TMDL Report

Dissolved Oxygen and Nutrient TMDLs for Baker Creek and Spartman Branch

September, 2004

Acknowledgments

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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 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 dissolved oxygen (DO) and nutrients in Baker Creek and Spartman Branch. These waterbodies are part of the Flint Creek watershed system which discharges into the Hillsborough River and are located in the Tampa Bay Tributaries Basin. Using the methodology described in Chapter 62-303, Florida Administrative Code (F.A.C.) (Identification of Impaired Surface Waters Rule, or IWR) (Florida Department of Environmental Protection, 2001) to identify and verify water quality impairments, the freshwater segments were verified as impaired for dissolved oxygen (DO) in Baker Creek, and Spartman Branch; nutrients in Baker Creek and Spartman Branch. Per the IWR, they were included on the Verified List of impaired waters for the Tampa Bay Basin that was adopted by Secretarial Order on August 28, 2002. The TMDL process quantifies the amount of a pollutant that can be assimilated in a waterbody, identifies the sources of the pollutant, and recommends regulatory or other actions to be taken to achieve compliance with applicable water quality standards, based on the relationship between pollution sources and instream water quality conditions. Baker Creek and Spartman Branch were listed as DO impaired due to nitrogen. These TMDLs establish the allowable loadings of nitrogen to Baker Creek, and Spartman Branch that would restore the waterbodies so that they meet their applicable water quality criteria for nutrients and dissolved oxygen.

1.2 Identification of Waterbodies

The Flint Creek Watershed System

Flint Creek is a tributary to the Hillsborough River which is used as a water supply source by the City of Tampa. The Hillsborough River outfalls into Tampa Bay. The major conveyance systems within the Flint Creek watershed include, Baker Creek, Campbell Branch, Holloman's Branch, Pemberton Creek, Baker Canal (aka Seffner Canal), Spartman Branch and Lake Thonotosassa (**Figure 1.1**). Lake Thonotosassa is the receiving waterbody for Baker Creek, Baker Canal, Campbell Branch, Pemberton Creek, and Spartman Branch. The Flint Creek system is located between U.S. Highway 301 and Lake Thonotosassa. Flint Creek originates on the northeast corner of Lake Thonotosassa and discharges into the Hillsborough River. The Southwest Florida Water Management District (SWFWMD) maintains a control structure at the lake's outfall to Flint Creek to regulate lake elevations.

Topography above the Flint Creek system varies from a high of around 130 feet National Geodetic Vertical Datum (NGVD) along the eastern portion of the watershed to a low of about 30 feet NGVD in the area of Lake Thonotosassa and along the western portion of the watershed. Climate in the watershed and for Hillsborough County may be classified as humid subtropical. Annual average precipitation is around 52.4 inches. Approximately 60 percent of the rainfall occurs during the four month rainy season that extends from June through September. Hydrologically, stream flow in the system originates by both stormwater runoff and base flow. Base flow results from either lateral inflows or groundwater. Groundwater contributions to the surface water are from both the surficial and Floridan aquifers. In this part of Hillsborough County, the confining units of the Floridan aquifer are often reduced or absent and the potentiometric surface of the Floridan aquifer is above ground elevation. As a result, the hydrogeologic conditions influence water levels in many lakes, streams, swamps, and marshes within the Flint Creek system. These water levels usually fluctuate seasonally and reach a lower level in late spring (Hillsborough County Public Works Department, 2002).

For assessment purposes, the Florida Department of Environmental Protection (Department) has divided the Coastal Old Tampa Bay Planning Unit, which includes the Hillsborough River Basin, into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each water segment or stream reach. This report will address the Baker Creek (WBID 1522C), and Spartman Branch (WBID 1561) sub-basins in the watershed that were verified as impaired for the water quality variables noted in Section 1.1.

Baker Creek

The Baker Creek segment (WBID 1522C) is a third order stream located in the north central area of Hillsborough County It flows in the southeast-to-northwest direction into Lake Thonotosassa and drains a watershed area of about 27.4-square-miles (mi^2). The stream is about 2 miles in length and is flanked by State route 41 to the north and State Route 400 to the south (**Figure 1.2**). The nearest major urban center to Baker Creek is the City of Bradenton approximately nine miles to the south.

The Baker Creek System is the relatively short connection from the confluence of the Pemberton Creek and Baker Canal Systems to Lake Thonotosassa. Baker Creek may have been a natural water course at one time, but now is a rather straight, dredged canal. The distance from the confluence to the Lake is approximately one mile, of which about one-half is through an historic cypress wetland. The creek passes under a private bridge and Thonotosassa Road as it conveys collected flows to Lake Thonotosassa.

The watershed is part of the Gulf Coastal Lowland area, which has a relatively low relief and abundant existence of Karst features. Interaction of surface water with the ground water is frequent in this area. Baker Creek is a Class III water body, with designated uses under Rule 62-302.400, Florida Administrative Code (F.A.C.), and include human recreation and the "propagation and maintenance of a healthy, well-balanced population of fish and wildlife." Additional information about the creek's hydrology and geology are available in the Basin Status Report for the Group 1 Tampa Bay Basin (Florida Department of Environmental Protection, 2001) and the Pemberton Creek and Baker Canal Area Stormwater Management Master Plan (Hillsborough County Pubic Works Department, 2002).

Spartman Branch

Spartman Branch (WBID 1561) is a first order stream located in the north central area of Hillsborough County (**Figure 1.2**). It flows in a southeast-to-northwest direction into Pemberton Creek and drains a watershed area of about 9-square-miles (mi^2)**.** Pemberton Creek then flows into Lake Thonotosassa via Baker Creek. Spartman Branch was channelized some years ago, but some recovery of sinuosity and in-stream habitat has since occurred. The stream is approximately two miles in length and is flanked by State route 400 to the north and State Route 39 to the west. The nearest major urban center is Plant City, approximately one mile to the east. The drainage basin consists primarily of urban development, draining Plant City and the Plant City Municipal Airport.

The watershed is part of the Gulf Coastal Lowland area, which has a relatively low relief and abundant existence of Karst features. Interaction of surface water with the ground water is frequent in this area. Spartman Branch is a Class III water body, with designated uses under Rule 62-302.400, Florida Administrative Code (F.A.C.), that include human recreation and the "propagation and maintenance of a healthy, well-balanced population of fish and wildlife." Additional information about the creek's hydrology and geology are available in the Basin Status Report for the Group 1 Tampa Bay Basin (Florida Department of Environmental Protection, 2001) and the Pemberton Creek and Baker Canal Area Stormwater Management Master Plan (Hillsborough County Pubic Works Department, 2002).

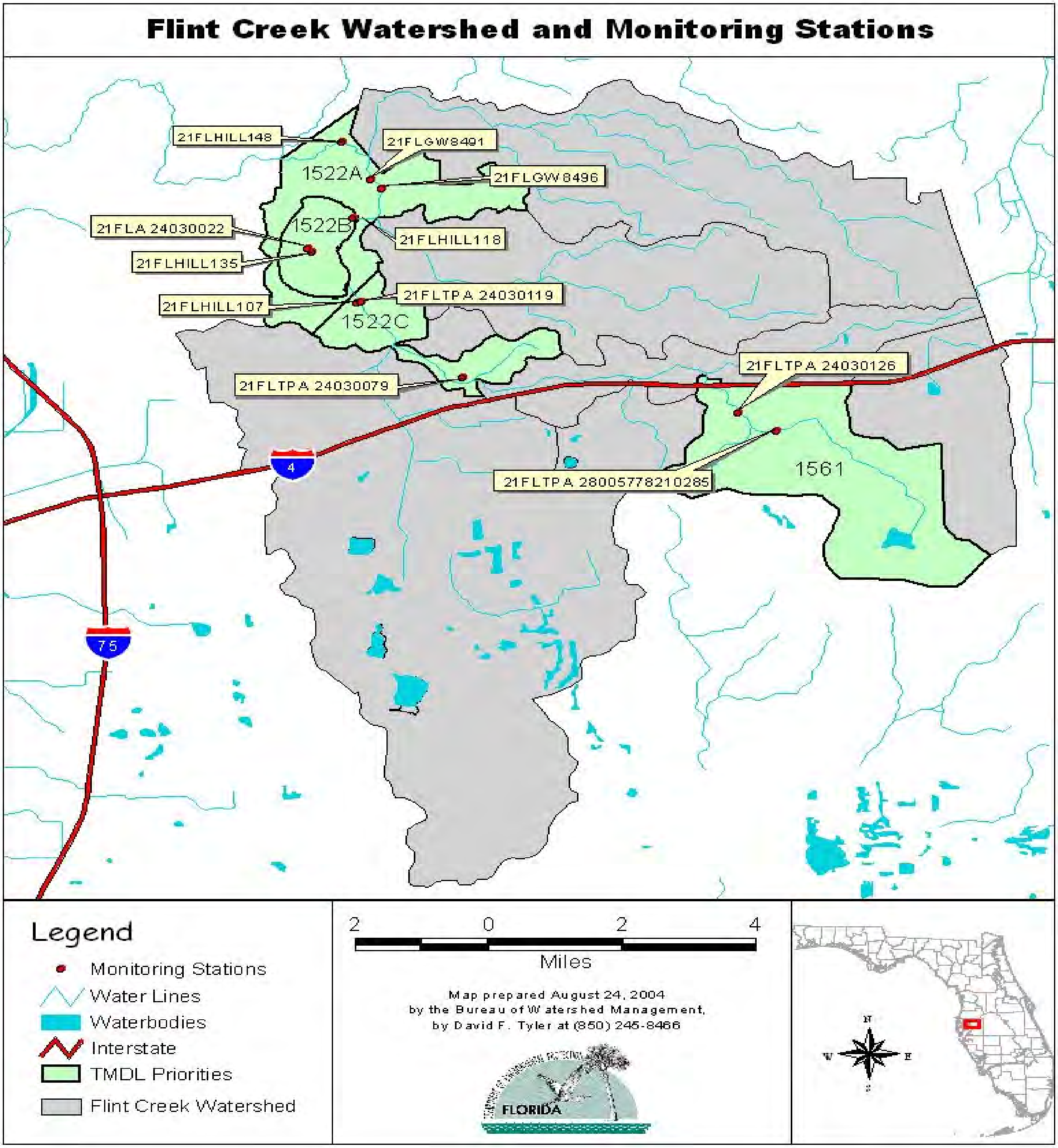

Figure 1.2. Flint Creek Watershed System and Monitoring Locations

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 for each TMDL, to reduce the amount of TN needed to address the dissolved oxygen, un-ionized ammonia, and nutrient impairment in the Flint Creek watershed system. The action plan's activities will depend heavily on the active participation of Hillsborough County, the Southwest Florida Water Management District (SWFWMD), businesses, and other stakeholders. The Department will work with these organizations and individuals to undertake or continue reductions in the discharge of pollutants and achieve the established TMDLs for impaired waterbodies.

Chapter 2: DESCRIPTION OF WATER QUALITY PROBLEM

2.1 Statutory Requirements and Rulemaking History

Section 303(d) of the federal Clean Water Act requires states to submit to the U.S. Environmental Protection Agency (EPA) a list of surface waters that do not meet applicable water quality standards (impaired waters) and establish a TMDL for each pollutant causing the identified impairment of the listed 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 Department is developing basin-specific lists as part of the watershed management cycle.

The 1998 303(d) list included 47 waterbodies (WBIDs) in the Tampa Bay Basin (Florida Department of Environmental Protection, 1998). 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), (Florida Department of Environmental Protection, 2001). 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

Baker Creek

The Department used the IWR to assess water quality impairments in the Baker Creek watershed and verified impairments for DO and nutrients **(**Table 1**).** The main source of data for the IWR assessment was station 21FLHILL24030034/21FLHILL107 sampled by the Hillsborough County Environmental Protection Commission (HCEPC) **(Figure 1.2).** The nomenclature for staton t21FLHILL24030034 changed in 1999 to 21FLHILL107. The IWR methodology uses chlorophyll *a* measurements (a measure of algal biomass) to interpret Florida's narrative nutrient criterion, and the number of DO criterion exceedances is evaluated to assess for DO impairment.

The DO results from 1996 to 2003 (the verified period used for the IWR assessment) are shown in Figure 1**.** Figure 2 and Figure 3 display monthly and annual average chlorophyll *a* levels respectively from 1996 to 2003. Baker Creek is on the Verified List for DO and chlorophyll *a* because, from 1995 to 2002, more than 10 percent of the DO results did not meet the freshwater DO criterion of 5 milligrams per liter (mg/L) and more than 10 percent of the chlorophyll *a* results did not meet the freshwater chlorophyll *a* criterion of 20 micrograms per liter (μg/L). Summary statistics for DO and chlorophyll *a* from 1996 to 2003 are provided in

Table 2 and Table 3**.** The individual water quality measurements for DO and chlorophyll *a* used in the WAM modeling assessment are provided in **Appendix B**.

Table 1: Verified Impaired Listings in the Baker Creek Watershed, WBID 1522C

Parameters of Concern	Priority for TMDL Development	Projected Year for TMDL Development*
Nutrients (Chlorophyll *a*)	High	2003
Dissolved Oxygen	High	2003

*These TMDLs were scheduled to be completed by December 31, 2003, based on a Consent Decree between the EPA and EarthJustice, but the Consent Decree allows a 9-month extension for completing the TMDLs.

