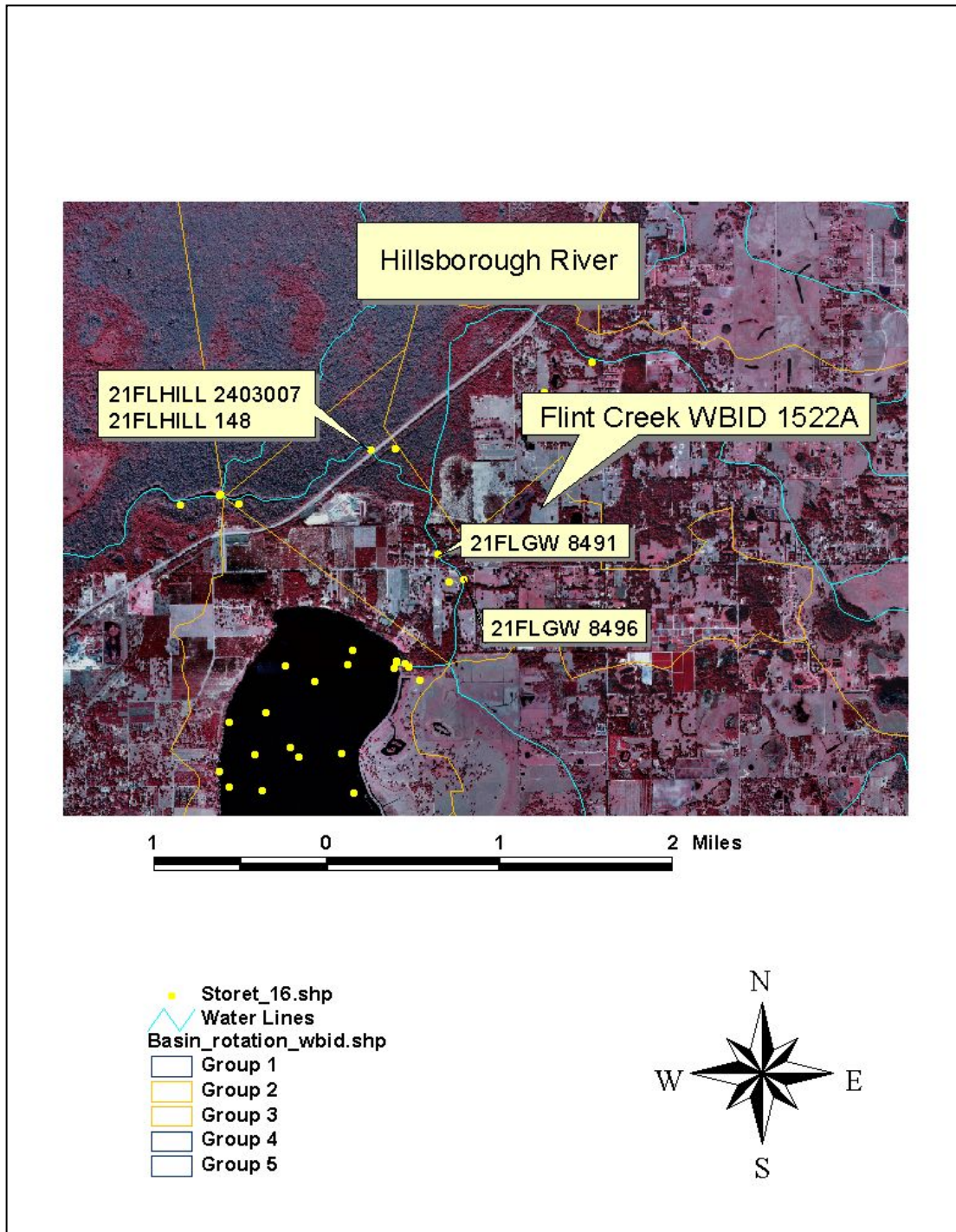


Table 5.1. Statistical Summary of Fecal and Total Coliform Data for Flint Creek, WBID 1522A

| Statistics | Fecal Coliforms | Total Coliforms |
|--------------------|-----------------|-----------------|
| No. of cases | 155 | 143 |
| Minimum | 20 | 200 |
| Maximum | 30000 | 30000 |
| Median | 260 | 1600 |
| Mean | 655.3806452 | 3069.230769 |
| Standard Deviation | 2463.524648 | 4337.183333 |
| N 1 of 10 | 40 | 500 |
| N 2 of 10 | 100 | 700 |
| N 3 of 10 | 120 | 940 |
| N 4 of 10 | 200 | 1200 |
| N 5 of 10 | 260 | 1600 |
| N 6 of 10 | 305 | 2000 |
| N 7 of 10 | 400 | 2600 |
| N 8 of 10 | 700 | 3400 |
| N 9 of 10 | 1040 | 9220 |

5.1.2 TMDL Development Process

As described in **Section 5.1**, tables of observations that exceeded the respective fecal or total coliform criterion were constructed, and the percent reduction necessary for each observation to achieve the appropriate criterion was calculated using the expression:

$$\frac{[(\text{observed concentration}) - (\text{allowable concentration})] \times 100}{(\text{observed concentration})}$$

Tables 5.2 and 5.3 summarize the individual calculations and the overall average reductions in fecal and total coliforms necessary to meet the respective criterion.

Table 5.2. Calculation of Percent Reduction in Fecal Coliforms Necessary To Meet Water Quality Standard of 400 Colonies/100 mL in Flint Creek, WBID 1522A

| Date | Station | Fecal Coliform | % Reduction |
|-----------|------------------|----------------|-------------|
| 1/22/1991 | 21FLHILL24030007 | 1800 | 77.78 |
| 2/25/1991 | 21FLHILL24030007 | 1100 | 63.64 |
| 5/21/1991 | 21FLHILL24030007 | 30000 | 98.67 |
| 6/25/1991 | 21FLHILL24030007 | 800 | 50.00 |
| 7/30/1991 | 21FLHILL24030007 | 2400 | 83.33 |

