DRAFT
TOTAL MAXIMUM DAILY LOAD (TMDL)

For

Nutrients and Dissolved Oxygen

In

Rocky Creek

Tampa Bay Basin

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LIST OF ABBREVIATIONS

AWT	Advanced Waste Treatment
BMP	Best Management Practices
BOD	Biochemical Oxygen Demand
BPJ	Best Professional Judgment
CFS	Cubic Feet per Second
DEM	Digital Elevation Model
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
EPA	Environmental Protection Agency
FAC	Florida Administrative Code
FDEP	Florida Department Environmental Protection
GIS	Geographic Information System
HUC	Hydrologic Unit Code
LA	Load Allocation
MGD	Million Gallons per Day
MOS	Margin of Safety
MS4	Municipal Separate Storm Sewer Systems
NLCD	National Land Cover Data
NPDES	National Pollutant Discharge Elimination System
OSTD	Onsite Sewer Treatment and Disposal Systems
RM	River Mile
STORET	STORage RETrieval database
TMDL	Total Maximum Daily Load
TP	Total Phosphorus
TN	Total Nitrogen
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WBID	Water Body Identification
WLA	Waste Load Allocation
WMP	Water Management Plan
WRF	Water Reclamation Facility
WWTP	Waste Water Treatment Plant

DRAFT SUMMARY SHEET
Total Maximum Daily Load (TMDL)

1. 303(d) Listed Waterbody Information

State: Florida
County: Hillsborough
Major River Basin: Tampa Bay Basin (HUC 03100206)

Waterbody (List ID)	Listing Year	Impairment(s)	Pollutant(s)
Rocky Creek (WBID 1507)	**1998**	**Nutrients**	**TN, TP**
		Dissolved Oxygen	**TN, TP**
Rocky Creek (WBID 1507A)	**1998**	**Nutrients**	**TN, TP**
		Dissolved Oxygen	**TN, TP**

Note: TP = Total Phosphorus; TN = Total Nitrogen

2. TMDL Endpoints (i.e., Targets) for Class III Waters (marine):

Total phosphorus concentration of 0.09 mg/L (annual average)

Total nitrogen concentration of 0.51 mg/l (annual average)

Dissolved Oxygen shall not average less than 5.0 in a 24-hour period and shall never be less than 4.0.

3. Pollutant Allocations for WBID 1507 and 1507A

Pollutant	TMDL (lbs/day)	WLA		LA (lbs/day)	MOS[1]	Percent Reduction[2]
		Continuous (lbs/day)	MS4 (%reduction)			
Total Phosphorus (TP)	29	10	59%	17.55	1.45	59%
Total Nitrogen (TN)	164	48	61%	107.8	8.2	61%

Notes:
1. Explicit MOS of 5% from nonpoint source loads (LA)
2. Percent reduction to achieve the nutrient standard. Controlling TP and TN concentrations should result in attainment of Dissolved Oxygen criteria. For these WBIDs it is difficult to differential between the contribution of load from point and nonpoint sources; therefore, achieving the total TMDL should be achieved through both point and nonpoint reductions.

4. Endangered Species (yes or blank): Yes

5. EPA Lead on TMDL (EPA or blank): EPA

6. TMDL Considers Point Source, Nonpoint Source, or both: Both

7. Major Municipal NPDES Discharges to surface waters:

Facility Name	NPDES No.	Facility Type	Impacted Stream
Dale Mabry WWTP	FL0036820	AWT	Brushy Creek (tributary to Rocky Creek)
River Oaks WWTP	FL0027821	AWT	Rocky Creek Channel A

Northwest Regional WRF	FL0041670	AWT	Rocky Creek Channel A
Hillsborough County	FLS000006	MS4	Rocky Creek

TOTAL MAXIMUM DAILY LOAD (TMDL)
NUTRIENTS AND DISSOLVED OXYGEN IN ROCKY CREEK

1. INTRODUCTION

Section 303(d) of the Clean Water Act requires each state to list those waters within its boundaries for which technology-based effluent limitations are not stringent enough to protect any water quality standard applicable to such waters. Listed waters are prioritized with respect to designated use classifications and the severity of pollution. In accordance with this prioritization, states are required to develop Total Maximum Daily Loads (TMDLs) for those water bodies that are not meeting water quality standards. The TMDL process establishes allowable loadings of pollutants or other quantifiable parameters for a waterbody based on the relationship between pollution sources and in-stream water quality conditions. This allows states to establish water quality based controls to reduce pollution from both point and nonpoint sources and restore and maintain the quality of their water resources (USEPA, 1991).