Table 2: Summary Statistics for DO from 1996 to 2003, Baker Creek Watershed, WBID 1522C

Parameter (mg/L)	Station ID	Number of Samples	Minimum	Maximum	Mean	Median	Exceed -ances	% Excee-dances
Dissolved Oxygen	21FLHILL24030034 / 21FLHILL107	155	0.1	10.0	4.7	4.7	89	57.4

Table 3: Summary Statistics for Chlorophyll a from 1996 to 2003, Baker Creek Watershed, WBID 1522C

Parameter (µg/L)	Station ID	Number of Samples	Minimum	Maximum	Mean	Median	Exceed -ances	% Excee-dances
Chlorophyll *a*	21FLHILL24030034 / 21FLHILL107	94	1.0	163.5	14.9	5.76	15	15.9

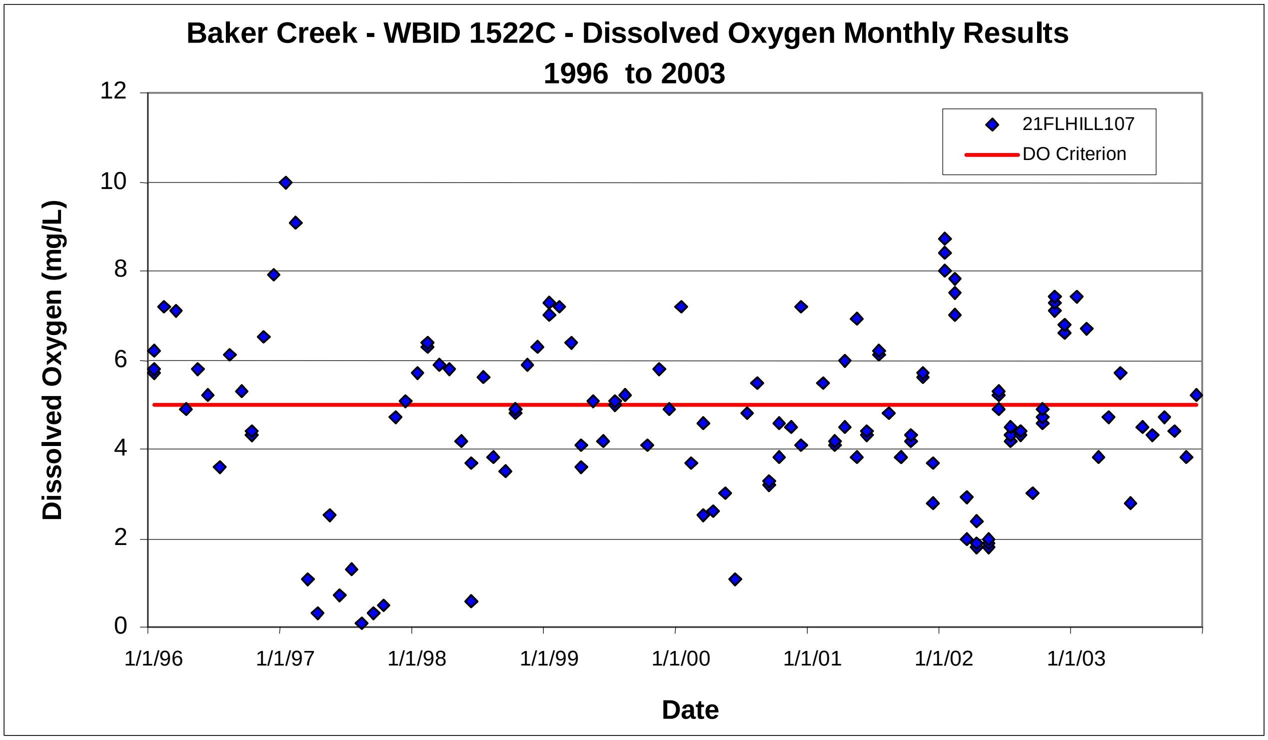

Figure 1: Dissolved Oxygen Monthly Results, 1996 to 2003, Baker Creek Watershed, WBID 1522C

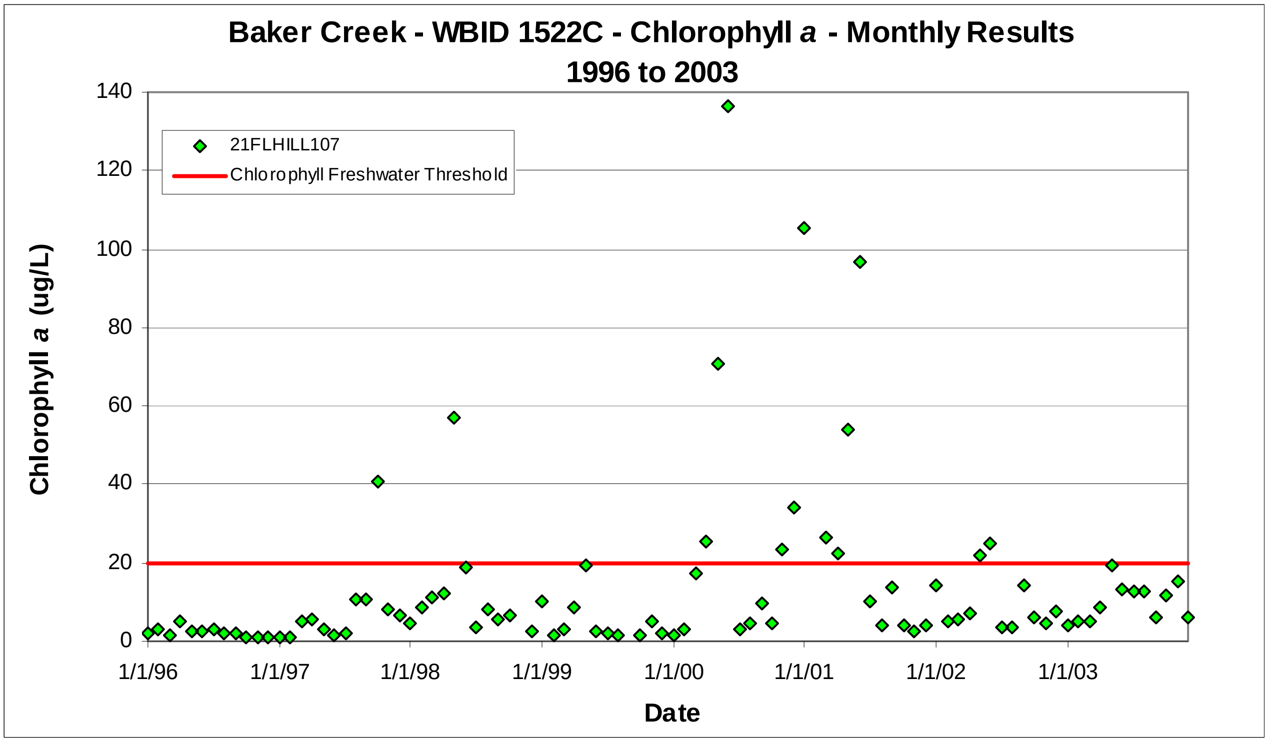

Figure 2: Chlorophyll a Monthly Results, 1996 to 2003, Baker Creek Watershed, WBID 1522C

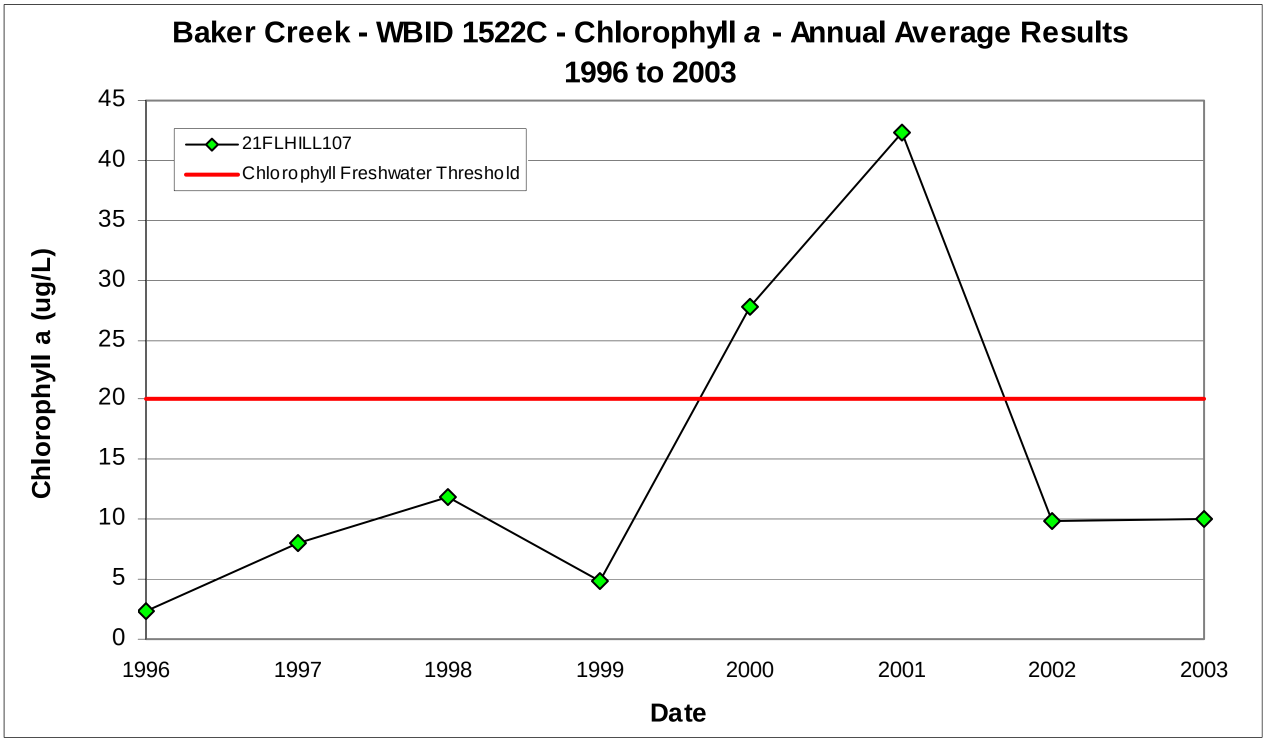

Figure 3: Chlorophyll a Annual Averages, 1996 to 2003, Baker Creek Watershed, WBID 1522

Spartman Branch

The Department used the IWR to assess water quality impairment in the Spartman Branch watershed and verified an impairment for dissolved oxygen (DO) **(**Table 4**).** The main source of data for the IWR assessment came from DEP Tampa District stations 21FLTPA 24030126 and 21FLTPA 28005778210285 **(Figure 1.2).** The IWR methodology uses the number of DO criterion exceedances to assess for DO impairment.

The DO monthly results for the years 1998 and 2002 are shown in Figure 4**.** Spartman Branch is on the Verified List for DO because, for 1998 and 2002, more than 10 percent of the DO results did not meet the state's freshwater DO criterion of 5 milligrams per liter (mg/L). Summary statistics for DO for 1998 and 2002 are provided in Table 5**.** The individual water quality measurements for DO utilized in the WAM modeling assessment and TMDL development are provided in **Appendix B**.

Table 4: Verified Impaired Listings in the Spartman Branch Watershed, WBID 1561

Parameters of Concern	Priority for TMDL Development	Projected Year for TMDL Development*
Dissolved Oxygen	High	2003
Nutrients (Chlorophyll *a*)	High	2003

*These TMDLs were scheduled to be completed by December 31, 2003, based on a Consent Decree between the EPA and EarthJustice, but the Consent Decree allows a 9-month extension for completing the TMDLs.

Table 5: Summary Statistics for Dissolved Oxygen for 1998 and 2002, Spartman Branch Watershed, WBID 1561

Parameter (mg/L)	Station ID	Number of Samples	Minimum	Maximum	Mean	Median	Exceed -ances	% Exceed -ances
Dissolved Oxygen	21FLTPA 24030126	8	3.7	8.1	5.0	4.9	12	57.1
	21FLTPA 28005778210285	7						
	21FLTPA 280132821113	6						
	Total	21						

Table 6: Summary of chlorophyll-a data in Spartman Branch

Parameter (μg/L)	Station ID	Number of Samples	Minimum	Maximum	Mean	Median	Exceed -ances	% Excee-dances
Chlorophyll *a*	21FLTPA 24030126	6	0.85 (detection limit)	41	6.1	1.1	2	15
Chlorophyll *a*	21FLTPA 28005778210285	7						

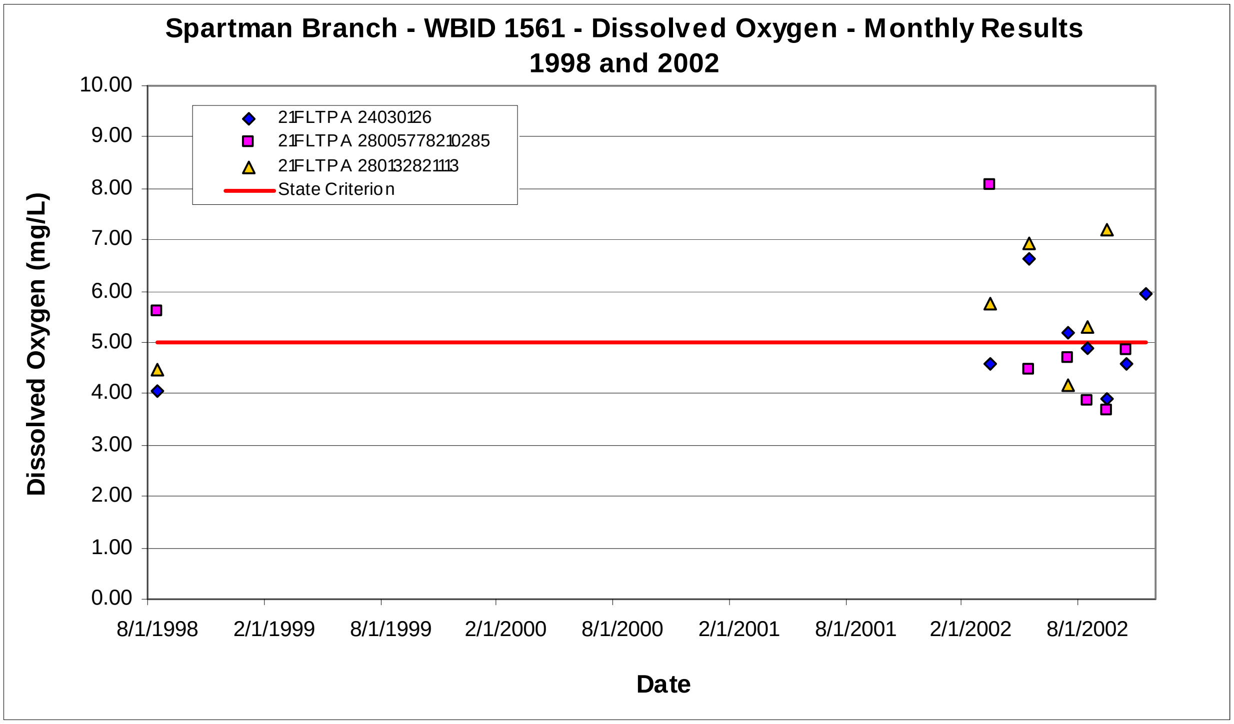

Figure 4: Dissolved Oxygen Monthly Results, 1998 and 2002, Spartman Branch Watershed, WBID 1561