| Date | Station | Fecal Coliform | % Reduction |
|------------|------------------|----------------|-------------|
| 9/24/1991 | 21FLHILL24030007 | 1000 | 60.00 |
| 10/22/1991 | 21FLHILL24030007 | 800 | 50.00 |
| 11/19/1991 | 21FLHILL24030007 | 2500 | 84.00 |
| 12/10/1991 | 21FLHILL24030007 | 1100 | 63.64 |
| 1/28/1992 | 21FLHILL24030007 | 1300 | 69.23 |
| 2/25/1992 | 21FLHILL24030007 | 2300 | 82.61 |
| 2/25/1992 | 21FLHILL24030007 | 2300 | 82.61 |
| 4/21/1992 | 21FLHILL24030007 | 1900 | 78.95 |
| 5/26/1992 | 21FLHILL24030007 | 1300 | 69.23 |
| 6/23/1992 | 21FLHILL24030007 | 1400 | 71.43 |
| 10/27/1992 | 21FLHILL24030007 | 500 | 20.00 |
| 10/27/1992 | 21FLHILL24030007 | 500 | 20.00 |
| 9/14/1993 | 21FLHILL24030007 | 620 | 35.48 |
| 9/14/1993 | 21FLHILL24030007 | 620 | 35.48 |
| 4/26/1994 | 21FLHILL24030007 | 900 | 55.56 |
| 8/23/1994 | 21FLHILL24030007 | 720 | 44.44 |
| 9/27/1994 | 21FLHILL24030007 | 540 | 25.93 |
| 12/13/1994 | 21FLHILL24030007 | 700 | 42.86 |
| 7/25/1995 | 21FLHILL24030007 | 460 | 13.04 |
| 9/26/1995 | 21FLHILL24030007 | 800 | 50.00 |
| 10/24/1995 | 21FLHILL24030007 | 720 | 44.44 |
| 10/24/1995 | 21FLHILL24030007 | 720 | 44.44 |
| 11/28/1995 | 21FLHILL24030007 | 780 | 48.72 |
| 7/16/1996 | 21FLHILL24030007 | 580 | 31.03 |
| 9/24/1996 | 21FLHILL24030007 | 480 | 16.67 |
| 12/10/1996 | 21FLHILL24030007 | 960 | 58.33 |
| 1/21/1997 | 21FLHILL24030007 | 940 | 57.45 |
| 4/15/1997 | 21FLHILL24030007 | 1000 | 60.00 |
| 7/22/1997 | 21FLHILL24030007 | 840 | 52.38 |
| 2/17/1998 | 21FLHILL24030007 | 4760 | 91.60 |
| 7/21/1998 | 21FLHILL24030007 | 4000 | 90.00 |
| 6/15/1999 | 21FLHILL148 | 660 | 39.39 |
| 8/17/1999 | 21FLHILL148 | 660 | 39.39 |
| 9/22/1999 | 21FLHILL148 | 500 | 20.00 |
| 10/12/1999 | 21FLHILL148 | 620 | 35.48 |
| 12/14/1999 | 21FLHILL148 | 520 | 23.08 |
| 2/15/2000 | 21FLHILL148 | 560 | 28.57 |
| 3/20/2001 | 21FLHILL148 | 700 | 42.86 |
| 1/15/2002 | 21FLHILL148 | 960 | 58.33 |
| 7/23/2002 | 21FLHILL148 | 1040 | 61.54 |

| Date | Station | Fecal Coliform | % Reduction |
|-----------------------------|-------------|----------------|-------------|
| 12/10/2002 | 21FLHILL148 | 1920 | 79.17 |
| MEDIAN % REDUCTION = | | | 51.2 |

Table 5.3. Calculation of Percent Reduction in Total Coliforms Necessary To Meet Water Quality Standard of 2,400 colonies/100 mL. Observed Data for Calculating Exceedances to the State Criterion for Total Coliforms for Flint Creek, WBID1522A

| Date | Station | Total Coliform | % Reduction |
|-----------------|------------------|----------------|-------------|
| 6/23/1992 0:00 | 21FLHILL24030007 | 2500 | 4.00 |
| 6/15/2000 0:00 | 21FLGW 8491 | 2500 | 4.00 |
| 2/25/1992 0:00 | 21FLHILL24030007 | 2600 | 7.69 |
| 2/25/1992 0:00 | 21FLHILL24030007 | 2600 | 7.69 |
| 9/14/1993 0:00 | 21FLHILL24030007 | 2600 | 7.69 |
| 9/14/1993 0:00 | 21FLHILL24030007 | 2600 | 7.69 |
| 9/27/1994 0:00 | 21FLHILL24030007 | 2600 | 7.69 |
| 6/15/1993 0:00 | 21FLHILL24030007 | 2700 | 11.11 |
| 6/15/1993 0:00 | 21FLHILL24030007 | 2700 | 11.11 |
| 11/28/1995 0:00 | 21FLHILL24030007 | 2700 | 11.11 |
| 2/21/1995 0:00 | 21FLHILL24030007 | 2800 | 14.29 |
| 12/10/1996 0:00 | 21FLHILL24030007 | 2800 | 14.29 |
| 4/21/1992 0:00 | 21FLHILL24030007 | 2900 | 17.24 |
| 6/27/1995 0:00 | 21FLHILL24030007 | 3100 | 22.58 |
| 7/30/1991 0:00 | 21FLHILL24030007 | 3200 | 25.00 |
| 5/26/1992 0:00 | 21FLHILL24030007 | 3200 | 25.00 |
| 8/23/1994 0:00 | 21FLHILL24030007 | 3300 | 27.27 |
| 1/18/2000 0:00 | 21FLHILL148 | 3400 | 29.41 |
| 3/14/2000 0:00 | 21FLHILL148 | 3400 | 29.41 |
| 10/16/2001 0:00 | 21FLHILL148 | 3400 | 29.41 |
| 7/25/1995 0:00 | 21FLHILL24030007 | 3600 | 33.33 |
| 4/15/1997 0:00 | 21FLHILL24030007 | 3800 | 36.84 |
| 4/17/2001 0:00 | 21FLHILL148 | 3800 | 36.84 |
| 9/22/1999 0:00 | 21FLHILL148 | 4100 | 41.46 |
| 10/12/1999 0:00 | 21FLHILL148 | 4200 | 42.86 |
| 11/19/1991 0:00 | 21FLHILL24030007 | 4300 | 44.19 |
| 8/17/1999 0:00 | 21FLHILL148 | 4400 | 45.45 |
| 11/13/2001 0:00 | 21FLHILL148 | 5100 | 52.94 |