FDEP developed a statewide, watershed-based approach to water resource management. Following this approach, water resources are managed on the basis of natural boundaries, such as river or lake basins, rather than political boundaries. The watershed management approach is the framework DEP uses for implementing TMDLs. The state's 52 basins are divided into 5 groups. Water quality is assessed in each group on a rotating five-year cycle. Group 1 waters includes the Tampa Bay basin while Group 2 waters includes tributaries to Tampa Bay. Group 1 waters were first assessed in 2001 with plans to revisit water management issues in 2006. Group 2 waters were assessed a year later. FDEP established five water management districts (WMD) responsible for managing ground and surface water supplies in the counties encompassing the districts. The Tampa Bay basin is located in the Southwest Florida Water Management District (SWFWMD).

For the purpose of planning and management, the WMDs divided the district into planning units defined as either an individual primary tributary basin or a group of adjacent primary tributary basins with similar characteristics. These planning units contain smaller, hydrological based units called drainage basins, which are further divided into "water segments". A water segment usually contains only one unique waterbody type (stream, lake, cannel, etc.) and is about 5 square miles. Unique numbers or waterbody identification (WBIDs) numbers are assigned to each water segment.

2. PROBLEM DEFINITION

Florida's final 1998 Section 303(d) list identified two WBIDs encompassing Rocky Creek as potentially impaired for nutrients and dissolved oxygen (D.O.). WBID 1507A is the marine segment of Rocky Creek discharging directly into Old Tampa Bay. WBID 1507 is the freshwater segment directly upstream of WBID 1507A. The geographic locations of the Rocky Creek WBIDs are shown in Figure 1. The TMDLs addressed in this document are being established pursuant to EPA commitments in the 1998 Consent Decree in the Florida TMDL lawsuit (Florida Wildlife Federation, et al. v. Carol Browner, et al., Civil Action No. 4: 98CV356-WS, 1998).

The Rocky Creek WBIDs are Class III waters with the designated use of recreation, and propagation and maintenance of a healthy, well-balanced population of fish and wildlife. Excessive nutrients in a waterbody can lead to overgrowth of algae and other aquatic plants such as phytoplankton, periphyton and macrophytes. This process can deplete oxygen in the water,

adversely affecting aquatic life and potentially restricting recreational uses such as fishing and boating.

The D.O. concentrations in Rocky Creek are impacted by excessive eutrophication of the system due to the high algal growth. Inadequate flushing in the lower reaches of Channel A due to small tidal amplitude, combined with the salinity gate operation schedule, create a low D.O. environment. The first step in restoring the D.O. levels back to natural conditions is to control the eutrophication problem. Biochemical Oxygen Demand (B.O.D.) and D.O. data did not correlate; however, it was possible to correlate B.O.D. and chlorophyll–a concentrations (see Appendix A). Therefore, once nutrient (i.e., total nitrogen and total phosphorus) and chlorophyll-a levels are in an acceptable range, D.O. concentrations should meet water quality standards.