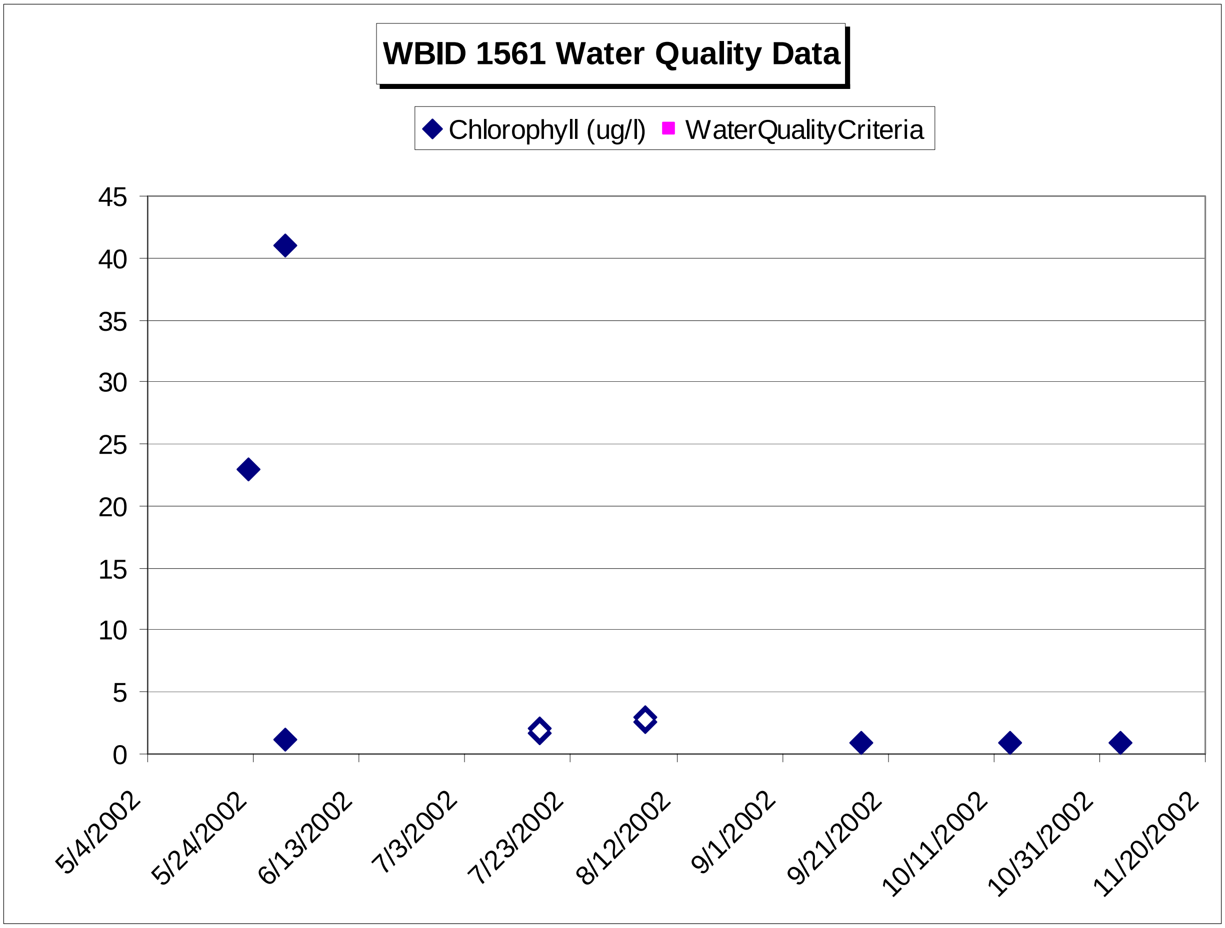

Figure 5: Chlorophyll-a in Spartman Branch

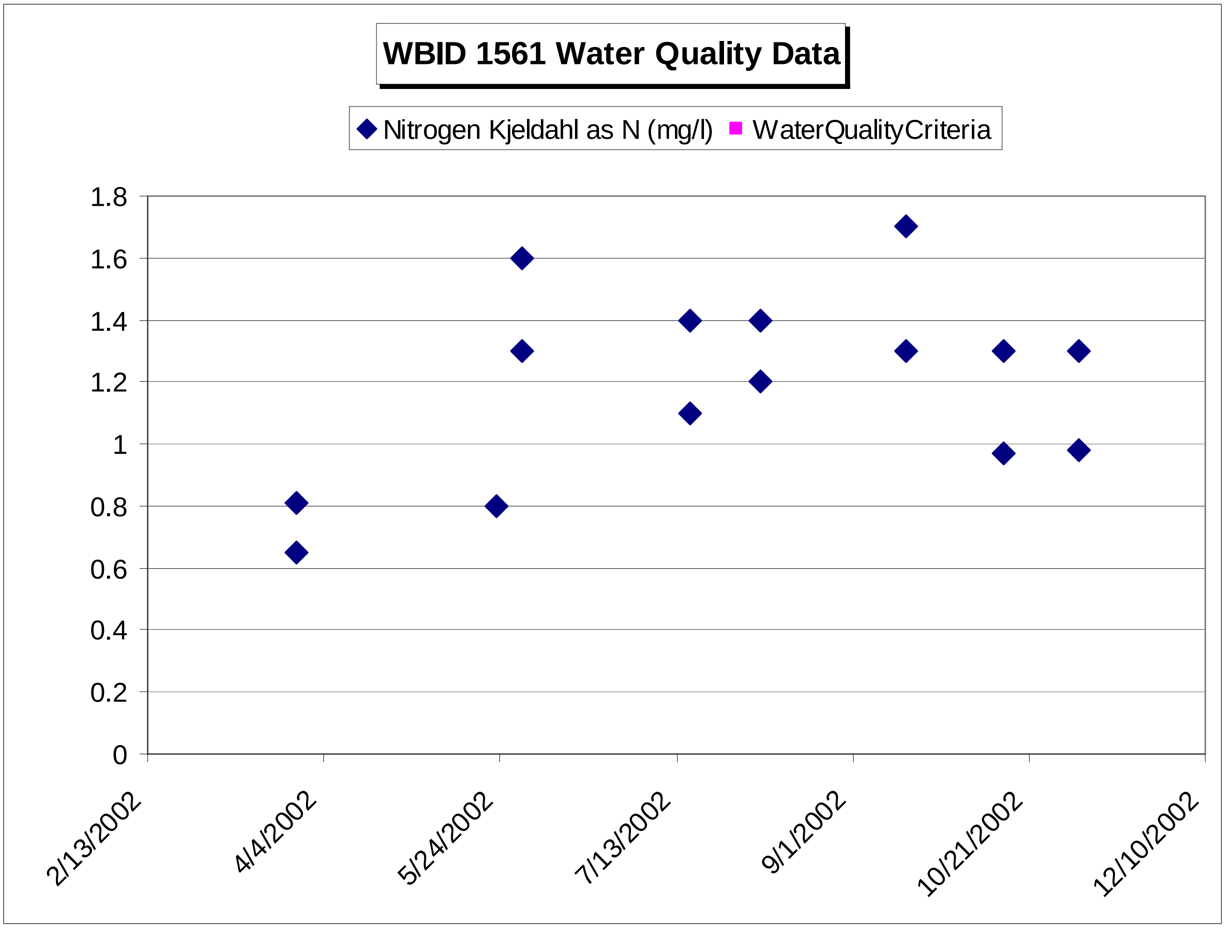
WBID 1561 Water Quality Data
Nitrogen Kjeldahl as N (mg/l)
WaterQualityCriteria
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2/13/2002
4/4/2002
5/24/2002
7/13/2002
9/1/2002
10/21/2002
12/10/2002

Figure 6: TKN in Spartman Branch. Median TKN is 1.2 and the statewide median is 0.83.

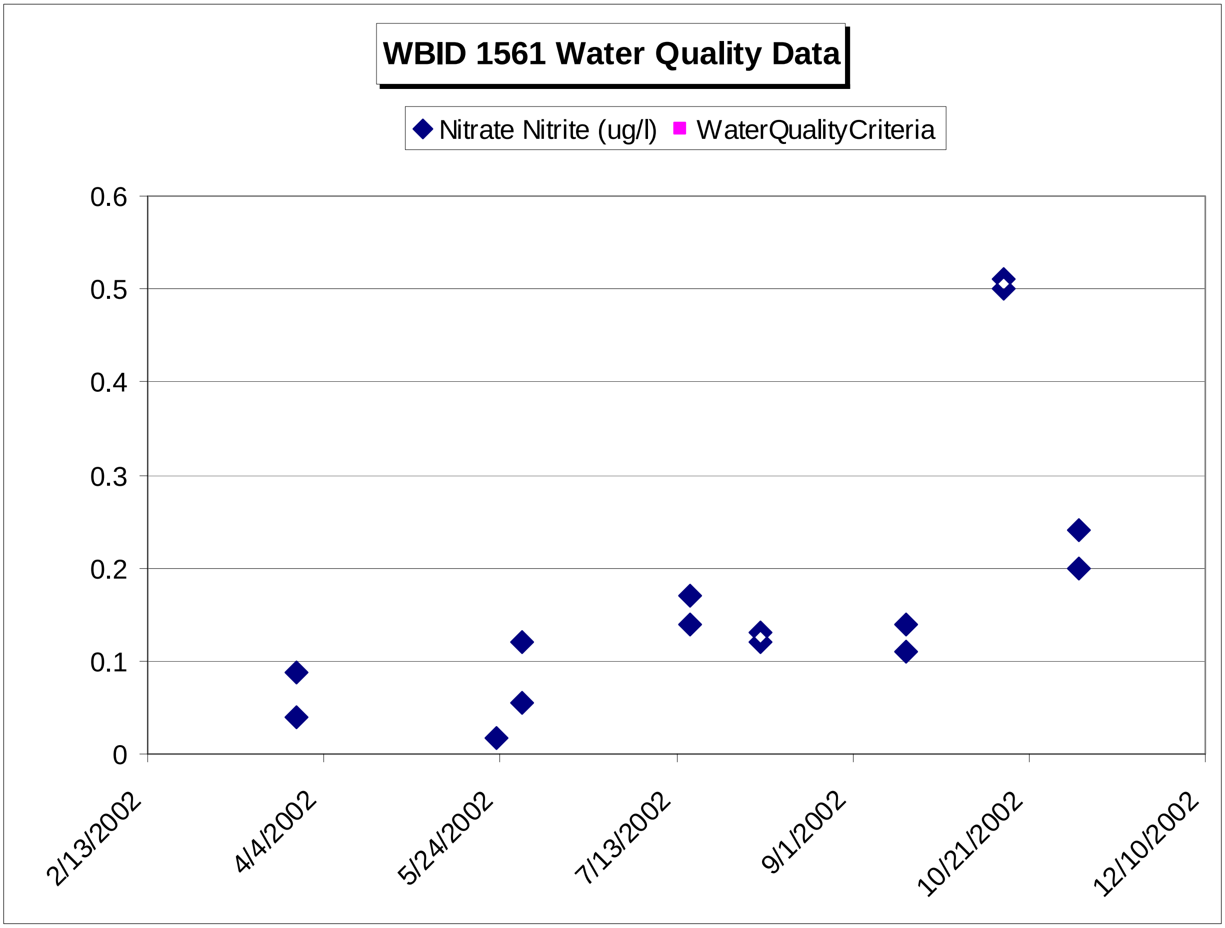

Figure 7: Nitrate and nitrite in Spartman Branch. The median is 0.13 mg/l and the statewide median is 3.95 mg/l. Note that the units in the figure are mg/l not ug/l.

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 TMDL segments of Baker Creek, and Spartman Branch are Class III freshwater waterbodies, 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 observed impairments are DO and the chlorophyll *a* narrative nutrient criteria for Baker and DO for Spartman Branch.

3.2 Applicable Water Quality Standards and Numeric Water Quality Targets

Baker Creek (WBID 1522C), Flint Creek WBID (1522C), and Spartman Branch (WBID 1561)

3.2.1 DO Criterion

The Class III freshwater criterion for DO, established by Subsection 62-302.530(31), F.A.C., states that DO shall not average less than 5.0 mg/L in a 24-hour period, and shall not be less than 4 mg/L, and that normal daily and seasonal fluctuations above these levels shall be maintained.

3.2.2 Interpretation of Narrative Nutrient Criterion

The IWR's numeric chlorophyll *a* threshold for estuaries is used to represent levels at which an imbalance in flora or fauna is expected to occur. While the IWR provides a threshold for nutrient impairment for streams and estuaries based on annual average chlorophyll *a* levels, these thresholds are not standards and need not be used as the nutrient-related water quality target for TMDLs. In fact, in recognition that the IWR thresholds were developed using statewide average conditions, the IWR (Section 62-303.450, F.A.C.) specifically allows the use of alternative, site-specific thresholds that more accurately reflect conditions beyond which an imbalance in flora or fauna occurs in the waterbody.

As there were no site-specific thresholds for nutrient impairment available for Baker, the water quality targets used to determine the TMDL for LSC were the impairment thresholds defined in the IWR, Section 62-303.353, F.A.C. Under the IWR, nutrient impairment for freshwater streams is assessed by determining if annual average chlorophyll *a* values exceed 20 μg/L, or if they are more than 50 percent greater than the **historical value (10.4 μg/L)** for at least 2 consecutive years. For developing this TMDL, the water quality target is an annual average chlorophyll *a* value of 20 μg/L, rather than a 50 percent increase over historical levels, because the former is the more conservative of the two chlorophyll *a* thresholds used for defining nutrient impairment.

Chapter 4: ASSESSMENT OF SOURCES

4.1 Types of Sources

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

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

To be consistent with Clean Water Act definitions, the term “point source” is 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. 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 Point Sources

4.2.1 NPDES Permitted Wastewater Facilities

Baker Creek

There is only one NPDES permitted wastewater treatment facility that discharges a maximum flow of 4.02 MGD indirectly into Baker Creek. The Crystals International, Inc. Facility discharges once-through cooling water through a discharge pipe to Westside Canal thence to Pemberton Creek, a tributary to Baker Creek.

Spartman Branch

There are no permitted wastewater treatment facilities or industrial facilities that discharge either directly or indirectly into the Spartman Branch watershed.

4.2.2 Municipal Separate Storm Sewer System Permittees

Municipal separate storm sewer systems (MS4s) may discharge nutrients to waterbodies in response to storm events. To address stormwater discharges, the EPA developed the NPDES stormwater permitting program in two phases. Phase I, promulgated in 1990, addresses large and medium MS4s located in incorporated places and counties with populations of 100,000 or more. Phase II permitting began in 2003. Regulated Phase II MS4s, which are defined in Section 62-624.800, F.A.C., typically cover urbanized areas serving jurisdictions with a population of at least 10,000 or discharge into Class I or Class II waters, or Outstanding Florida Waters.

The stormwater collection systems in the Baker, and Spartman Creek watersheds, which are owned and operated by Hillsborough County in conjunction with the Florida Department of Transportation, are covered by Phase I MS4 permits.

Within the Tampa Bay Basin, the stormwater collection systems owned and operated by Plant City, Hillsborough County, and the Florida Department of Transportation for Hillsborough County are covered by an NPDES municipal separate storm sewer system (MS4) permit, FLS000006. Hillsborough County is the lead co-permittee for the **Spartman Branch** watershed. In October 2000, Hillsborough County drafted a watershed management plan involving berm construction, channel improvements, and structural upgrades for flood control and some water quality treatment. Other recommendations for the **Spartman Branch** watershed included beginning a study to identify areas or sources that discharge pathogens, and beginning to provide treatment through the implementation of best management practices (BMPs) to reduce the loadings.

The Hillsborough Planning and Growth Management Department is in the process of carrying out a septic tank study for the watershed that identifies the location of septic tanks, assesses their impacts on water quality, and recommends management techniques to improve their efficiency.

4.3 Land Uses and Nonpoint Sources

Nutrient loading from urban areas is most often attributable to multiple sources, including stormwater runoff, leaks and overflows from sanitary sewer systems, illicit discharges of sanitary waste, runoff from improper disposal of waste materials, leaking septic systems, and domestic animals. Because the LSC watershed is primarily urban, wildlife and agricultural animals or livestock sources are not expected to contribute significantly to the impairments.

The total nonpoint source loads for each pollutant were quantified based on land use areas in the watershed. The loadings include runoff from urban areas and transportation and utility areas. Part of the surface runoff loads come from atmospheric deposition that falls directly onto the land surface. Although not specifically quantified, the runoff from residential areas includes leachate from septic systems.

4.3.1 Land Uses

The spatial distribution and acreage of different land use categories for the Baker Creek, and Spartman Branch watersheds were identified using 1999 land use coverage data (scale 1:40,000) contained in the Department's geographic information system (GIS) library (Florida Department of Environmental Protection, June 2004) **(Figure 4.1)**.

Baker Creek

Land use categories in the watershed were aggregated using the simplified Level 3 codes tabulated in **Table 4.1. Figure 4.1** shows the acreage of the principal land uses in the watershed.

The dominant land use category is the agricultural and primarily low and medium residential areas. The total area occupied by the residential land use category is about 228 acres and accounts for about 15.5% of the total watershed area. Another 61% of the watershed is claimed by agriculture and rangeland. The natural land use area, which includes upland forest, water, and wetland, accounts for about 20% of the total watershed area. Table 4.2 lists the area for each land use category. A general impression is that the watershed is low density residential, which is most likely to have a septic tank system. Leakage from these systems could be a potential source of fecal and total coliform. Some of the open land areas are used as pasture or rangeland. Contribution from the livestock could be another important source of fecal and total coliform. In addition, wildlife contribution in some of the open land and swamp areas could also contribute to the high fecal and total coliform concentration in Baker Creek.