| Date | Station | Total Coliform | % Reduction |
|-----------------------------|------------------|----------------|-------------|
| 9/26/1995 0:00 | 21FLHILL24030007 | 5200 | 53.85 |
| 12/11/2001 0:00 | 21FLHILL148 | 7500 | 68.00 |
| 2/15/2000 0:00 | 21FLHILL148 | 8800 | 72.73 |
| 6/15/2000 0:00 | 21FLGW 8496 | 9000 | 73.33 |
| 7/18/2000 0:00 | 21FLHILL148 | 9200 | 73.91 |
| 10/10/2000 0:00 | 21FLHILL148 | 9300 | 74.19 |
| 9/19/2000 0:00 | 21FLHILL148 | 9600 | 75.00 |
| 8/15/2000 0:00 | 21FLHILL148 | 10200 | 76.47 |
| 12/12/2000 0:00 | 21FLHILL148 | 10500 | 77.14 |
| 6/19/2001 0:00 | 21FLHILL148 | 10900 | 77.98 |
| 9/18/2001 0:00 | 21FLHILL148 | 11200 | 78.57 |
| 2/17/1998 0:00 | 21FLHILL24030007 | 11500 | 79.13 |
| 8/21/2001 0:00 | 21FLHILL148 | 12200 | 80.33 |
| 7/24/2001 0:00 | 21FLHILL148 | 13300 | 81.95 |
| 3/20/2001 0:00 | 21FLHILL148 | 15600 | 84.62 |
| 5/15/2001 0:00 | 21FLHILL148 | 15700 | 84.71 |
| 11/14/2000 0:00 | 21FLHILL148 | 18400 | 86.96 |
| 7/21/1998 0:00 | 21FLHILL24030007 | 20000 | 88.00 |
| 5/21/1991 0:00 | 21FLHILL24030007 | 30000 | 92.00 |
| MEDIAN % REDUCTION = | | | 41.5 |

5.2.3 Critical Conditions/Seasonality

In **Chapter 2**, summary statistics were provided that considered temporal patterns in exceedances of fecal and total coliforms in Flint Creek. Exceedances of the fecal and total coliform criteria occurred in every month. Although the summer quarter (July – September) had the largest exceedance rate for both fecal and total coliforms and the mean monthly rainfall amount was the highest in this quarter, linear regressions between exceedance rates by season versus rainfall were not significant. Consequently, the method of determining the TMDL considered all the exceedances, independent of month or season, and calculated a median percent reduction necessary to meet the respective water quality standard.

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:

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

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 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 Flint Creek WBID 1522A are expressed in terms of percent reductions and represent the maximum coliform the river can assimilate and maintain the water quality criteria for fecal and total coliform (**Table 6.1**).

Table 6.1. Fecal and Total Coliform TMDLs for Flint Creek, WBID 1522A

| Parameter | TMDL (Colonies/ 100 mL) | WLA | | LA (Percent Reduction)† | MOS |
|----------------|-------------------------------|------------------------------|----------------------------------|-------------------------------|----------|
| | | Wastewater (Colonies/day) | NPDES Stormwater (percent) | | |
| Fecal Coliform | 400 #/100 mL | NA | 51.2% | 51.2 % | Implicit |
| Total Coliform | 2400 #/100 mL | NA | 41.5% | 41.5 % | Implicit |

NA – Not applicable.

6.2 Load Allocation (LA)

A fecal coliform reduction of 51.2 percent and a total coliform reduction of 41.5 percent are needed from nonpoint sources. It should be noted that the LA includes loading from stormwater discharges that are not part of the NPDES Stormwater Program.

6.3 Wasteload Allocation (WLA)

There are no point sources with surface discharges to this WBID. Consequently, there are no reductions that would be applied to domestic and/or industrial point sources in the WBID. Any future discharge permits issued within Flint Creek WBID 1522A will be required to meet state Class III criteria for fecal and total coliforms, as well as the TMDL value. Any future allocations would require a reduction in nonpoint sources such that these values are not exceeded.

6.3.2 NPDES Stormwater Discharges

Flint Creek is part of Hillsborough County and is covered by the Hillsborough County Public Works and the Florida Department of Transportation District 7 Phase I MS4 permit. The WLA for stormwater discharges with a MS4 permit is a 51.2 percent reduction in current fecal coliform and a 41.5 percent reduction in current total coliform loading from the MS4. It should be noted that any MS4 permittee will only be responsible for reducing the loads associated with stormwater outfalls which 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 (MOS)

Consistent with the recommendations of the Allocation Technical Advisory Committee (Florida Department of Environmental Protection, February 2001), an implicit margin of safety (MOS)

was used in the development of this TMDL. A 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. Finally, the TMDL calculated for fecal coliforms was based on meeting the water quality criterion of 400 colonies/100 mL without any exceedances, while the actual criterion allows for a 10 percent exceedance over that level.

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 Tampa Bay Tributaries. 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 Agriculture and Consumer Services. 2003. *Florida Agricultural Fast Facts 2003 Directory*. Tallahassee, Florida.
- 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. March 2003. *Tampa Bay Tributaries Basin Status Report*. Tallahassee, Florida. Available at http://www.dep.state.fl.us/water/tmdl/stat_rep.htm
- Florida Department of Environmental Protection. 2001. *Ocklawaha Basin Status Report*. Tallahassee, Florida. Available at http://www.dep.state.fl.us/water/tmdl/stat_rep.htm.
- Florida Department of Health Web site. 2004. Available at <http://www.doh.state.fl.us/>.
- Florida Watershed Restoration Act. Chapter 99-223, Laws of Florida.
- U.S. Census Bureau. 2004. Available at <http://www.census.gov/>.
- U.S. Department of Agriculture. March, 1999. *1997 Census of Agriculture. Florida State and County Data Volume 1 Geographic Area Series Part 9*. Washington, D.C.
- U.S. Environmental Protection Agency. January, 2001. *Protocol for Developing Pathogen TMDLs*. EPA 841-R-00-002. Office of Water, Washington, D.C.

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, Florida Statutes (F.S.), was established as a technology-based program that relies on the implementation of best management practices (BMPs) that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Chapter 62-40, Florida Administrative Code (F.A.C.).