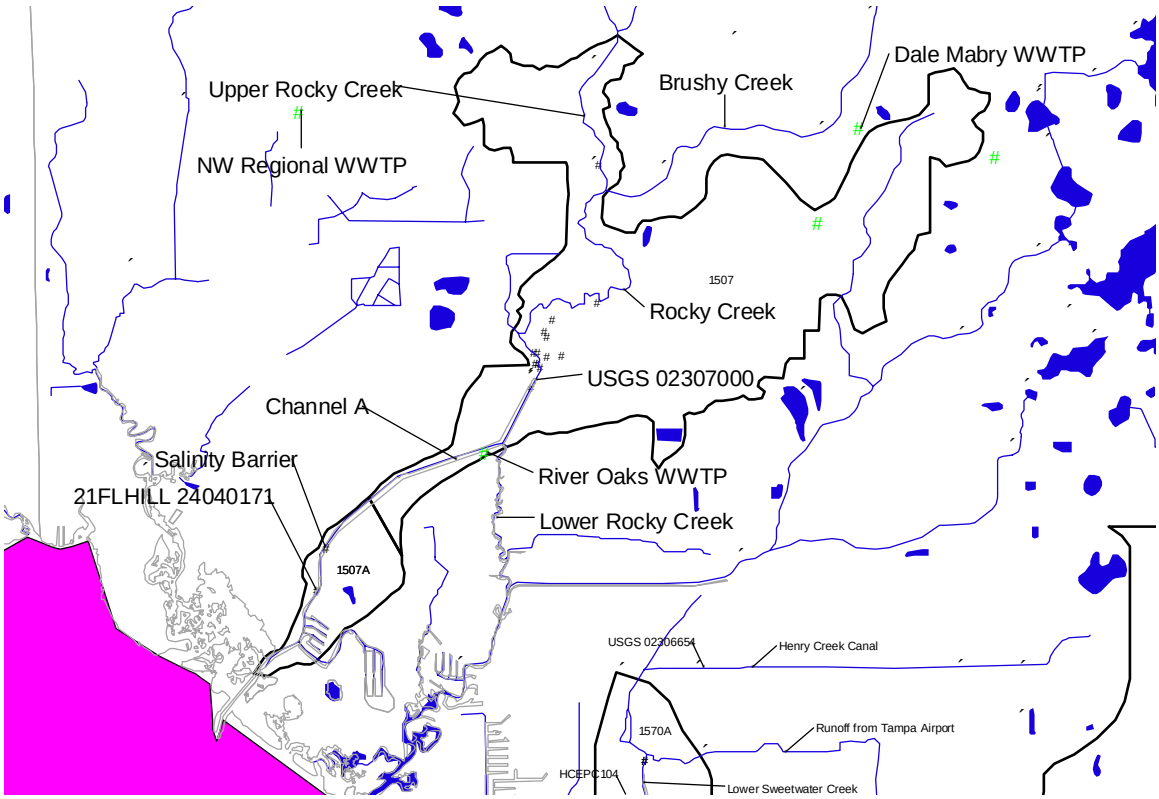

Figure 1. Location of Rocky Creek WBIDs

3. WATERSHED DESCRIPTION

WBIDs 1507 and 1507A represent the central and lower portions of the Rocky Creek watershed, respectively. WBID 1507 collects flow from upper portions of Rocky Creek to the north, Brushy Creek, which joins Rocky Creek from the northeast, and Sweetwater Creek, which flows from the east. Below Linebaugh Avenue the stream becomes channelized. Below Sulphur Springs within 1507, Rocky Creek splits and flows either southwards along its original channel or flows to the southwest in the constructed Channel A Canal. There is a salinity control structure within 1507A just upstream of water quality monitoring station HCEPC141 controlling discharges into Old Tampa

Bay.
Underlying the topsoil in west-central Florida is a mineral matrix rich in phosphate ore. The presence of this phosphatic material is the basis of one of Florida's most important industries – the phosphate industry. Phosphate mining and the associated fertilizer manufacturing activities present special environmental challenges and considerations in Hillsborough County and west central Florida.

The Rocky Creek watershed is primarily residential with high-density residential areas dominating the land cover in WBID 1507A. WBID 1507 has a mixture of high and mixed density residential uses with scattered riparian vegetation and wetlands along the stream corridors, other urbanized uses, and a public landfill just north of USGS Gauge 02307000 and west of Veteran's Expressway. Land cover distribution in the impaired WBIDs is shown in Table 1 (SWFWMD, 1999).

Table 1. Land Cover Distribution[1] (acres) in Rocky Creek

WBID	Residential	Com, Ind, Public[2]	Agriculture	Rangeland[3]	Forest	Water	Wetlands	Transp & utilities	Barren & extractive	Total (acres)
1507	2408.5	951.8	295.1	144.8	103.6	305.3	853.3	14.4	402.3	5479.1
1507A	270.0	131.4	17.9	0.7	19.9	83.8	41.8	0	9.4	574.9

Notes:
1. Acreage represents land use distribution in the WBID and not the entire drainage area.
2. Public lands include urban and recreational areas.
3. Rangeland includes shrubland, grassland, and herbaceous land covers.