Table 4.1 Classification of Land Use Categories in the Baker Creek Watershed

Level 1	Land Use Attribute	Area (acres)	Area (sq. miles)	Percentage
1000	Urban Open	4,534.5	7.1	12.95
1100	Residential Low Density < 2 Dwelling Units	4,228.1	6.6	12.08
1200	Residential Med Density 2->5 Dwelling Unit	4,528.7	7.1	12.94
1300	Residential High Density	2,064.7	3.2	5.90
2000	Cropland And Pastureland	11,279.5	17.6	32.22
3000	Mixed Rangeland	128.8	0.2	0.37
4000	Upland Coniferous Forest	2,367.4	3.7	6.76
5000	Lakes	1,121.3	1.8	3.20
6000	Freshwater Marshes	3,604.3	5.6	10.30
7000	Disturbed Land	215.5	0.3	0.62
8000	Utilities	932.7	1.5	2.66
Total		35,005.4	54.7	100

Spartman Branch

Land use categories in the watershed were aggregated using the Level 1 codes tabulated in **Table 4.4. Figure 4.1** shows the acreage of the principal land uses in the watershed.

The dominant land use category is urban open land. The total area occupied by the residential land use categories is about 1,397.2 acres and accounts for about 28% of the total watershed area. Another 17% of the watershed is claimed by agriculture and rangeland. The natural landuse area, which includes upland forest, water, and wetland, accounts for about 25% of the total watershed area. Table 4.1 lists the area for each land use category. A general impression is that the watershed is rural and medium density residential, which is most likely to have septic tank systems. Leakage from these systems could be a potential source of fecal and total coliform. Contribution from the livestock in the open land areas used as pasture or rangeland could be another important source of fecal and total coliform. In addition, wildlife contribution in some of the open land and swamp areas could also contribute to the high fecal and total coliform concentrations in Sparkman Branch.

Table 4.4 Classification of Land Use Categories in the Spartman Branch Watershed

Level 1	Land Use Attribute	Area (acres)	Area (sq. miles)	Percentage
1000	Urban Open	1,211.5	1.9	24.60
1100	Residential Low Density < 2	248.1	0.4	5.04

	Dwelling Units			
1200	Residential Med Density 2->5 Dwelling Unit	805.5	1.3	16.35
1300	Residential High Density	347.0	0.5	7.04
2000	Agriculture	810.7	1.3	16.46
3000/7000	Rangeland	70.3	0.1	1.43
4000	Forest/rural open	263.7	0.4	5.35
5000	Water	161.1	0.3	3.27
6000	Wetlands	808.3	1.3	16.41
8000	Transportation, Communication, and utilities	199.0	0.3	4.04
Total		4,925.2	7.7	100

4.3.2 Population

Hillsborough County Population

The Bureau reports that the total population for Hillsborough County for 2000 was 998,948 with 425,962 housing units. For all of Hillsborough County, the Bureau reported a housing density of 405 houses per square mile. This places Hillsborough County as having one of the highest housing densities in the state in 2000; a ranking of 6th out of 67 counties in the state of Florida (U.S. Census Bureau, 2004). This is also supported by the land use coverage information, which shows that 30.9 percent of land use is dedicated to residences in Baker Creek, 28.5 percent in Flint Creek, 30.2 percent in Lake Thonotosassa, and 28.4 percent in Spartman Branch.

Baker Creek

Baker Creek According to the U.S Census Bureau, the population density in and around WBID 1522C in the year 2000 was at or less than 405 people per square mile. The Bureau reports that the total population in Hillsborough County, which includes (but is not exclusive to) WBID 1522C, for 2000 was 998,948 with 425,962 housing units. This places Hillsborough County among the highest in housing densities in Florida (U.S. Census Bureau Web site, 2004). However, most of the high housing density is located further west of WBID 1561 in the Tampa Bay and Saint Petersburg areas. WBID 1561 is primarily composed of medium density residential (16.8%), and only 28.39 percent of the total land use in WBID is dedicated to residences.

According to the U.S Census Bureau, the population density in and around WBID 1522C in the year 2000 was at or less than 405 people per square mile. The Bureau reports that the total population in Hillsborough County, which includes (but is not exclusive to) WBID 1522C, for 2000 was 998,948 with 425,962 housing units. This places Hillsborough County among the highest in housing densities in Florida (U.S. Census Bureau Web site, 2004). However, most of the high housing density is located further west of WBID 1561 in the Tampa Bay and Saint Petersburg areas. WBID 1561 is primarily composed of medium density residential (16.8%), and only 28.39 percent of the total land use in WBID is dedicated to residences.

Spartman Branch

According to the U.S Census Bureau, the population density in and around WBID 1522C in the year 2000 was at or less than 405 people per square mile. The Bureau reports that the total population in Hillsborough County, which includes (but is not exclusive to) WBID 1522C, for 2000 was 998,948 with 425,962 housing units. This places Hillsborough County among the highest in housing densities in Florida (U.S. Census Bureau Web site, 2004). However, most of the high housing density is located further west of WBID 1561 in the Tampa Bay and Saint Petersburg areas. WBID 1561 is primarily composed of medium density residential (16.8%), and only 28.39 percent of the total land use in WBID is dedicated to residences.

4.3.3 Septic Tanks

Hillsborough County Septic Tanks

Onsite sewage treatment and disposal systems (OSTDSs), including septic tanks, are commonly used where providing central sewer is not cost-effective or practical. When properly sited, designed, constructed, maintained, and operated, OSTDSs are a safe means of disposing of domestic waste. The effluent from a well-functioning OSTDS is comparable to secondarily treated wastewater from a sewage treatment plant. When not functioning properly, however, OSTDSs can be a source of nutrients (nitrogen and phosphorus), pathogens, and other pollutants to both ground water and surface water. As of 2001, Hillsborough County had roughly 100,483 septic systems (Florida Department of Health, 2004). Data for septic tanks are based on 1970 – 2001 census results, with year-by-year additions based on new septic tank construction. The data do not reflect septic tanks that have been removed going back to 1970. From fiscal years 1993–2002, 9,140 permits for repairs were issued (Florida Department of Health, 2004). Based on the number of permitted septic tanks and housing units located in the county, approximately 76 percent of the housing units are connected to a wastewater treatment facility, with the remaining 24 percent utilizing septic tank systems.

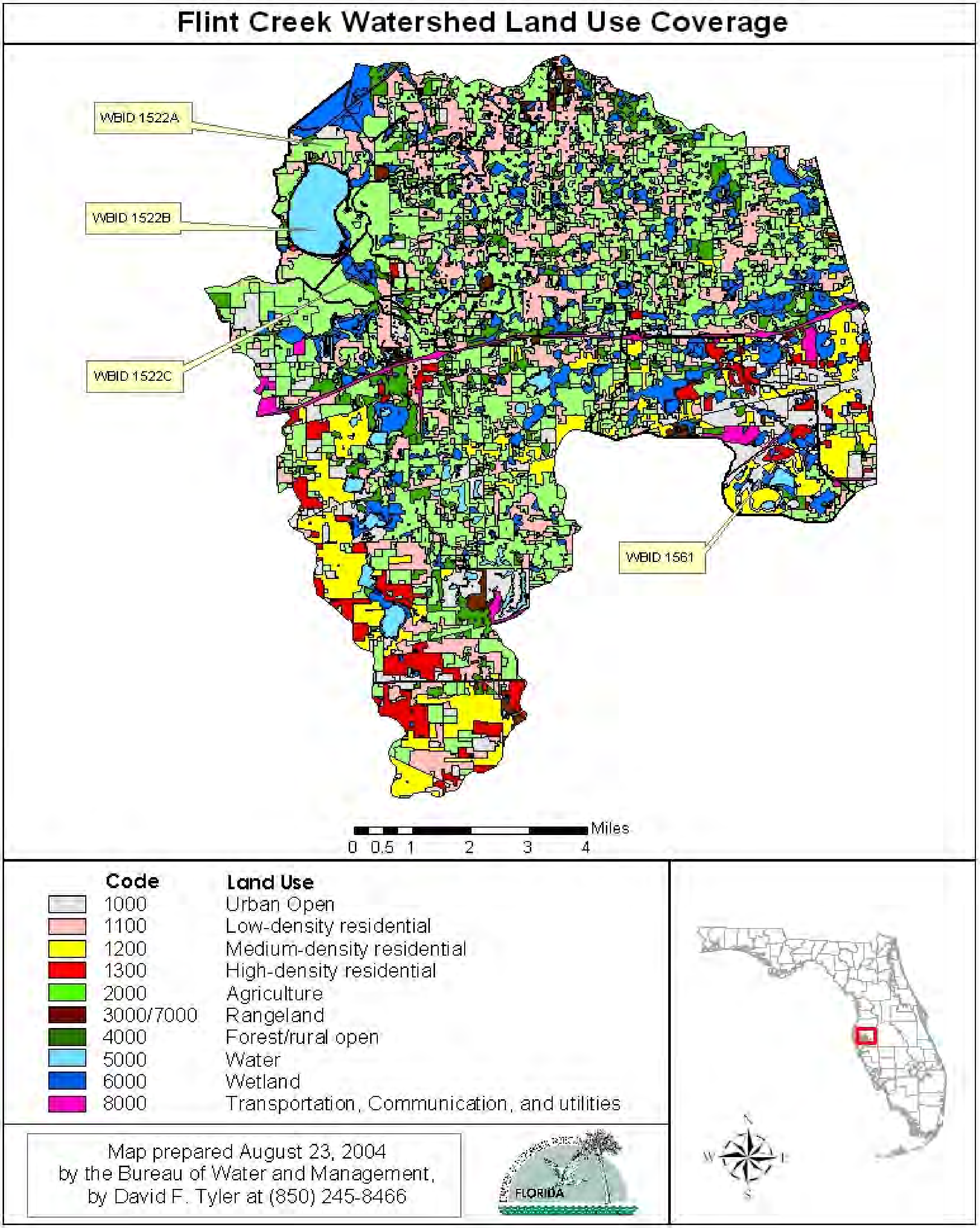

Figure 4.1 Flint Creek Watershed System Land Use Profile for WBIDs 1522A, 1522B, 1522C, and 1561

Table 4.1. Classification of Land Use Categories That Contribute to the Flint Creek Watershed System, WBIDs 1522A, 1522B, 1522C, and 1561

Level 1	Land Use Attribute	Area (acres)	Area (sq miles)	Percentage
1000	Urban Open	4817.7	7.53	8.82
1100	Residential Low Density < 2 Dwelling Units	8897.5	13.90	16.29
1200	Residential Med Density 2->5 Dwelling Unit	4590.8	7.17	8.40
1300	Residential High Density	2079.1	3.25	3.81
2000	Cropland And Pastureland	20599.5	32.18	37.71
3000	Mixed Rangeland	309.5	0.48	0.57
4000	Upland Coniferous Forest	3720.3	5.81	6.81
5000	Lakes	2197.0	3.43	4.02
6000	Freshwater Marshes	6183.7	9.66	11.32
7000	Disturbed Land	252.4	0.39	0.46
8000	Utilities	977.5	1.53	1.79
Total		54,625.1	85.3	100

Chapter 5: ANALYTICAL APPROACH/ MODEL SELECTION AND DEVELOPMENT

Approach

The Watershed Assessment Model (WAM) was utilized to estimate the flow, nutrients, total suspended solids, and BOD loads discharged from the Flint Creek watershed system. WAM (Soil and Water Engineering Technologies, Inc., 2004) is a Geographic Information Based (GIS) based model that allows engineers and planners to interactively simulate and assess the environmental effects of various land use changes and associated land use practices. The output from the WAM model was then used by the Watershed Assessment and Simulation Program (WASP) model to simulate the DO responses within the watershed's TMDL listed WBID reaches.

Models

The following summary on of the WAM model is from EPA's Watershed and Water Quality Modeling Technical Support Center web site (http://www.epa.gov/athens/wwqtsc/WAMView.pdf). WAM's interface uses ESRI's ArcView 3.2a with Spatial Analyst 1.1 (or 2.0). WAM was developed to allow engineers and planners to assess the water quality of both surface water and groundwater based on land use, soils, climate, and other factors. The model simulates the primary physical processes important for watershed hydrologic and pollutant transport. The WAM GIS-based coverages include land use, soils, topography, hydrography, basin and sub-basin boundaries, point sources and service area coverages, climate data, and land use and soils description files. The coverages are used to develop data that can be used in the simulation of a variety of physical and chemical processes.

WAM was developed based on a grid cell representation of the watershed. The grid cell representation allows for the identification of surface and groundwater flow and phosphorus concentrations for each cell. The model then "routes" the surface water and groundwater flows from the cells to assess the flow and phosphorus levels throughout the watershed. The model simulates the following elements: surface water and ground water flow allowing for the assessment of flow and pollutant loading for a tributary reach at both the daily and hourly time increment as necessary; water quality including particulate and soluble phosphorus, particulate and soluble nitrogen (NO3, NH4, and organic N), total suspended solids, and biological oxygen demand.

WAM was linked to WASP (SWET, 2003), which enables the simulation of dissolved oxygen and chlorophyll-a. The WAM model simulates the hydrology of the watershed using other imbedded models including "Groundwater Loading Effects of Agricultural Management Systems" (GLEAMS; Knisel, 1993), "Everglades Agricultural Area Model" (EAAMod; Botcher et al., 1998; SWET, 1999), and two submodels written specifically for WAM to handle wetland and urban landscapes. Dynamic routing of flows is accomplished through the use of an algorithm that uses a Manning's flow equation based technique (Jacobson et al., 1998). Attenuation is based on the flow rate, characteristics of the flow path, and the distance of travel. The model provides many features that improve its ability to simulate the physical features in the generation of flows and loadings including:

- Flow structures simulation
- Generation of typical farms
- BMPs
- Rain zones built into unique cells definitions, which also allows use with NEXRAD Data
- Full erosion/deposition and in-stream routing –is used with ponds and reservoirs
- Closed basins and depressions are simulated
- Separate simulation of vegetative areas in residential and urban
- Simulation of point sources with service areas
- Urban retention ponds
- Impervious sediment buildup/washoff
- Shoreline reaches for more precise delivery to rivers, lakes, and estuaries
- Wildlife diversity within wetlands
- Spatial map of areas having wetland assimilation protection
- Indexing submodels for BOD, bacteria, and toxins

The overall operation of the model is managed by the ArcView-based interface. The interface allows the user to view available data, modify land use conditions, execute the model, and view results.

In order to evaluate the effect of BOD, nutrients, algae, and other oxygen demanding substances on DO processes a Water Quality Analysis Simulation Program (WASP) model was setup for this river segment. The Water Quality Analysis Simulation Program version 6 (WASP6) is an enhancement of the original WASP (Di Toro et al., 1983; Connolly and Winfield, 1984; Ambrose, R.B. et al., 1988). This model helps users interpret and predict water quality responses to natural phenomena and man made pollution for various pollution management decisions. WASP6 is a dynamic compartment-modeling program for aquatic systems, including both the water column and the underlying benthos. The time varying processes of advection, dispersion, point and diffuse mass loading, and boundary exchange are represented in the basic program.