The rule 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 Total Maximum Daily Load (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 TMDL 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 Nonpoint Source Discharge Elimination System (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 U.S. Environmental Protection Agency (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 2 of the NPDES Program will expand the need for these permits to construction sites between 1 and 5 acres, and to local governments with as few as 10,000 people. The revised rules require that these additional activities obtain permits by 2003. While these urban stormwater discharges are now technically referred to as "point sources" for the purpose of regulation, they are still diffuse sources of pollution that cannot be easily collected and treated by a central treatment facility, as are other point sources of pollution, such as domestic and industrial wastewater discharges. The Florida Department of Environmental Protection 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 B: Fecal and Total Coliform Observations for Flint Creek, WBID 1522A, January 1991 – December 2001

Table B.1. Fecal Coliform Observations in Flint Creek, WBID 1522A, January 1991 – December 2001

| Date | Station | Time | Depth | Fecal Coliform | Remark code |
|------------|------------------|------|-------|----------------|-------------|
| 1/22/1991 | 21FLHILL24030007 | 1300 | 1.00 | 1800 | |
| 2/25/1991 | 21FLHILL24030007 | 1315 | 1.00 | 1100 | |
| 3/26/1991 | 21FLHILL24030007 | 1255 | 1.00 | 200 | |
| 4/23/1991 | 21FLHILL24030007 | 1240 | 1.00 | 400 | |
| 5/21/1991 | 21FLHILL24030007 | 1240 | 1.00 | 30000 | L |
| 6/25/1991 | 21FLHILL24030007 | 1330 | 1.00 | 800 | |
| 7/30/1991 | 21FLHILL24030007 | 1230 | 1.00 | 2400 | |
| 8/27/1991 | 21FLHILL24030007 | 1345 | 1.00 | 400 | |
| 9/24/1991 | 21FLHILL24030007 | 1225 | 1.00 | 1000 | |
| 10/22/1991 | 21FLHILL24030007 | 1313 | 1.00 | 800 | |
| 11/19/1991 | 21FLHILL24030007 | 1237 | 1.00 | 2500 | |
| 12/10/1991 | 21FLHILL24030007 | 1330 | 1.00 | 1100 | |
| 1/28/1992 | 21FLHILL24030007 | 1225 | 1.00 | 1300 | |
| 2/25/1992 | 21FLHILL24030007 | 1330 | 3.25 | 2300 | |
| 2/25/1992 | 21FLHILL24030007 | 1330 | 3.30 | 2300 | |
| 3/24/1992 | 21FLHILL24030007 | 1245 | 3.00 | 400 | |
| 4/21/1992 | 21FLHILL24030007 | 1305 | 3.00 | 1900 | |
| 5/26/1992 | 21FLHILL24030007 | 1315 | 2.50 | 1300 | |
| 6/23/1992 | 21FLHILL24030007 | 1245 | 2.50 | 1400 | J |
| 7/28/1992 | 21FLHILL24030007 | 1245 | 3.00 | 100 | K |
| 8/25/1992 | 21FLHILL24030007 | 1250 | 3.75 | 300 | |
| 8/25/1992 | 21FLHILL24030007 | 1250 | 3.80 | 300 | |
| 9/22/1992 | 21FLHILL24030007 | 1305 | 3.25 | 200 | |
| 9/22/1992 | 21FLHILL24030007 | 1305 | 3.30 | 200 | |
| 10/27/1992 | 21FLHILL24030007 | 1325 | 2.75 | 500 | |
| 10/27/1992 | 21FLHILL24030007 | 1325 | 2.80 | 500 | |
| 11/17/1992 | 21FLHILL24030007 | 1305 | 3.50 | 100 | |
| 12/15/1992 | 21FLHILL24030007 | 1345 | 3.30 | 400 | |
| 12/15/1992 | 21FLHILL24030007 | 1345 | 3.25 | 400 | |
| 1/19/1993 | 21FLHILL24030007 | 1330 | 3.25 | 100 | |
| 1/19/1993 | 21FLHILL24030007 | 1330 | 3.30 | 100 | |
| 2/16/1993 | 21FLHILL24030007 | 1350 | 1.00 | 100 | |
| 3/16/1993 | 21FLHILL24030007 | 1355 | 1.00 | 200 | |

| Date | Station | Time | Depth | Fecal Coliform | Remark code |
|------------|------------------|------|-------|----------------|-------------|
| 4/20/1993 | 21FLHILL24030007 | 1255 | 1.00 | 100 | K |
| 5/18/1993 | 21FLHILL24030007 | 1345 | 1.00 | 100 | |
| 6/15/1993 | 21FLHILL24030007 | 1347 | 2.25 | 100 | K |
| 6/15/1993 | 21FLHILL24030007 | 1347 | 2.30 | 100 | K |
| 7/20/1993 | 21FLHILL24030007 | 1330 | 2.80 | 300 | |
| 8/17/1993 | 21FLHILL24030007 | 1340 | 1.00 | 80 | |
| 8/17/1993 | 21FLHILL24030007 | 1340 | 2.50 | 80 | |
| 9/14/1993 | 21FLHILL24030007 | 1317 | 1.00 | 620 | |
| 9/14/1993 | 21FLHILL24030007 | 1317 | 3.25 | 620 | |
| 10/19/1993 | 21FLHILL24030007 | 1340 | 1.00 | 200 | |
| 11/16/1993 | 21FLHILL24030007 | 1320 | 1.00 | 280 | |
| 12/14/1993 | 21FLHILL24030007 | 1340 | 1.00 | 280 | |
| 1/25/1994 | 21FLHILL24030007 | 1325 | 1.00 | 240 | |
| 2/22/1994 | 21FLHILL24030007 | 1313 | 1.00 | 220 | |
| 3/22/1994 | 21FLHILL24030007 | 1329 | 1.00 | 340 | |
| 4/26/1994 | 21FLHILL24030007 | 1328 | 1.00 | 900 | |
| 5/24/1994 | 21FLHILL24030007 | 1335 | 1.00 | 20 | |
| 6/21/1994 | 21FLHILL24030007 | 1425 | 1.00 | 40 | |
| 7/26/1994 | 21FLHILL24030007 | 1355 | 1.00 | 280 | |
| 8/23/1994 | 21FLHILL24030007 | 1403 | 1.00 | 720 | |
| 9/27/1994 | 21FLHILL24030007 | 1400 | 1.00 | 540 | |
| 10/25/1994 | 21FLHILL24030007 | 1425 | 1.00 | 140 | |
| 11/29/1994 | 21FLHILL24030007 | 1345 | 1.00 | 220 | |
| 12/13/1994 | 21FLHILL24030007 | 1340 | 1.00 | 700 | |
| 1/24/1995 | 21FLHILL24030007 | 1405 | 1.00 | 300 | |
| 2/21/1995 | 21FLHILL24030007 | 1410 | 1.00 | 380 | |
| 3/21/1995 | 21FLHILL24030007 | 1350 | 1.00 | 100 | |
| 4/25/1995 | 21FLHILL24030007 | 1400 | 1.00 | 100 | |
| 5/23/1995 | 21FLHILL24030007 | 1425 | 1.00 | 260 | |
| 6/27/1995 | 21FLHILL24030007 | 1420 | 1.00 | 280 | |
| 7/25/1995 | 21FLHILL24030007 | 1410 | 1.00 | 460 | |
| 8/22/1995 | 21FLHILL24030007 | 1350 | 1.00 | 160 | |
| 9/26/1995 | 21FLHILL24030007 | 1400 | 1.00 | 800 | |
| 10/24/1995 | 21FLHILL24030007 | 1350 | 3.25 | 720 | |
| 10/24/1995 | 21FLHILL24030007 | 1350 | 3.30 | 720 | |
| 11/28/1995 | 21FLHILL24030007 | 1415 | 3.50 | 780 | |
| 12/12/1995 | 21FLHILL24030007 | 1336 | 3.50 | 220 | |
| 1/23/1996 | 21FLHILL24030007 | 1330 | 3.30 | 300 | |
| 2/20/1996 | 21FLHILL24030007 | 1410 | 3.00 | 240 | |
| 3/19/1996 | 21FLHILL24030007 | 1340 | 2.75 | 180 | |