4. WATER QUALITY STANDARD AND TARGET IDENTIFICATION

Rocky Creek, WBID 1507, is a Class III freshwater and WBID 1507A is a Class III marine water. The designated use of both WBIDs is recreation, and propagation and maintenance of a healthy, well-balanced population of fish and wildlife. The water quality criteria for the protection of Class III waters are established by the State of Florida in Section 62-302.530 of the F.A.C. The individual criteria should be considered in conjunction with other provisions in water quality standards, including Section 62-302.500 F.A.C. [Surface Waters: Minimum Criteria, General Criteria] that apply to all waters unless alternative or more stringent criteria are specified in F.A.C. Section 62-302.530. Unless otherwise stated, all criteria express the maximum not to be exceeded at any time. The State of Florida has numeric criteria for DO but for nutrients only narrative criteria exist. Because the State of Florida does not have numeric criteria for nutrients, FDEP uses chlorophyll-a as an indicator of excessive amounts of nutrients in streams and estuaries. Applicable criteria are described below.

4.1 Water Quality Criteria

Nutrients

The discharge of nutrients shall continue to be limited as needed to prevent violations of other standards contained in Section 62.302 F.A.C. Man-induced nutrient enrichment (total nitrogen or

total phosphorus) shall be considered degradation in relation to the provisions of Section 62-302.300, 62-302.700, and 62-4.242, F.A.C. In no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora and fauna.

Dissolved Oxygen: Class III Fresh

Dissolved Oxygen (D.O.) shall not be less than 5.0 mg/L. Normal daily and seasonal fluctuations above these levels shall be maintained.

Dissolved Oxygen: Class III Marine

Dissolved Oxygen shall not average less than 5.0 mg/L in a 24-hour period and shall never be less than 4.0 mg/L. Normal daily and seasonal fluctuations above these levels shall be maintained.

Biochemical Oxygen Demand: All Class Waters

B.O.D. shall not be increased to exceed values, which would cause D.O. to be depressed below the limits established for each class, and in no case, shall it be great enough to produce nuisance conditions.

4.2 Target Identification

The first step in developing a nutrient TMDL is translating Florida's narrative criteria into numeric targets. Phosphorus and nitrogen are the most common nutrients of concern in surface waters. Therefore, the nutrient TMDL targets both total phosphorus (TP) and total nitrogen (TN). Dissolved oxygen in Rocky Creek is impacted by the excessive eutrophication of the system due to high algal growth. Since algal production is in turn affected by excess nutrients, controlling TP and TN should result in attainment of D.O. standards. WBID 1507A shows the greatest impairment from D.O. and nutrients. Load reductions required for WBID 1507A should provide the necessary protection for attainment of D.O. and nutrient standards in the upstream segment (WBID 1507).

Based on a study of the trophic status of Florida estuaries, a chlorophyll concentration of 11 μg/l corresponds to a Trophic State Index (TSI) of 50, which defines the breakpoint between moderate eutrophic conditions and highly eutrophic conditions in estuarine waters (Janicki and Morrison, 2000). This chlorophyll concentration also approximates the 75th percentile of the cumulative frequency distribution for moderate eutrophic conditions. The chlorophyll-a concentration of 11 μg/l is in the range of the targets established for the Tampa Bay System (8 to 13 μg/l).

Site-specific data for WBID 1507A shows correlations between the annual average chlorophyll-a (CHLA) concentrations and the annual average TN and TP concentrations (see Figure 2). The annual average chlorophyll-a concentration was calculated from all available data excluding the algal blooms (i.e., CHLA > 70 μg/l). Algal blooms have decreased over time.