Water quality processes are represented in special kinetic subroutines that are either chosen from a library or written by the user. WASP is structured to permit easy substitution of kinetic subroutines into the overall package to form problem specific models. WASP6 comes with two such models -- TOXI for toxicants and EUTRO for conventional water quality. Earlier versions of WASP have been used to examine eutrophication of Tampa Bay; phosphorus loading to Lake Okeechobee; eutrophication of the Neuse River and estuary; eutrophication and PCB pollution of the Great Lakes (Thomann, 1975; Thomann et al., 1976; Thomann et al, 1979; Di Toro and Connolly, 1980), eutrophication of the Potomac Estuary (Thomann and Fitzpatrick, 1982), kepone pollution of the James River Estuary (O'Connor et al., 1983), volatile organic pollution of the Delaware Estuary (Ambrose, 1987), and heavy metal pollution of the Deep River, North Carolina (JRB, 1984). In addition to these, numerous applications are listed in Di Toro et al., 1983.

The flexibility afforded by the Water Quality Analysis Simulation Program is unique. WASP6 permits the modeler to structure one, two, and three-dimensional models; allows the specification of time variable exchange coefficients, advective flows, waste loads and water quality boundary conditions. The eutrophication module of WASP6 was applied to the Blackwater Creek in this study.

Flow, depth, velocity, and nutrient and BOD loads predicted by the WAM model was used in the WASP models. Solar radiation data was obtained on the University of Florida Institute of Food and Agricultural Sciences, Florida Automated Weather Network world-wide-web site http://fawn.ifas.ufl.edu/. Sediment oxygen demand (SOD) can be a major contributor to low D.O. SOD measurements in the nearby Alafai River range from 1.2 to over 7 grams/square meter/day, (Measured Sediment Oxygen Demand Rates, USEPA). SOD measurements in the Ocklawaha River Basin’s Rice Creek upstream of the Georgia Pacific Mill discharge range from 1.5 to 3.0. SOD rate of 2.0 was used in this WASP model for Baker Creek, Spartman Branch system. Incremental BOD and nutrient loads were entered into WASP from the results of the WAM model. These estimated existing nutrient and BOD loads from the watershed are summarized in Table 7 and Table 8. In-stream model predictions compared to observed water quality data are shown next.

Table 7: Model predicted nitrogen, phosphorous and biochemical oxygen demand loads for Baker Creek

Year	TN (kg/d)	TP (kg/d)	BOD (kg/d)	Annual Average Flow (m3/s)
1999	45	7	67	0.49
2000	58	10	81	0.53
2001	80	15	129	0.70
2002	75	12	104	0.71
2003	74	14	107	0.78

Table 8: Model predicted nitrogen, phosphorous and biochemical oxygen demand loads for Spartman Branch

Year	TN (kg/d)	TP (kg/d)	BOD (kg/d)	Annual Average Flow (m3/s)
1999	21	3	36	0.20
2000	25	4	44	0.21
2001	34	6	69	0.29
2002	33	5	56	0.29
2003	33	6	59	0.31

Table 9: Point source permitted concentrations and loads

Point Source Facilities	Unionized Ammonia (mg/l)	min DO (mg/l)	Flow (MGD)
Crystals International, Inc., FL0037389	0.02	5	4.02
	Unionized Ammonia (kg/d)	**min DO (kg/d)**	**Flow (m3/s)**
	0.2	50.7	0.18