| Date | Station | Time | Depth | Fecal Coliform | Remark code |
|------------|------------------|------|-------|----------------|-------------|
| 3/19/1996 | 21FLHILL24030007 | 1340 | 2.80 | 180 | |
| 4/16/1996 | 21FLHILL24030007 | 1335 | 3.00 | 60 | |
| 5/14/1996 | 21FLHILL24030007 | 1405 | 2.50 | 60 | |
| 6/18/1996 | 21FLHILL24030007 | 1400 | 3.25 | 260 | |
| 6/18/1996 | 21FLHILL24030007 | 1400 | 3.30 | 260 | |
| 7/16/1996 | 21FLHILL24030007 | 1353 | 3.00 | 580 | |
| 8/20/1996 | 21FLHILL24030007 | 1410 | 3.00 | 180 | |
| 9/24/1996 | 21FLHILL24030007 | 1340 | 2.80 | 480 | |
| 10/15/1996 | 21FLHILL24030007 | 1350 | 3.00 | 320 | |
| 11/19/1996 | 21FLHILL24030007 | 1340 | 3.30 | 400 | |
| 12/10/1996 | 21FLHILL24030007 | 1355 | 2.80 | 960 | |
| 1/21/1997 | 21FLHILL24030007 | 1343 | 2.30 | 940 | |
| 2/18/1997 | 21FLHILL24030007 | 1400 | 2.80 | 360 | |
| 3/18/1997 | 21FLHILL24030007 | 1350 | 2.00 | 20 | |
| 4/15/1997 | 21FLHILL24030007 | 1315 | 2.00 | 1000 | |
| 5/20/1997 | 21FLHILL24030007 | 1350 | 2.30 | 40 | |
| 6/17/1997 | 21FLHILL24030007 | 1445 | 2.50 | 40 | |
| 7/22/1997 | 21FLHILL24030007 | 1430 | 3.00 | 840 | |
| 8/19/1997 | 21FLHILL24030007 | 1345 | 3.80 | 100 | |
| 9/16/1997 | 21FLHILL24030007 | 1320 | 3.30 | 200 | |
| 10/14/1997 | 21FLHILL24030007 | 1410 | 2.80 | 320 | |
| 11/18/1997 | 21FLHILL24030007 | 1425 | 4.00 | 120 | |
| 12/9/1997 | 21FLHILL24030007 | 1335 | 3.80 | 180 | |
| 1/20/1998 | 21FLHILL24030007 | 1310 | 3.50 | 280 | |
| 2/17/1998 | 21FLHILL24030007 | 1400 | 5.00 | 4760 | |
| 3/17/1998 | 21FLHILL24030007 | 1330 | 3.50 | 100 | |
| 4/21/1998 | 21FLHILL24030007 | 1428 | 3.00 | 200 | |
| 5/19/1998 | 21FLHILL24030007 | 1432 | 2.50 | 20 | K |
| 6/16/1998 | 21FLHILL24030007 | 1310 | 2.30 | 60 | |
| 7/21/1998 | 21FLHILL24030007 | 1332 | 3.30 | 4000 | L |
| 8/25/1998 | 21FLHILL24030007 | 1334 | 3.80 | 80 | |
| 9/15/1998 | 21FLHILL24030007 | 1441 | 3.80 | 220 | |
| 10/20/1998 | 21FLHILL24030007 | 1332 | 3.50 | 220 | |
| 11/17/1998 | 21FLHILL24030007 | 1345 | 3.50 | 100 | |
| 12/8/1998 | 21FLHILL24030007 | 1320 | 2.50 | 120 | |
| 1/19/1999 | 21FLHILL148 | 1340 | 2.50 | 260 | |
| 2/16/1999 | 21FLHILL148 | 1346 | 3.30 | 20 | |
| 3/16/1999 | 21FLHILL148 | 1413 | 3.00 | 20 | U |
| 4/20/1999 | 21FLHILL148 | 1335 | 3.00 | 60 | |
| 5/18/1999 | 21FLHILL148 | 1335 | 3.00 | 40 | |

| Date | Station | Time | Depth | Fecal Coliform | Remark code |
|------------|-------------|------|-------|----------------|-------------|
| 6/15/1999 | 21FLHILL148 | 1332 | 2.50 | 660 | |
| 7/20/1999 | 21FLHILL148 | 1345 | 3.30 | 280 | |
| 8/17/1999 | 21FLHILL148 | 1534 | 3.50 | 660 | |
| 9/22/1999 | 21FLHILL148 | 1445 | 3.00 | 500 | |
| 10/12/1999 | 21FLHILL148 | 1420 | 3.50 | 620 | |
| 11/16/1999 | 21FLHILL148 | 1342 | 3.30 | 120 | |
| 12/14/1999 | 21FLHILL148 | 1420 | 3.30 | 520 | |
| 1/18/2000 | 21FLHILL148 | 1350 | 2.50 | 140 | |
| 2/15/2000 | 21FLHILL148 | 1330 | 3.00 | 560 | |
| 3/14/2000 | 21FLHILL148 | 1340 | 3.00 | 40 | |
| 6/15/2000 | 21FLGW 8491 | 1115 | 0.05 | 310 | |
| 6/15/2000 | 21FLGW 8496 | 1215 | 0.10 | 84 | |
| 7/18/2000 | 21FLHILL148 | 1435 | 2.80 | 20 | U |
| 8/15/2000 | 21FLHILL148 | 1445 | 3.00 | 220 | |
| 9/19/2000 | 21FLHILL148 | 1440 | 3.50 | 180 | |
| 10/10/2000 | 21FLHILL148 | 1410 | . | 180 | |
| 11/14/2000 | 21FLHILL148 | 1345 | . | 60 | |
| 12/12/2000 | 21FLHILL148 | 1337 | . | 20 | |
| 1/16/2001 | 21FLHILL148 | 1325 | . | 20 | U |
| 2/20/2001 | 21FLHILL148 | 1332 | . | 20 | U |
| 3/20/2001 | 21FLHILL148 | 1303 | . | 700 | |
| 4/17/2001 | 21FLHILL148 | 1422 | . | 20 | |
| 5/15/2001 | 21FLHILL148 | 1335 | . | 80 | |
| 6/19/2001 | 21FLHILL148 | 1435 | . | 20 | |
| 7/24/2001 | 21FLHILL148 | 1349 | . | 300 | |
| 8/21/2001 | 21FLHILL148 | 1400 | . | 140 | |
| 9/18/2001 | 21FLHILL148 | 1405 | . | 20 | U |
| 10/16/2001 | 21FLHILL148 | 1347 | . | 100 | |
| 11/13/2001 | 21FLHILL148 | 1411 | . | 180 | |
| 12/11/2001 | 21FLHILL148 | 1357 | . | 380 | |
| 1/15/2002 | 21FLHILL148 | 1445 | 2.95 | 960 | |
| 2/19/2002 | 21FLHILL148 | 1428 | 1.97 | 340 | |
| 3/19/2002 | 21FLHILL148 | 1506 | 2.95 | 180 | |
| 4/16/2002 | 21FLHILL148 | 1405 | 2.30 | 320 | |
| 5/14/2002 | 21FLHILL148 | 1331 | 2.62 | 90 | |
| 6/18/2002 | 21FLHILL148 | 1352 | 2.62 | 360 | |
| 7/23/2002 | 21FLHILL148 | 1442 | 2.95 | 1040 | |
| 8/20/2002 | 21FLHILL148 | 1351 | 3.61 | 60 | |
| 9/17/2002 | 21FLHILL148 | 1428 | 2.95 | 170 | |
| 10/15/2002 | 21FLHILL148 | 1345 | 3.61 | 180 | |

| Date | Station | Time | Depth | Fecal Coliform | Remark code |
|------------|-------------|------|-------|----------------|-------------|
| 11/19/2002 | 21FLHILL148 | 1327 | 3.61 | 230 | |
| 12/10/2002 | 21FLHILL148 | 1413 | 3.28 | 1920 | |

Remark Codes: J – Estimated value
 K – Actual value is known to be less than value given
 L – Actual value is known to be greater than value given
 U – Material analyzed for but not detected, value reported is minimum detection limit

Table B2. Total Coliform Observations in Flint Creek, WBID 1522A, January 1991 - December 2001

| Date | Station | Time | Depth | Total Coliform | Remark Code |
|-----------------|------------------|------|-------|----------------|-------------|
| 1/22/1991 0:00 | 21FLHILL24030007 | 1300 | 1 | 1800 | |
| 2/25/1991 0:00 | 21FLHILL24030007 | 1315 | 1 | 1100 | |
| 3/26/1991 0:00 | 21FLHILL24030007 | 1255 | 1 | 600 | |
| 4/23/1991 0:00 | 21FLHILL24030007 | 1240 | 1 | 600 | |
| 5/21/1991 0:00 | 21FLHILL24030007 | 1240 | 1 | 30000 | L |
| 6/25/1991 0:00 | 21FLHILL24030007 | 1330 | 1 | 800 | |
| 7/30/1991 0:00 | 21FLHILL24030007 | 1230 | 1 | 3200 | |
| 8/27/1991 0:00 | 21FLHILL24030007 | 1345 | 1 | 900 | |
| 9/24/1991 0:00 | 21FLHILL24030007 | 1225 | 1 | 2100 | |
| 10/22/1991 0:00 | 21FLHILL24030007 | 1313 | 1 | 2300 | |
| 11/19/1991 0:00 | 21FLHILL24030007 | 1237 | 1 | 4300 | |
| 12/10/1991 0:00 | 21FLHILL24030007 | 1330 | 1 | 1100 | |
| 1/28/1992 0:00 | 21FLHILL24030007 | 1225 | 1 | 1900 | |
| 2/25/1992 0:00 | 21FLHILL24030007 | 1330 | 3.3 | 2600 | |
| 2/25/1992 0:00 | 21FLHILL24030007 | 1330 | 3.25 | 2600 | |
| 3/24/1992 0:00 | 21FLHILL24030007 | 1245 | 3 | 1200 | |
| 4/21/1992 0:00 | 21FLHILL24030007 | 1305 | 3 | 2900 | |
| 5/26/1992 0:00 | 21FLHILL24030007 | 1315 | 2.5 | 3200 | |
| 6/23/1992 0:00 | 21FLHILL24030007 | 1245 | 2.5 | 2500 | |
| 7/28/1992 0:00 | 21FLHILL24030007 | 1245 | 3 | 400 | |
| 8/25/1992 0:00 | 21FLHILL24030007 | 1250 | 3.8 | 700 | |
| 8/25/1992 0:00 | 21FLHILL24030007 | 1250 | 3.75 | 700 | |
| 9/22/1992 0:00 | 21FLHILL24030007 | 1305 | 3.3 | 1700 | |
| 9/22/1992 0:00 | 21FLHILL24030007 | 1305 | 3.25 | 1700 | |
| 10/27/1992 0:00 | 21FLHILL24030007 | 1325 | 2.8 | 2200 | |
| 10/27/1992 0:00 | 21FLHILL24030007 | 1325 | 2.75 | 2200 | |
| 11/17/1992 0:00 | 21FLHILL24030007 | 1305 | 3.5 | 1600 | |
| 12/15/1992 0:00 | 21FLHILL24030007 | 1345 | 3.3 | 600 | |
| 12/15/1992 0:00 | 21FLHILL24030007 | 1345 | 3.25 | 600 | |
| 1/19/1993 0:00 | 21FLHILL24030007 | 1330 | 3.3 | 600 | |
| 1/19/1993 0:00 | 21FLHILL24030007 | 1330 | 3.25 | 600 | |
| 2/16/1993 0:00 | 21FLHILL24030007 | 1350 | 1 | 500 | |
| 3/16/1993 0:00 | 21FLHILL24030007 | 1355 | 1 | 2000 | |
| 4/20/1993 0:00 | 21FLHILL24030007 | 1255 | 1 | 1200 | |
| 5/18/1993 0:00 | 21FLHILL24030007 | 1345 | 1 | 1000 | |
| 6/15/1993 0:00 | 21FLHILL24030007 | 1347 | 2.25 | 2700 | |
| 6/15/1993 0:00 | 21FLHILL24030007 | 1347 | 2.3 | 2700 | |