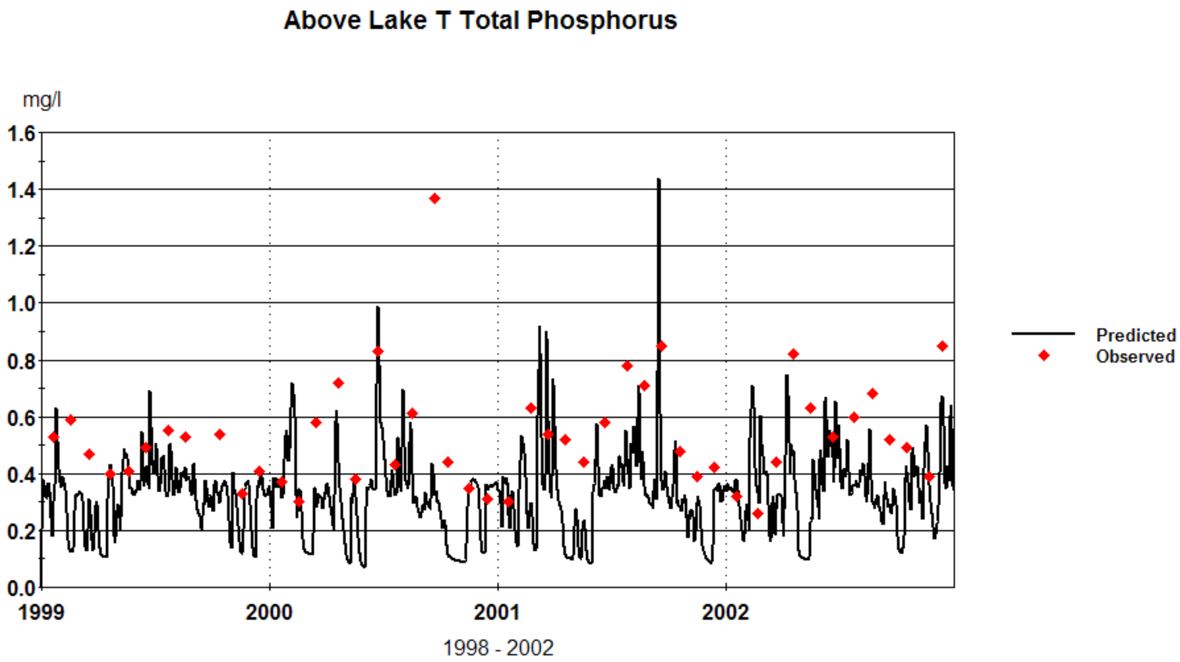

Figure 8: Predicted and observed phosphorous

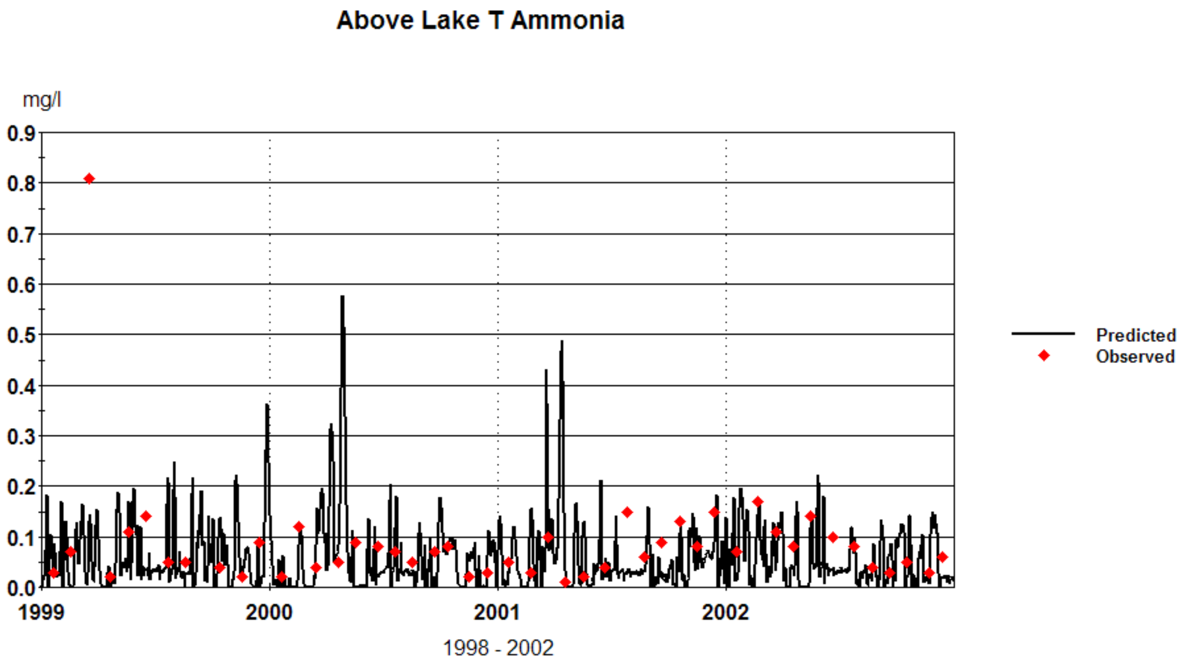

Figure 9: Predicted and observed ammonia

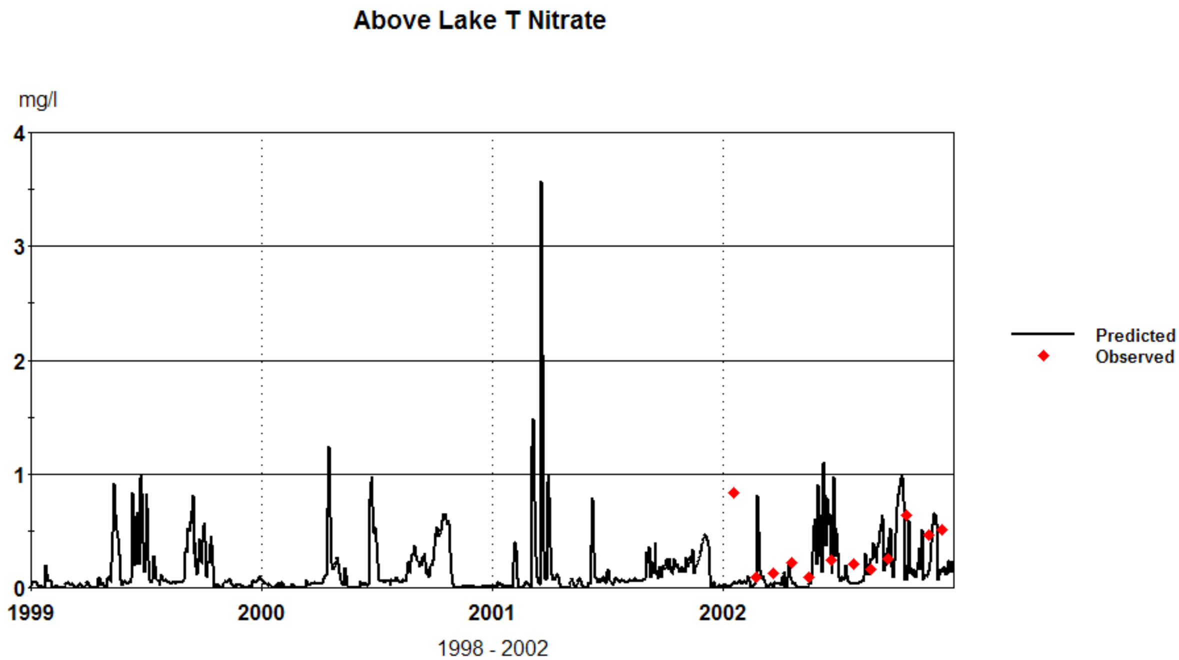

Figure 10: Predicted and observed nitrate

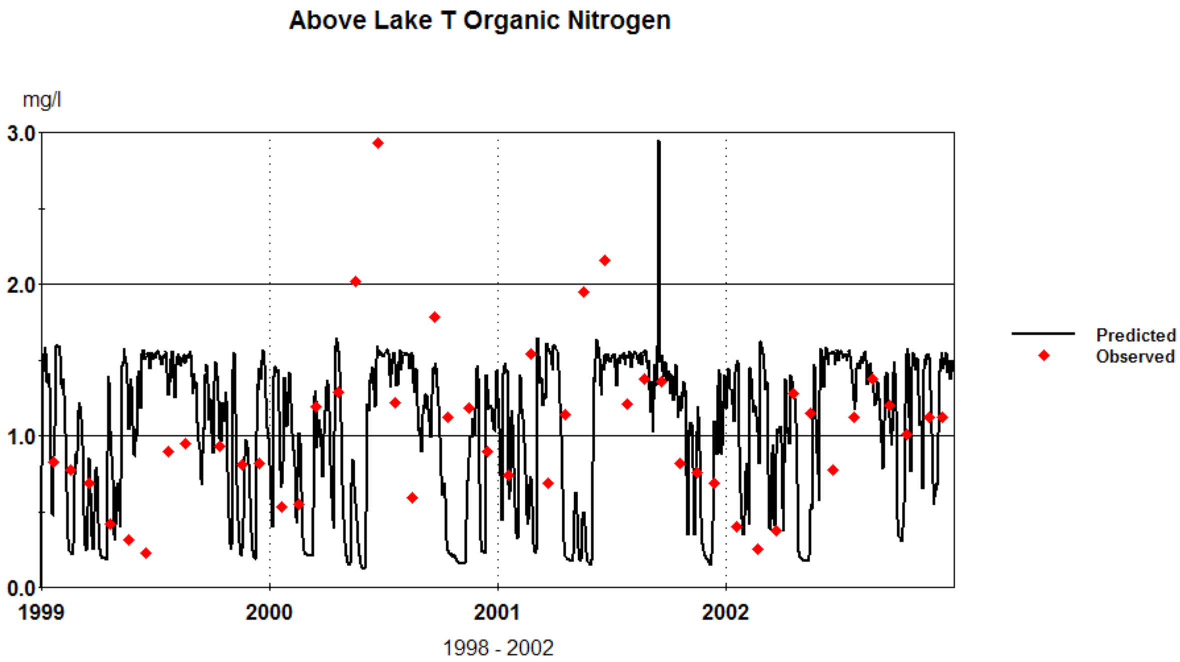

Figure 11: Predicted and observed organic nitrogen

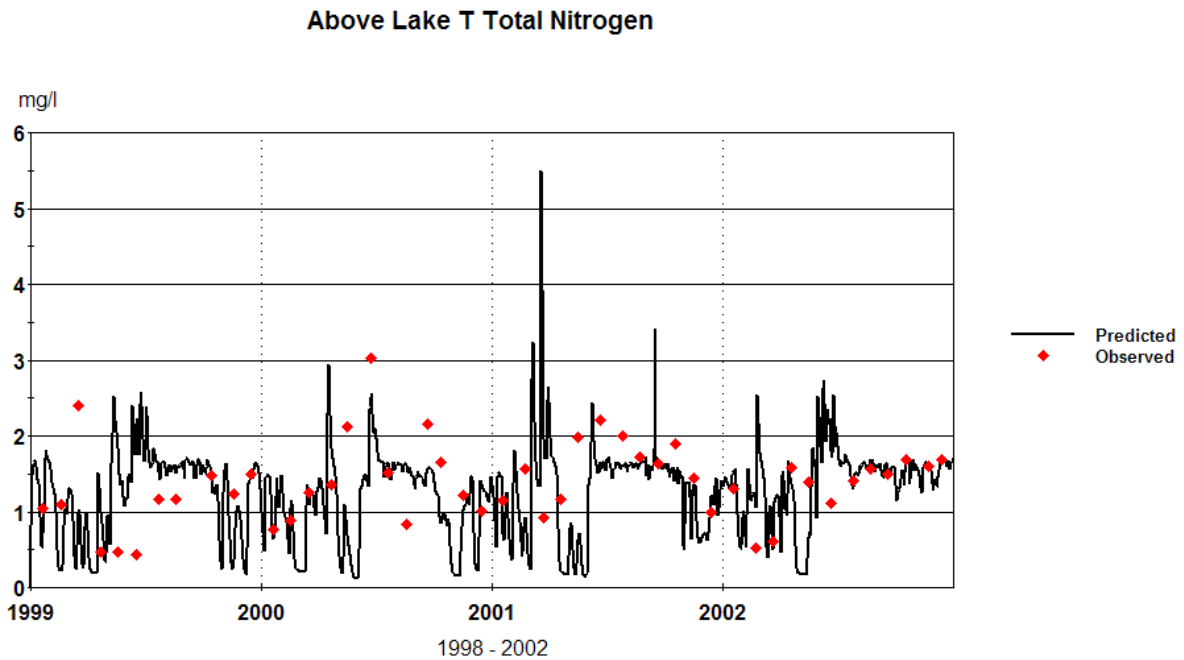

Figure 12: Predicted and observed total nitrogen

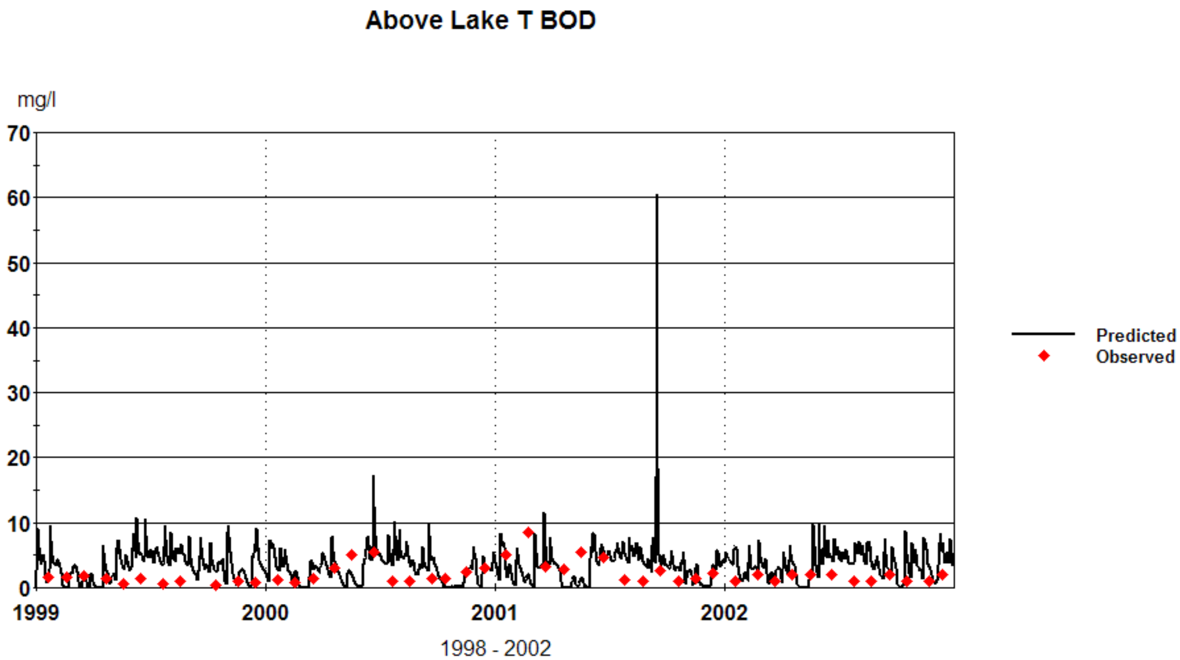

Figure 13: Predicted and observed BOD

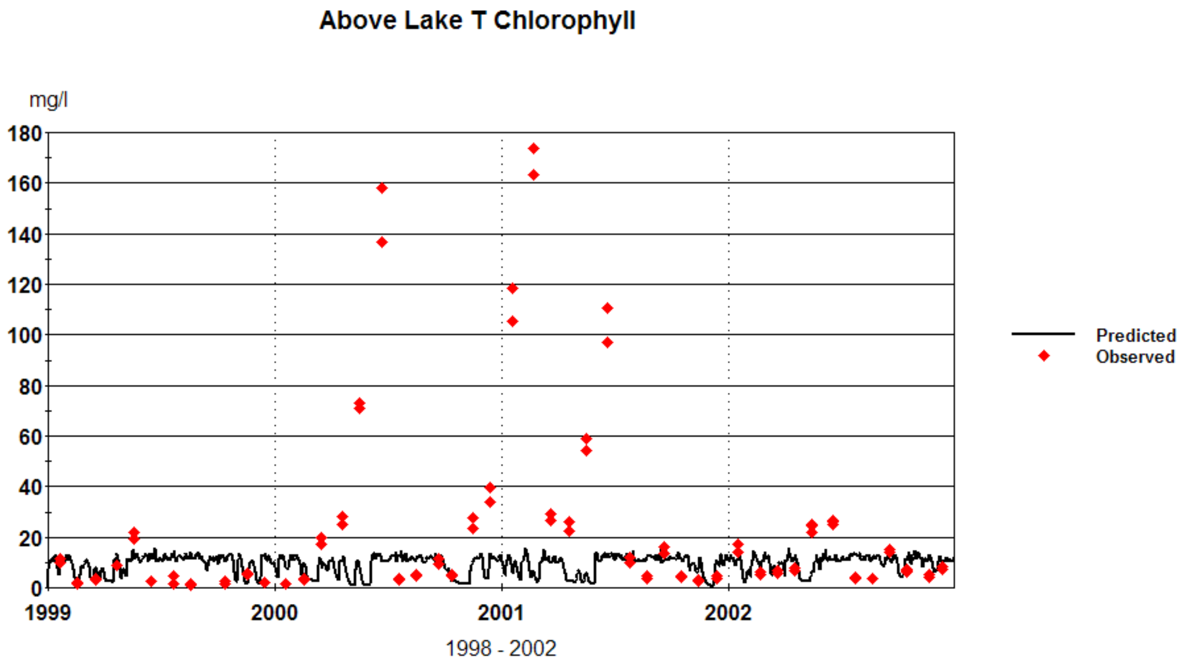

Figure 14: Predicted and observed chlorophyll-a. The high observed chlorophyll-a data appear to be the result of backwater from Lake Thonotosassa at this water quality monitoring station.

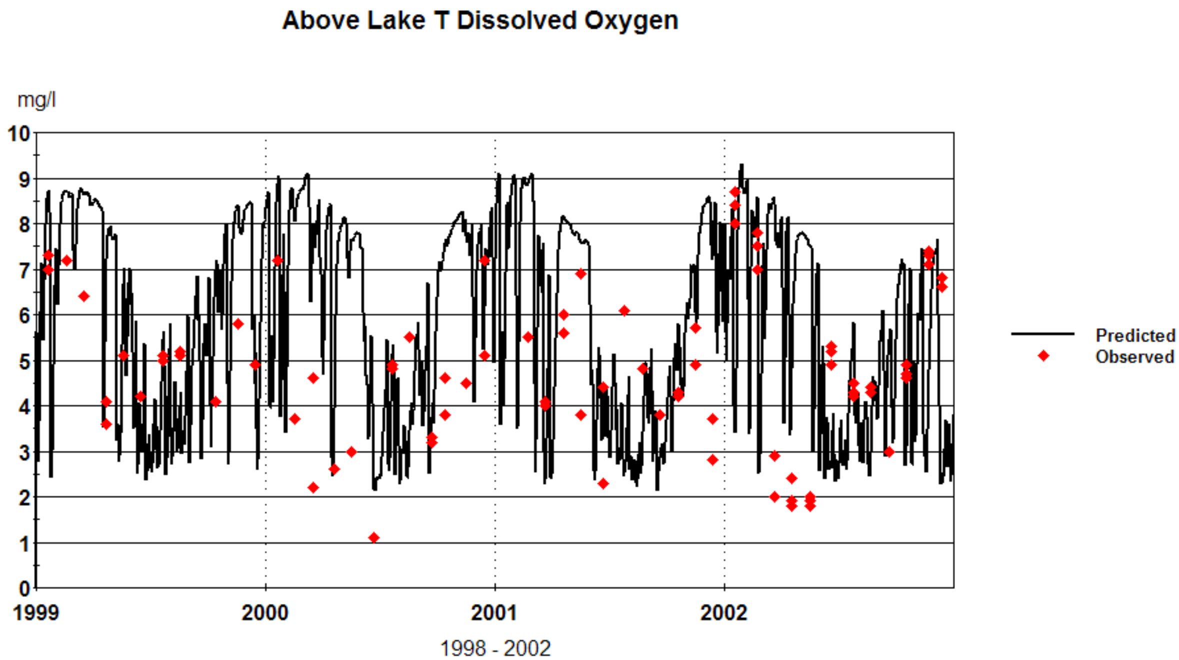

Figure 15: Predicted and observed DO

TMDL Development

The TMDLs were developed by using the model to understand the river system and determine the levels of the water quality parameters that result in attainment of the DO water quality standard. As shown in Figure 13, BOD is relatively low, near detection limits and has little impact on the DO in this river system. Figure 16 shows that the DO varies little with a five fold difference in BOD.

Nutrients can affect the DO through algae and other plant production and respiration. An excess of algae growth can imbalance the natural system and cause large DO swings from high super saturation to low levels. Additionally, the algae population can reach a limiting level of nutrients or light and then experience a large die-off, that can then result in DO consumption and low in-stream DO. Figure 17 shows that DO in this river system is not greatly affected by algae production. Excess growth of algae may be partially prevented by the naturally dark water in this system.

Sediment oxygen demand (SOD) is another factor that can contribute to low DO. However, based on measured data from similar streams and the model results, the SOD in the stream channel is likely not high enough to cause the chronic low DO found in this river system.

After examining each of the factors that can contribute to low DO, the levels of these factors found in the Spartman Branch and Baker Creek system are not excessive enough to cause the chronically low DO found in this system.

The low DO in this river system is likely a result of natural processes in the wetlands and groundwater flowing into these streams. Since the watershed model is not simulating the DO processes on the watershed and wetland areas, and the receiving stream model is simulating only the processes that occur in the streams, the DO levels in the water flowing from the wetlands and groundwater to the streams is unknown. The sensitivity of the in-stream DO to the DO concentration of the water entering from the watershed can be simulated by ranging these watershed DO concentrations. Figure 18 shows simulated in-stream DO with the watershed DO set to 2 mg/l and then at 5 mg/l. This demonstrates that if the water flowing from the watershed had DO concentrations of 5 mg/l then the in-stream DO would remain above the water quality standard.

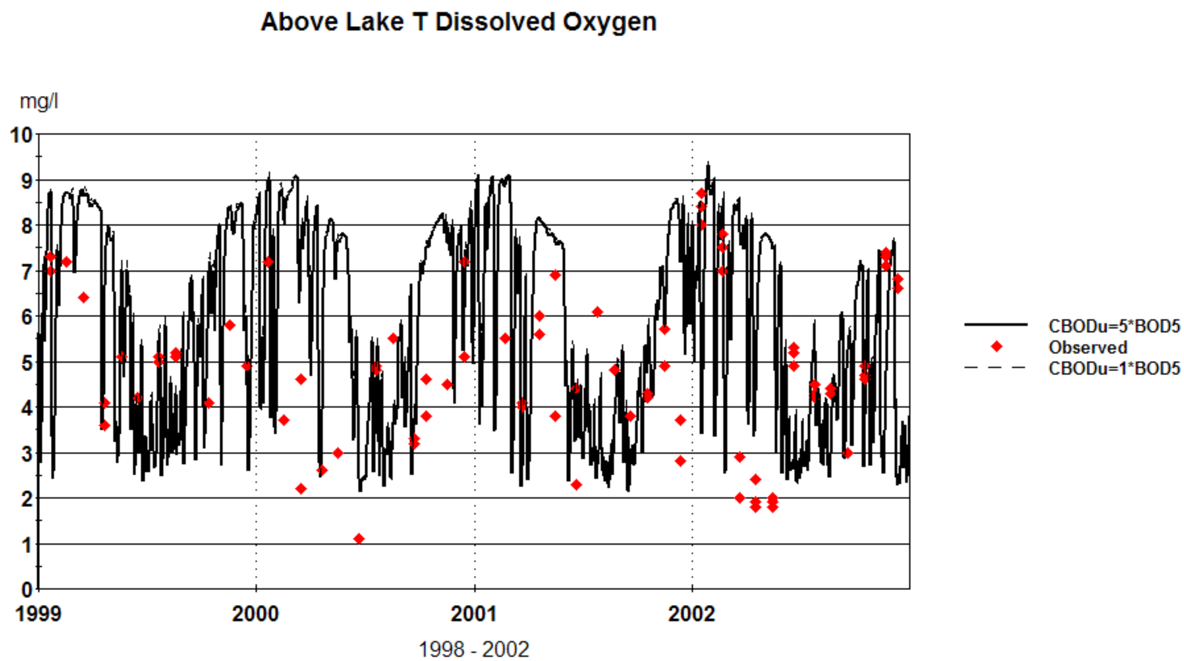

Figure 16: DO with ultimate CBOD at 1 and 5 times the 5-day BOD. A five fold difference in BOD causes no noticeable difference in in-stream DO.

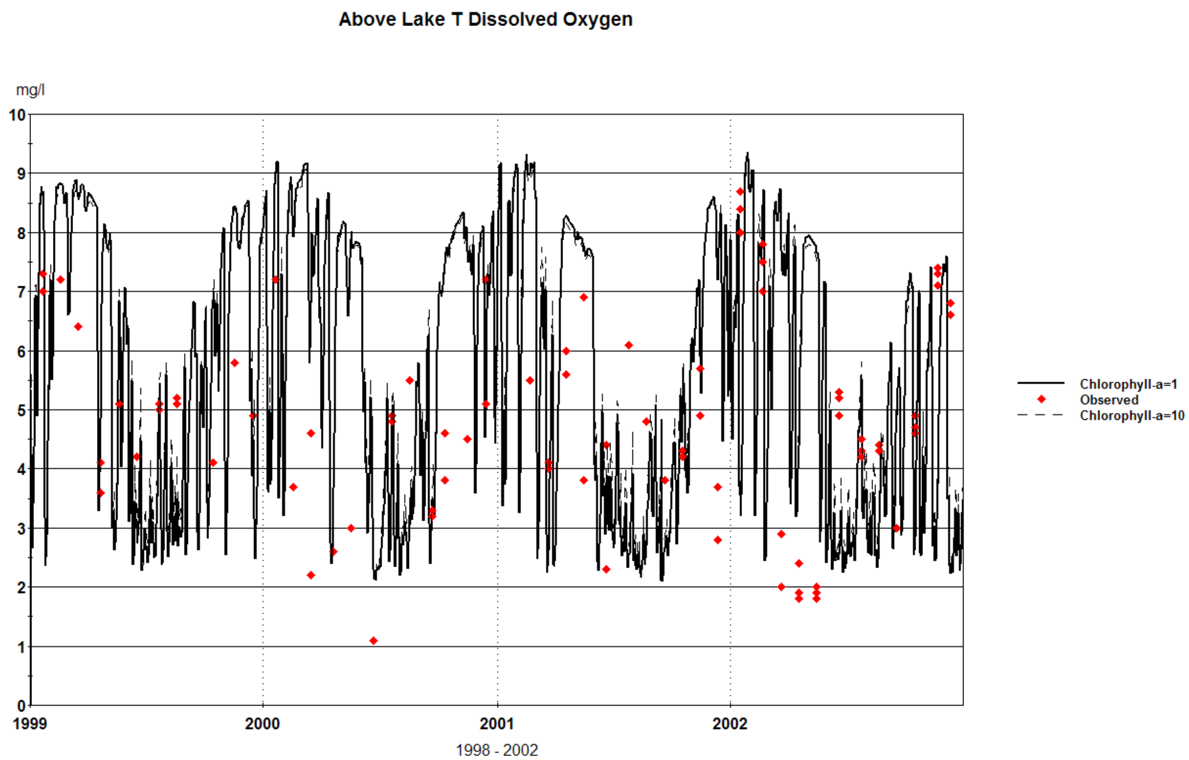

Figure 17: DO with chlorophyll-a at 1 and 10. A 10 fold difference causes minor difference in in-stream DO.