| Date | Station | Time | Depth | Total Coliform | Remark Code |
|-----------------|------------------|------|-------|----------------|-------------|
| 7/20/1993 0:00 | 21FLHILL24030007 | 1330 | 2.8 | 1900 | |
| 8/17/1993 0:00 | 21FLHILL24030007 | 1340 | 1 | 1100 | |
| 8/17/1993 0:00 | 21FLHILL24030007 | 1340 | 2.5 | 1100 | |
| 9/14/1993 0:00 | 21FLHILL24030007 | 1317 | 1 | 2600 | |
| 9/14/1993 0:00 | 21FLHILL24030007 | 1317 | 3.25 | 2600 | |
| 10/19/1993 0:00 | 21FLHILL24030007 | 1340 | 1 | 1300 | |
| 11/16/1993 0:00 | 21FLHILL24030007 | 1320 | 1 | 900 | |
| 12/14/1993 0:00 | 21FLHILL24030007 | 1340 | 1 | 1100 | |
| 1/25/1994 0:00 | 21FLHILL24030007 | 1325 | 1 | 300 | |
| 2/22/1994 0:00 | 21FLHILL24030007 | 1313 | 1 | 1500 | |
| 3/22/1994 0:00 | 21FLHILL24030007 | 1329 | 1 | 1400 | |
| 4/26/1994 0:00 | 21FLHILL24030007 | 1328 | 1 | 1400 | |
| 5/24/1994 0:00 | 21FLHILL24030007 | 1335 | 1 | 500 | |
| 6/21/1994 0:00 | 21FLHILL24030007 | 1425 | 1 | 1800 | |
| 7/26/1994 0:00 | 21FLHILL24030007 | 1355 | 1 | 1400 | |
| 8/23/1994 0:00 | 21FLHILL24030007 | 1403 | 1 | 3300 | |
| 9/27/1994 0:00 | 21FLHILL24030007 | 1400 | 1 | 2600 | |
| 10/25/1994 0:00 | 21FLHILL24030007 | 1425 | 1 | 1100 | |
| 11/29/1994 0:00 | 21FLHILL24030007 | 1345 | 1 | 900 | |
| 12/13/1994 0:00 | 21FLHILL24030007 | 1340 | 1 | 1800 | |
| 1/24/1995 0:00 | 21FLHILL24030007 | 1405 | 1 | 1100 | |
| 2/21/1995 0:00 | 21FLHILL24030007 | 1410 | 1 | 2800 | |
| 3/21/1995 0:00 | 21FLHILL24030007 | 1350 | 1 | 900 | |
| 4/25/1995 0:00 | 21FLHILL24030007 | 1400 | 1 | 1300 | |
| 5/23/1995 0:00 | 21FLHILL24030007 | 1425 | 1 | 2200 | |
| 6/27/1995 0:00 | 21FLHILL24030007 | 1420 | 1 | 3100 | |
| 7/25/1995 0:00 | 21FLHILL24030007 | 1410 | 1 | 3600 | |
| 8/22/1995 0:00 | 21FLHILL24030007 | 1350 | 1 | 400 | |
| 9/26/1995 0:00 | 21FLHILL24030007 | 1400 | 1 | 5200 | |
| 10/24/1995 0:00 | 21FLHILL24030007 | 1350 | 3.25 | 2400 | |
| 10/24/1995 0:00 | 21FLHILL24030007 | 1350 | 3.3 | 2400 | |
| 11/28/1995 0:00 | 21FLHILL24030007 | 1415 | 3.5 | 2700 | |
| 12/12/1995 0:00 | 21FLHILL24030007 | 1336 | 3.5 | 1300 | |
| 1/23/1996 0:00 | 21FLHILL24030007 | 1330 | 3.3 | 1100 | |
| 2/20/1996 0:00 | 21FLHILL24030007 | 1410 | 3 | 700 | |
| 3/19/1996 0:00 | 21FLHILL24030007 | 1340 | 2.75 | 600 | |
| 3/19/1996 0:00 | 21FLHILL24030007 | 1340 | 2.8 | 600 | |
| 4/16/1996 0:00 | 21FLHILL24030007 | 1335 | 3 | 700 | |
| 5/14/1996 0:00 | 21FLHILL24030007 | 1405 | 2.5 | 800 | |
| 6/18/1996 0:00 | 21FLHILL24030007 | 1400 | 3.25 | 1900 | |