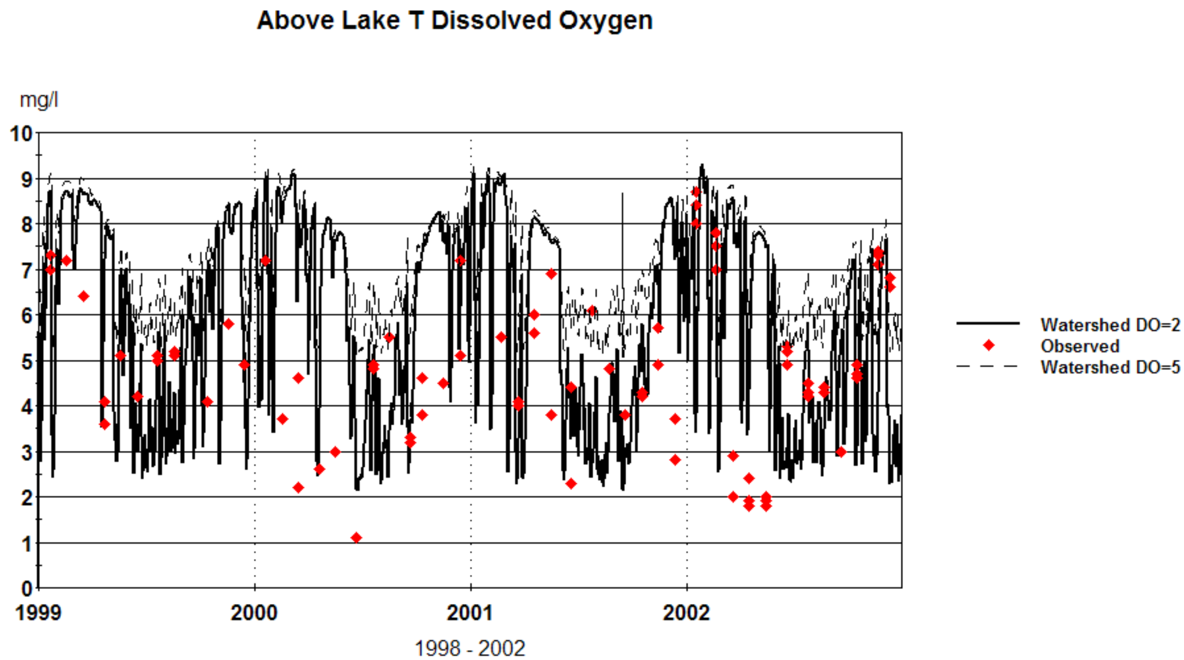

Figure 18: In-stream DO with the watershed DO at 2 and 5 mg/l. The DO flowing from the wetlands and groundwater control the in-stream DO.

Chapter 6: DETERMINATION OF THE TMDL

Baker Creek

Allocation:

The TMDL and allocation of the load is shown in **Error! Reference source not found.**. Since the low in-stream DO is a result of low DO water flowing from groundwater and wetlands, and not the result of in-stream algae, nutrient, and BOD oxygen consumption, no load reductions to achieve the DO standard are specified in this TMDL report. The TMDL for DO is the water quality standard of 5 mg/l. This equates to 302 kg/d of dissolved oxygen in year 2001 when the flow was 0.70 cms.In order to achieve this standard in-stream, the water flowing from the wetlands and groundwater into the stream needs to be 5.0 mg/l. This groundwater and wetlands water is naturally below 5.0 mg/l. For this water to meet the DO standard of 5.0 mg/l, and addition of oxygen would be required. For example, to raise the DO from 2 mg/l to 5 mg/l, a flow of 0.7 cms (the average annual flow in 2001) would require an addition of 181 kg/d of oxygen.

Baker Creek and Spartman Branch are also listed as impaired for nutrients. The limiting nutrient is nitrogen in this system, and therefore the TMDL targets total nitrogen. A TMDL, SWIM plan and PLRG have been developed for Lake Thonotosassa for nutrients. The loads proposed for Lake Thonotosassa would need to be applied to the Baker Creek and Spartman Branch system to implement the Lake Thonotosassa TMDL. Therefore, it is appropriate to use those same nutrient loadings to address the nutrient impairment in these tributary streams. The total nitrogen load can be determined by multiplying the target concentration for TN (1.2 mg/l) by the estimated annual average flow. Using year 2001 flow of 0.7 cms, this gives a TN load of 73 kg/d. The estimated current TN load is 80 kg/d, so a reduction of 7 kg/d, or 8.75 percent would be required. With an added margin of safety this reduction would be 14.5 kg/d or 18 percent.

Table 10: TMDL load allocations to Baker Creek

Pollutant	TMDL	WLA		LA	MOS
		Continuous	MS4		
Dissolved Oxygen (DO)	(min.) 5.0 mg/l or 302 kg/d	---	(min.) 5.0 mg/l or 302 kg/d	(min.) 5.0 mg/l or 302 kg/d	implicit
Total nitrogen (TN)	73 kg/d	0.2 kg/d	18% reduction	18% reduction	7.3 kg/d

Waste Load Allocations (Regulated with treatment plant and stormwater permits)

The waste load allocation (WLA) is divided into continuous discharges from treatment plants and storm water loads from municipal separate storm sewer systems. The continuous WLA for DO is equal to the water quality standard of a minimum of 5 mg/l. For total nitrogen the continuous WLA is a maximum of 0.2 kg/d which is based on the current permit limits for unionized ammonia of 0.2 mg/l. For DO the sum of the MS4 WLA and the LA should not fall below 302 kg/d. The regulated storm-water (MS4) loads for TN should be reduced by 18 percent so the sum of the MS4 load and the non-point source loads do not exceed 65.5 kg/d.

Load Allocations (Non- Regulated)

The LA for DO is equal to the water quality standard of a minimum of 5 mg/l. For DO the sum of the MS4 WLA and the LA should not fall below 302 kg/d. For total nitrogen the LA is an 18% reduction so the sum of the MS4 load and the non-point source loads do not exceed 65.5 kg/d.

Spartman Branch

For Spartman Branch the TMDL and load allocation is shown in **Error! Not a valid bookmark self-reference.**. Since the low in-stream DO is a result of low DO water flowing from groundwater and wetlands, and not the result of in-stream algae, nutrient, and BOD oxygen consumption, no load reductions to achieve the DO standard are specified in this TMDL report. The TMDL for DO is the water quality standard of 5 mg/l. This equates to 125 kg/d of dissolved oxygen in year 2001 when the average annual daily flow was 0.29 cms. In order to achieve this standard in-stream, the water flowing from the wetlands and groundwater into the stream needs to be 5.0 mg/l. This groundwater and wetlands water is naturally below 5.0 mg/l. For this water to meet the DO standard of 5.0 mg/l, an addition of oxygen would be required. For example, to raise the DO from 2 mg/l to 5 mg/l, a flow of 0.29 cms (the average annual flow in 2001) would require an addition of 75 kg/d of oxygen.

The nutrient impairment in Spartman can be addressed similarly to Baker Creek. The estimated annual average flow for 2001 is 0.29 cms. Multiplying by the nitrogen target concentration of 1.2 mg/l gives a TN load of 30 kg/d. Including a ten percent margin of safety leaves 27 kg/d to allocate. The estimated current load for Spartman Branch TN is 34 kg/d, and so the required reduction is 7 kg/d or 21 percent.

Table 11: TMDL load allocations to Spartman Branch

Pollutant	TMDL	WLA		LA	MOS
		Continuous	MS4		
Dissolved Oxygen (DO)	(Min.) 5.0 mg/l or 125 kg/d	----	(Min.) 5.0 mg/l or 125 kg/d	(Min.) 5.0 mg/l or 125 kg/d	implicit

Total Nitrogen	30 kg/d	---	21% reduction	21% reduction	3 kg/d

Waste Load Allocations (Regulated with treatment plant and stormwater permits)

The waste load allocation (WLA) is divided into continuous discharges from treatment plants and storm water loads from municipal separate storm sewer systems. Since there are no continuous discharges, continuous WLA for DO and TN is zero. For DO the sum of the MS4 WLA and the LA should not fall below 125 kg/d. For TN the regulated storm-water (MS4) loads should be reduced by 21 percent so the sum of the MS4 load and the non-point source loads do not exceed 27 kg/d.

Load Allocations (Non- Regulated)

The LA for DO is equal to the water quality standard of a minimum of 5 mg/l. For DO the sum of the MS4 WLA and the LA should not fall below 125 kg/d. For total nitrogen the LA is a 21% reduction so the sum of the MS4 load and the non-point source loads do not exceed 27 kg/d.

MARGIN OF SAFETY

A ten percent explicit margin of safety is included in the allocation of TN. This also implies an implicit margin of safety on the DO allocation.

CRITICAL CONDITIONS

Critical conditions were considered by analyzing a multi year period containing wet, normal, and dry conditions. Since these impaired waters receive both storm water driven loads and continuous flow loads, both wet events and dry events were analyzed.

SEASONAL VARIATION

Seasonal variation was considered by analyzing a multi year period containing all seasons and wet, normal, and dry conditions.

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Appendices

Appendix A: Background Information on Federal and State Stormwater Programs

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

The rule requires the state's water management districts (WMDs) to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a Surface Water Improvement and Management (SWIM) plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL. To date, stormwater PLRGs have been established for Tampa Bay, Lake Thonotosassa, the Winter Haven Chain of Lakes, the Everglades, Lake Okeechobee, and Lake Apopka. No PLRG has been developed for Newnans Lake at the time this report was developed.

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

An important difference between the federal and state stormwater permitting programs is that the federal program covers both new and existing discharges, while the state program focuses on new discharges. Additionally, Phase II of the NPDES Program will expand the need for these permits to construction sites between 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 similar to other point sources of pollution, such as domestic and industrial wastewater discharges. The Department recently accepted delegation from the EPA for the stormwater part of the NPDES Program. It should be noted that most MS4 permits issued in Florida include a reopener clause that allows permit revisions to implement TMDLs once they are formally adopted by rule.

Appendix B: Water Quality Monitoring Results for Baker Creek (WBID 1522C), and Spartman Branch (WBID 1561)

Baker Creek Dissolved Oxygen Data

WBID	Station ID	Date (m/d/y)	Time	Depth (ft)	DO (mg/L)
1522C	21FLHILL24030034	1/24/96	1209	1	5.7
1522C	21FLHILL24030034	1/24/96	1209	3	5.8
1522C	21FLHILL24030034	1/24/96	1209	6	6.2
1522C	21FLHILL24030034	2/21/96	1250	2	7.2
1522C	21FLHILL24030034	3/20/96	1300	1.5	7.1
1522C	21FLHILL24030034	4/17/96	1340	1.5	**4.9**
1522C	21FLHILL24030034	5/15/96	1540	1.3	5.8
1522C	21FLHILL24030034	6/19/96	1420	2	5.2
1522C	21FLHILL24030034	7/17/96	1305	1	**3.6**
1522C	21FLHILL24030034	8/21/96	1248	1.5	6.1
1522C	21FLHILL24030034	9/25/96	1252	1	5.3
1522C	21FLHILL24030034	10/16/96	1156	1.5	**4.3**
1522C	21FLHILL24030034	10/16/96	1156	3	**4.3**
1522C	21FLHILL24030034	10/16/96	1156	1	**4.4**
1522C	21FLHILL24030034	11/20/96	1312	1.5	6.5
1522C	21FLHILL24030034	12/11/96	1400	0.3	7.9
1522C	21FLHILL24030034	1/22/97	1250	1.5	10
1522C	21FLHILL24030034	2/19/97	1323	1.3	9.1
1522C	21FLHILL24030034	3/19/97	1306	1.5	**1.1**
1522C	21FLHILL24030034	4/16/97	1246	1.3	**0.3**
1522C	21FLHILL24030034	5/21/97	1340	1.3	**2.5**
1522C	21FLHILL24030034	6/18/97	1246	1	**0.7**
1522C	21FLHILL24030034	7/23/97	1252	1.5	**1.3**
1522C	21FLHILL24030034	8/20/97	1230	2	**0.1**
1522C	21FLHILL24030034	9/17/97	1256	1	**0.3**
1522C	21FLHILL24030034	10/15/97	1338	2	**0.5**
1522C	21FLHILL24030034	11/19/97	1300	1	**4.7**
1522C	21FLHILL24030034	12/10/97	1200	1.5	5.1
1522C	21FLHILL24030034	1/21/98	1235	2.3	5.7
1522C	21FLHILL24030034	2/18/98	1245	1	6.3
1522C	21FLHILL24030034	2/18/98	1245	2	6.4
1522C	21FLHILL24030034	2/18/98	1245	4	6.4
1522C	21FLHILL24030034	3/18/98	1250	1.5	5.9
1522C	21FLHILL24030034	4/22/98	1235	1	5.8
1522C	21FLHILL24030034	5/20/98	1240	1	**4.2**
1522C	21FLHILL24030034	6/17/98	1230	1.8	**0.6**
1522C	21FLHILL24030034	6/17/98	1230	4	**0.6**

1522C	21FLHILL24030034	6/17/98	1230	1	**3.7**
1522C	21FLHILL24030034	7/22/98	1223	2	5.6
1522C	21FLHILL24030034	8/26/98	1238	1.3	**3.8**
1522C	21FLHILL24030034	9/16/98	1230	1.5	**3.5**
1522C	21FLHILL24030034	10/21/98	1136	2	**4.8**
1522C	21FLHILL24030034	10/21/98	1136	1	**4.9**
1522C	21FLHILL24030034	10/21/98	1136	4	**4.9**
1522C	21FLHILL24030034	11/18/98	1315	2	5.9
1522C	21FLHILL24030034	12/9/98	1120	2	6.3
1522C	21FLHILL107	1/20/99	1312	1	7
1522C	21FLHILL107	1/20/99	1312	2	7.3
1522C	21FLHILL107	2/17/99	1105	1.5	7.2
1522C	21FLHILL107	3/17/99	1136	1.5	6.4
1522C	21FLHILL107	4/21/99	1315	1.8	**3.6**
1522C	21FLHILL107	4/21/99	1315	1	**4.1**
1522C	21FLHILL107	5/19/99	1220	1.3	5.1
1522C	21FLHILL107	6/16/99	1232	1	**4.2**
1522C	21FLHILL107	7/21/99	1325	2	5
1522C	21FLHILL107	7/21/99	1325	1	5.1
1522C	21FLHILL107	8/18/99	1155	1	5.2
1522C	21FLHILL107	8/18/99	1155	2.3	5.2
1522C	21FLHILL107	10/13/99	1200	2	**4.1**
1522C	21FLHILL107	11/17/99	1202	2	5.8
1522C	21FLHILL107	12/15/99	1323	2	**4.9**
1522C	21FLHILL107	1/19/00	1245	1.8	7.2
1522C	21FLHILL107	2/16/00	1340	2.3	**3.7**
1522C	21FLHILL107	3/15/00	1230	1.8	**2.5**
1522C	21FLHILL107	3/15/00	1230	1	**4.6**
1522C	21FLHILL107	4/19/00	1305	1.5	**2.6**
1522C	21FLHILL107	5/16/00	1140	1	**3**
1522C	21FLHILL107	6/21/00	1340	1.3	**1.1**
1522C	21FLHILL107	7/19/00	1220	1	**4.8**
1522C	21FLHILL107	7/19/00	1220	1.5	**4.8**
1522C	21FLHILL107	8/16/00	1334	1	5.5
1522C	21FLHILL107	8/16/00	1334	2.5	5.5
1522C	21FLHILL107	9/20/00	1335	2.8	**3.2**
1522C	21FLHILL107	9/20/00	1335	1	**3.3**
1522C	21FLHILL107	10/11/00	1336	.	**3.8**
1522C	21FLHILL107	10/11/00	1336	1	**4.6**
1522C	21FLHILL107	11/15/00	1323	.	**4.5**
1522C	21FLHILL107	12/13/00	1300	.	**4.1**
1522C	21FLHILL107	12/13/00	1300	1	7.2
1522C	21FLHILL107	1/17/01	1300	.	
1522C	21FLHILL107	2/21/01	1317	.	5.5
1522C	21FLHILL107	3/21/01	1150	1	**4.1**
1522C	21FLHILL107	3/21/01	1150	.	**4.2**
1522C	21FLHILL107	4/18/01	1433	.	**4.5**

1522C	21FLHILL107	4/18/01	1433	1	6
1522C	21FLHILL107	5/16/01	1305	.	**3.8**
1522C	21FLHILL107	5/16/01	1305	1	6.9
1522C	21FLHILL107	6/20/01	1140	.	**4.3**
1522C	21FLHILL107	6/20/01	1140	1	**4.4**
1522C	21FLHILL107	7/25/01	1302	1	6.1
1522C	21FLHILL107	7/25/01	1302	.	6.2
1522C	21FLHILL107	8/22/01	1504	.	**4.8**
1522C	21FLHILL107	8/22/01	1504	1	**4.8**
1522C	21FLHILL107	9/19/01	1355	.	**3.8**
1522C	21FLHILL107	9/19/01	1355	1	**3.8**
1522C	21FLHILL107	10/17/01	1253	.	**4.2**
1522C	21FLHILL107	10/17/01	1253	1	**4.3**
1522C	21FLHILL107	11/14/01	1356	.	5.6
1522C	21FLHILL107	11/14/01	1356	1	5.7
1522C	21FLHILL107	12/12/01	1335	.	**2.8**
1522C	21FLHILL107	12/12/01	1335	1	**3.7**
1522C	21FLHILL107	1/16/02	1359	4.59	8
1522C	21FLHILL107	1/16/02	1359	2.3	8.4
1522C	21FLHILL107	1/16/02	1359	1	8.7
1522C	21FLHILL107	2/20/02	1324	2	7
1522C	21FLHILL107	2/20/02	1324	3.94	7
1522C	21FLHILL107	2/20/02	1324	1.97	7.5
1522C	21FLHILL107	2/20/02	1324	1	7.8
1522C	21FLHILL107	3/20/02	1400	4.59	**2**
1522C	21FLHILL107	3/20/02	1400	1	**2.9**
1522C	21FLHILL107	3/20/02	1400	2.3	**2.9**
1522C	21FLHILL107	4/17/02	1312	2.6	**1.8**
1522C	21FLHILL107	4/17/02	1312	5.25	**1.8**
1522C	21FLHILL107	4/17/02	1312	2.62	**1.9**
1522C	21FLHILL107	4/17/02	1312	1	**2.4**
1522C	21FLHILL107	5/15/02	1307	1.97	**1.8**
1522C	21FLHILL107	5/15/02	1307	2	**1.8**
1522C	21FLHILL107	5/15/02	1307	3.94	**1.9**
1522C	21FLHILL107	5/15/02	1307	1	**2**
1522C	21FLHILL107	6/19/02	1140	1	**4.9**
1522C	21FLHILL107	6/19/02	1140	1.97	5.2
1522C	21FLHILL107	6/19/02	1140	2	5.2
1522C	21FLHILL107	6/19/02	1140	3.94	5.3
1522C	21FLHILL107	7/24/02	1522	3.94	**4.2**
1522C	21FLHILL107	7/24/02	1522	1.97	**4.3**
1522C	21FLHILL107	7/24/02	1522	2	**4.3**
1522C	21FLHILL107	7/24/02	1522	1	**4.5**
1522C	21FLHILL107	8/21/02	1347	1	**4.3**
1522C	21FLHILL107	8/21/02	1347	1.97	**4.4**
1522C	21FLHILL107	8/21/02	1347	2	**4.4**
1522C	21FLHILL107	8/21/02	1347	3.94	**4.4**

1522C	21FLHILL107	9/18/02	1326	1	**3**
1522C	21FLHILL107	9/18/02	1326	2.3	**3**
1522C	21FLHILL107	10/16/02	1315	4.59	**4.6**
1522C	21FLHILL107	10/16/02	1315	2.3	**4.7**
1522C	21FLHILL107	10/16/02	1315	1	**4.9**
1522C	21FLHILL107	11/20/02	1341	1	7.1
1522C	21FLHILL107	11/20/02	1341	2.62	7.3
1522C	21FLHILL107	11/20/02	1341	2.6	7.4
1522C	21FLHILL107	11/20/02	1341	5.25	7.4
1522C	21FLHILL107	12/11/02	1345	1	6.6
1522C	21FLHILL107	12/11/02	1345	2.62	6.6
1522C	21FLHILL107	12/11/02	1345	2.6	6.8
1522C	21FLHILL107	12/11/02	1345	5.25	6.8
1522C	21FLHILL107	1/15/03	1425		7.4
1522C	21FLHILL107	2/19/03	1431		6.7
1522C	21FLHILL107	3/19/03	1436		**3.8**
1522C	21FLHILL107	4/16/03	1502		**4.7**
1522C	21FLHILL107	5/21/03	1503		5.7
1522C	21FLHILL107	6/18/03	1324		**2.8**
1522C	21FLHILL107	7/16/03	1423		**4.5**
1522C	21FLHILL107	8/13/03	1448		**4.3**
1522C	21FLHILL107	9/17/03	1445		**4.7**
1522C	21FLHILL107	10/8/03	1418		**4.4**
1522C	21FLHILL107	11/19/03	1505		**3.83**
1522C	21FLHILL107	12/10/03	1452		5.2

Note: Bold DO results represent measurements that were below the state's Class III freshwater water quality criterion of 5.0 mg/L.

Baker Creek Chlorophyll *a* Data

WBID	Station	Date (m/d/y)	Time	Depth (ft)	Chlorophyll *a* (μg/L)
1522C	21FLHILL24030034	01/24/96	1209	3	2.0
1522C	21FLHILL24030034	02/21/96	1250	2	3.2
1522C	21FLHILL24030034	03/20/96	1300	1.5	1.7
1522C	21FLHILL24030034	04/17/96	1340	1.5	4.9
1522C	21FLHILL24030034	05/15/96	1540	1.3	2.4
1522C	21FLHILL24030034	06/19/96	1420	2	2.6
1522C	21FLHILL24030034	07/17/96	1305	1	3.0
1522C	21FLHILL24030034	08/21/96	1248	1.5	2.1
1522C	21FLHILL24030034	09/25/96	1252	1	2.2
1522C	21FLHILL24030034	10/16/96	1156	1.5	1.0
1522C	21FLHILL24030034	11/20/96	1312	1.5	1.0
1522C	21FLHILL24030034	12/11/96	1400	0.3	1.0
1522C	21FLHILL24030034	01/22/97	1250	1.5	1.0
1522C	21FLHILL24030034	02/19/97	1323	1.3	1.0

1522C	21FLHILL24030034	03/19/97	1306	1.5	5.0
1522C	21FLHILL24030034	04/16/97	1246	1.3	5.5
1522C	21FLHILL24030034	05/21/97	1340	1.3	3.0
1522C	21FLHILL24030034	06/18/97	1246	1	1.3
1522C	21FLHILL24030034	07/23/97	1252	1.5	2.0
1522C	21FLHILL24030034	08/20/97	1230	2	10.7
1522C	21FLHILL24030034	09/17/97	1256	1	10.7
1522C	21FLHILL24030034	10/15/97	1338	2	**40.8**
1522C	21FLHILL24030034	11/19/97	1300	1	8.4
1522C	21FLHILL24030034	12/10/97	1200	1.5	6.5
1522C	21FLHILL24030034	01/21/98	1235	2.3	4.4
1522C	21FLHILL24030034	02/18/98	1245	2	8.6
1522C	21FLHILL24030034	03/18/98	1250	1.5	11.1
1522C	21FLHILL24030034	04/22/98	1235	1	12.3
1522C	21FLHILL24030034	05/20/98	1240	1	**56.8**
1522C	21FLHILL24030034	06/17/98	1230	1.8	18.9
1522C	21FLHILL24030034	07/22/98	1223	2	3.6
1522C	21FLHILL24030034	08/26/98	1238	1.3	8.0
1522C	21FLHILL24030034	09/16/98	1230	1.5	5.7
1522C	21FLHILL24030034	10/21/98	1136	2	6.5
1522C	21FLHILL24030034	11/18/98	1315	2	
1522C	21FLHILL24030034	12/09/98	1120	2	2.5
1522C	21FLHILL107	01/20/99	1312	2	10.0
1522C	21FLHILL107	02/17/99	1105	1.5	1.7
1522C	21FLHILL107	03/17/99	1136	1.5	3.3
1522C	21FLHILL107	04/21/99	1315	1.8	8.7
1522C	21FLHILL107	05/19/99	1220	1.3	19.1
1522C	21FLHILL107	06/16/99	1232	1	2.8
1522C	21FLHILL107	07/21/99	1325	2	1.8
1522C	21FLHILL107	08/18/99	1155	2.3	1.3
1522C	21FLHILL107	10/13/99	1200	2	1.6
1522C	21FLHILL107	11/17/99	1202	2	5.1
1522C	21FLHILL107	12/15/99	1323	2	2.1
1522C	21FLHILL107	01/19/00	1245	1.8	1.4
1522C	21FLHILL107	02/16/00	1340	2.3	2.9
1522C	21FLHILL107	03/15/00	1230	1.8	17.1
1522C	21FLHILL107	04/19/00	1305	1.5	**25.3**
1522C	21FLHILL107	05/16/00	1140	1	**70.7**
1522C	21FLHILL107	06/21/00	1340	1.3	**136.6**
1522C	21FLHILL107	07/19/00	1220	1.5	3.1
1522C	21FLHILL107	08/16/00	1334	2.5	4.8
1522C	21FLHILL107	09/20/00	1335	2.8	9.5
1522C	21FLHILL107	10/11/00	1336	.	4.7
1522C	21FLHILL107	11/15/00	1323	.	**23.6**
1522C	21FLHILL107	12/13/00	1300	.	**34.0**
1522C	21FLHILL107	01/17/01	1300	.	**105.5**
1522C	21FLHILL107	02/21/01	1317	.	**163.5**

1522C	21FLHILL107	03/21/01	1150	.	**26.4**
1522C	21FLHILL107	04/18/01	1433	.	**22.5**
1522C	21FLHILL107	05/16/01	1305	.	**54.2**
1522C	21FLHILL107	06/20/01	1140	.	**96.8**
1522C	21FLHILL107	07/25/01	1302	.	10.1
1522C	21FLHILL107	08/22/01	1504	.	3.9
1522C	21FLHILL107	09/19/01	1355	.	13.8
1522C	21FLHILL107	10/17/01	1253	.	4.2
1522C	21FLHILL107	11/14/01	1356	.	2.8
1522C	21FLHILL107	12/12/01	1335	.	3.9
1522C	21FLHILL107	01/16/02	1359	2.3	14.3
1522C	21FLHILL107	02/20/02	1324	1.97	5.2
1522C	21FLHILL107	03/20/02	1400	2.3	5.8
1522C	21FLHILL107	04/17/02	1312	2.6	7.0
1522C	21FLHILL107	05/15/02	1307	1.97	**21.8**
1522C	21FLHILL107	06/19/02	1140	1.97	**24.8**
1522C	21FLHILL107	07/24/02	1522	1.97	3.7
1522C	21FLHILL107	08/21/02	1347	1.97	3.5
1522C	21FLHILL107	09/18/02	1326	2.3	14.2
1522C	21FLHILL107	10/16/02	1315	2.3	6.2
1522C	21FLHILL107	11/20/02	1341	2.6	4.4
1522C	21FLHILL107	12/11/02	1345	2.6	7.5
1522C	21FLHILL107	01/15/03	1425		4.0
1522C	21FLHILL107	02/19/03	1431		5.3
1522C	21FLHILL107	03/19/03	1436		4.9
1522C	21FLHILL107	04/16/03	1502		8.5
1522C	21FLHILL107	05/21/03	1503		19.5
1522C	21FLHILL107	06/18/03	1324		13.3
1522C	21FLHILL107	07/16/03	1423		12.7
1522C	21FLHILL107	08/13/03	1448		12.8
1522C	21FLHILL107	09/17/03	1445		6.3
1522C	21FLHILL107	10/08/03	1418		11.6
1522C	21FLHILL107	11/19/03	1505		15.3
1522C	21FLHILL107	12/10/03	1452		6.1

Note: Bold chlorophyll *a* results represent measurements that were above the state's Class III freshwater quality criterion of 20 μg/L.

Spartman Branch Dissolved Oxygen Data

WBID	Station ID	Date (y/m/d)	Time	Depth (ft)	DO (mgL)	DO Criterion (mg/L)
1561	21FLTPA 24030126/TP107	8/26/1998	1115	0.2	**4.06**	5
1561	21FLTPA 24030126/TP107	3/27/2002	215	0.1	**4.60**	5
1561	21FLTPA 28005778210285/SMB-3	3/27/2002	150	0.1	5.61	5
1561	21FLTPA 280132821113/SMB-1	3/27/2002		0.2	**4.46**	5
1561	21FLTPA 24030126/TP107	5/30/2002	1100	0.15	6.64	5
1561	21FLTPA 28005778210285/SMB-3	5/30/2002	1130	0.2	8.06	5
1561	21FLTPA 24030126/TP107	7/17/2002	955	0.2	5.20	5
1561	21FLTPA 28005778210285/SMB-3	7/17/2002	1015	0.2	**4.48**	5
1561	21FLTPA 280132821113/SMB-1	7/17/2002		0.2	5.74	5
1561	21FLTPA 24030126/TP107	8/6/2002	1145	0.3	**4.87**	5
1561	21FLTPA 28005778210285/SMB-3	8/6/2002	1130	0.2	**4.68**	5
1561	21FLTPA 280132821113/SMB-1	8/6/2002		0.2	6.94	5
1561	21FLTPA 24030126/TP107	9/16/2002	1145	0.2	**3.89**	5
1561	21FLTPA 28005778210285/SMB-3	9/16/2002	1130	0.2	**3.87**	5
1561	21FLTPA 280132821113/SMB-1	9/16/2002		0.2	**4.15**	5
1561	21FLTPA 24030126/TP107	10/14/2002	1125	0.2	**4.60**	5
1561	21FLTPA 28005778210285/SMB-3	10/14/2002	1100	0.2	**3.68**	5
1561	21FLTPA 280132821113/SMB-1	10/14/2002		0.2	5.29	5
1561	21FLTPA 24030126/TP107	11/4/2002	1120	0.2	5.93	5
1561	21FLTPA 28005778210285/SMB-3	11/4/2002	1100	0.2	**4.84**	5
1561	21FLTPA 280132821113/SMB-1	11/4/2002		0.2	7.19	5

Note: Bold DO results represent measurements that were below the state's Class III freshwater quality criterion of 5.0 mg/L.