| Date | Station | Time | Depth | Total Coliform | Remark Code |
|-----------------|------------------|------|-------|----------------|-------------|
| 6/18/1996 0:00 | 21FLHILL24030007 | 1400 | 3.3 | 1900 | |
| 7/16/1996 0:00 | 21FLHILL24030007 | 1353 | 3 | 2000 | |
| 8/20/1996 0:00 | 21FLHILL24030007 | 1410 | 3 | 800 | |
| 9/24/1996 0:00 | 21FLHILL24030007 | 1340 | 2.8 | 500 | |
| 10/15/1996 0:00 | 21FLHILL24030007 | 1350 | 3 | 1400 | |
| 11/19/1996 0:00 | 21FLHILL24030007 | 1340 | 3.3 | 1400 | |
| 12/10/1996 0:00 | 21FLHILL24030007 | 1355 | 2.8 | 2800 | |
| 1/21/1997 0:00 | 21FLHILL24030007 | 1343 | 2.3 | 2000 | |
| 2/18/1997 0:00 | 21FLHILL24030007 | 1400 | 2.8 | 2000 | |
| 3/18/1997 0:00 | 21FLHILL24030007 | 1350 | 2 | 900 | |
| 4/15/1997 0:00 | 21FLHILL24030007 | 1315 | 2 | 3800 | |
| 5/20/1997 0:00 | 21FLHILL24030007 | 1350 | 2.3 | 1400 | |
| 6/17/1997 0:00 | 21FLHILL24030007 | 1445 | 2.5 | 500 | |
| 7/22/1997 0:00 | 21FLHILL24030007 | 1430 | 3 | 1400 | |
| 8/19/1997 0:00 | 21FLHILL24030007 | 1345 | 3.8 | 200 | |
| 9/16/1997 0:00 | 21FLHILL24030007 | 1320 | 3.3 | 300 | |
| 10/14/1997 0:00 | 21FLHILL24030007 | 1410 | 2.8 | 1100 | |
| 11/18/1997 0:00 | 21FLHILL24030007 | 1425 | 4 | 1000 | |
| 12/9/1997 0:00 | 21FLHILL24030007 | 1335 | 3.8 | 500 | |
| 1/20/1998 0:00 | 21FLHILL24030007 | 1310 | 3.5 | 800 | |
| 2/17/1998 0:00 | 21FLHILL24030007 | 1400 | 5 | 11500 | |
| 3/17/1998 0:00 | 21FLHILL24030007 | 1330 | 3.5 | 700 | |
| 4/21/1998 0:00 | 21FLHILL24030007 | 1428 | 3 | 1000 | |
| 5/19/1998 0:00 | 21FLHILL24030007 | 1432 | 2.5 | 800 | |
| 6/16/1998 0:00 | 21FLHILL24030007 | 1310 | 2.3 | 300 | |
| 7/21/1998 0:00 | 21FLHILL24030007 | 1332 | 3.3 | 20000 | L |
| 8/25/1998 0:00 | 21FLHILL24030007 | 1334 | 3.8 | 900 | |
| 9/15/1998 0:00 | 21FLHILL24030007 | 1441 | 3.8 | 600 | |
| 10/20/1998 0:00 | 21FLHILL24030007 | 1332 | 3.5 | 700 | |
| 11/17/1998 0:00 | 21FLHILL24030007 | 1345 | 3.5 | 600 | |
| 12/8/1998 0:00 | 21FLHILL24030007 | 1320 | 2.5 | 400 | |
| 1/19/1999 0:00 | 21FLHILL148 | 1340 | 2.5 | 600 | |
| 2/16/1999 0:00 | 21FLHILL148 | 1346 | 3.3 | 1200 | |
| 3/16/1999 0:00 | 21FLHILL148 | 1413 | 3 | 400 | |
| 4/20/1999 0:00 | 21FLHILL148 | 1335 | 3 | 200 | |
| 5/18/1999 0:00 | 21FLHILL148 | 1335 | 3 | 1000 | |
| 6/15/1999 0:00 | 21FLHILL148 | 1332 | 2.5 | 2300 | |
| 7/20/1999 0:00 | 21FLHILL148 | 1345 | 3.3 | 1900 | |
| 8/17/1999 0:00 | 21FLHILL148 | 1534 | 3.5 | 4400 | |
| 9/22/1999 0:00 | 21FLHILL148 | 1445 | 3 | 4100 | |

| Date | Station | Time | Depth | Total Coliform | Remark Code |
|-----------------|-------------|------|-------|----------------|-------------|
| 10/12/1999 0:00 | 21FLHILL148 | 1420 | 3.5 | 4200 | |
| 11/16/1999 0:00 | 21FLHILL148 | 1342 | 3.3 | 1400 | |
| 12/14/1999 0:00 | 21FLHILL148 | 1420 | 3.3 | 1900 | |
| 1/18/2000 0:00 | 21FLHILL148 | 1350 | 2.5 | 3400 | |
| 2/15/2000 0:00 | 21FLHILL148 | 1330 | 3 | 8800 | |
| 3/14/2000 0:00 | 21FLHILL148 | 1340 | 3 | 3400 | |
| 6/15/2000 0:00 | 21FLGW 8491 | 1115 | 0.05 | 2500 | |
| 6/15/2000 0:00 | 21FLGW 8496 | 1215 | 0.1 | 9000 | |
| 7/18/2000 0:00 | 21FLHILL148 | 1435 | 2.8 | 9200 | |
| 8/15/2000 0:00 | 21FLHILL148 | 1445 | 3 | 10200 | |
| 9/19/2000 0:00 | 21FLHILL148 | 1440 | 3.5 | 9600 | |
| 10/10/2000 0:00 | 21FLHILL148 | 1410 | . | 9300 | |
| 11/14/2000 0:00 | 21FLHILL148 | 1345 | . | 18400 | |
| 12/12/2000 0:00 | 21FLHILL148 | 1337 | . | 10500 | |
| 1/16/2001 0:00 | 21FLHILL148 | 1325 | . | 300 | |
| 2/20/2001 0:00 | 21FLHILL148 | 1332 | . | 2000 | |
| 3/20/2001 0:00 | 21FLHILL148 | 1303 | . | 15600 | |
| 4/17/2001 0:00 | 21FLHILL148 | 1422 | . | 3800 | |
| 5/15/2001 0:00 | 21FLHILL148 | 1335 | . | 15700 | |
| 6/19/2001 0:00 | 21FLHILL148 | 1435 | . | 10900 | |
| 7/24/2001 0:00 | 21FLHILL148 | 1349 | . | 13300 | |
| 8/21/2001 0:00 | 21FLHILL148 | 1400 | . | 12200 | |
| 9/18/2001 0:00 | 21FLHILL148 | 1405 | . | 11200 | |
| 10/16/2001 0:00 | 21FLHILL148 | 1347 | . | 3400 | |
| 11/13/2001 0:00 | 21FLHILL148 | 1411 | . | 5100 | |
| 12/11/2001 0:00 | 21FLHILL148 | 1357 | . | 7500 | |

Remark Codes: J – Estimated value
 K – Actual value is known to be less than value given
 L – Actual value is known to be greater than value given
 U – Material analyzed for but not detected, value reported is minimum detection limit



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