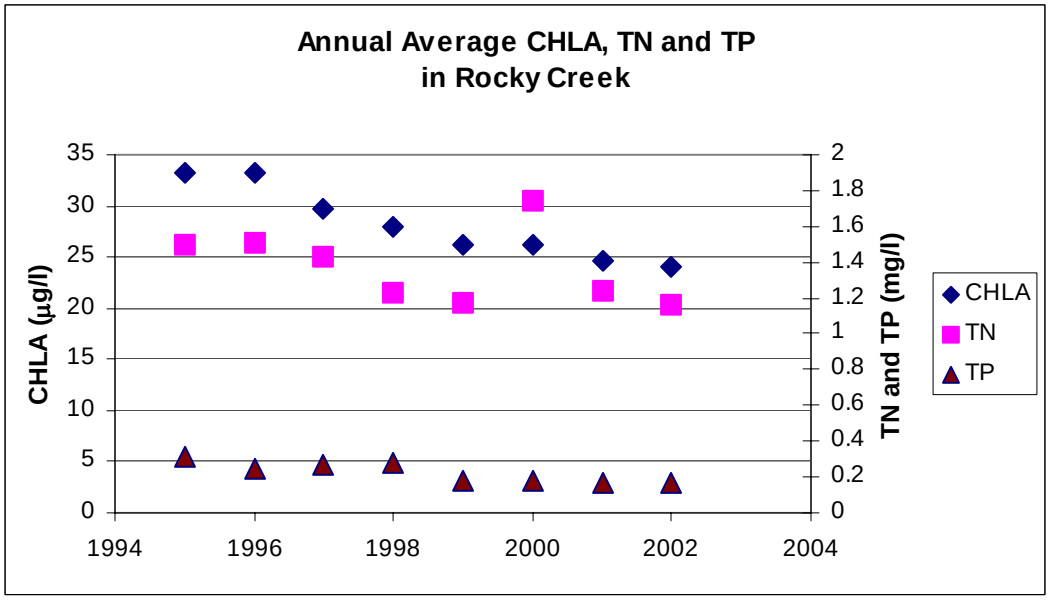

Figure 2. Relationship between Chlorophyll-a and TN and TP in Rocky Creek

Empirical relationships were developed between chlorophyll-a and TP and TN concentrations and are shown graphically in Figure 3 and Figure 4. Based on these site-specific relationships, meeting a chlorophyll-a concentration of 11 µg/l would require meeting an annual average TP concentration of 0.09 mg/L and an annual average TN concentration of 0.51 mg/L. This TN target is consistent with data and information reported by the Tampa Bay Estuary Program (Janicki and Wade, 1996).

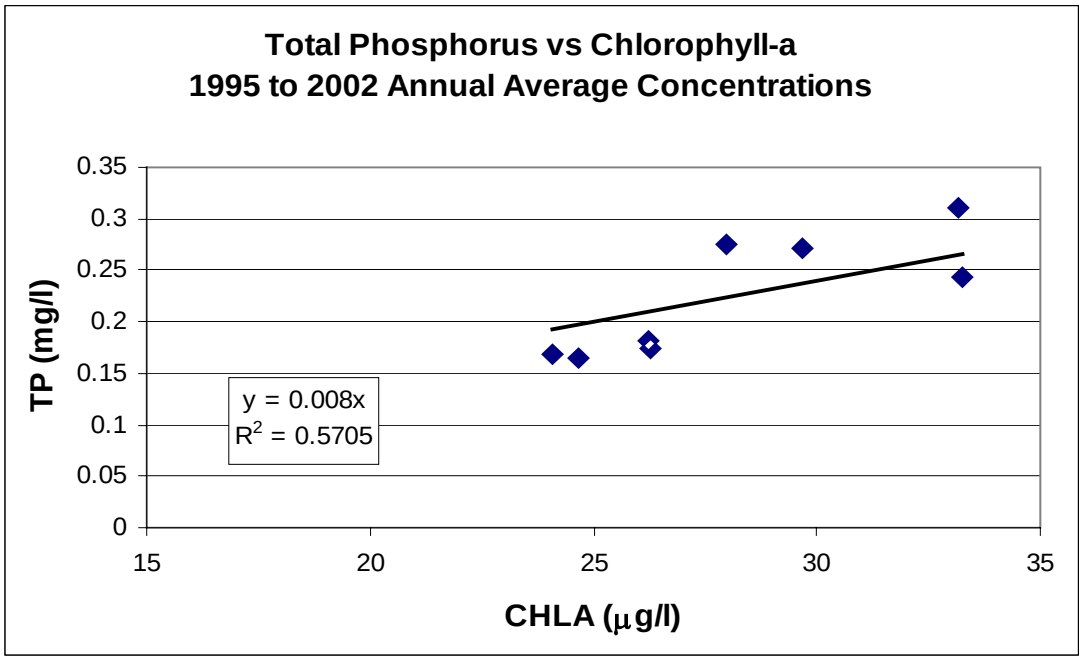

Figure 3. Relationship between Chlorophyll and Total Phosphorus

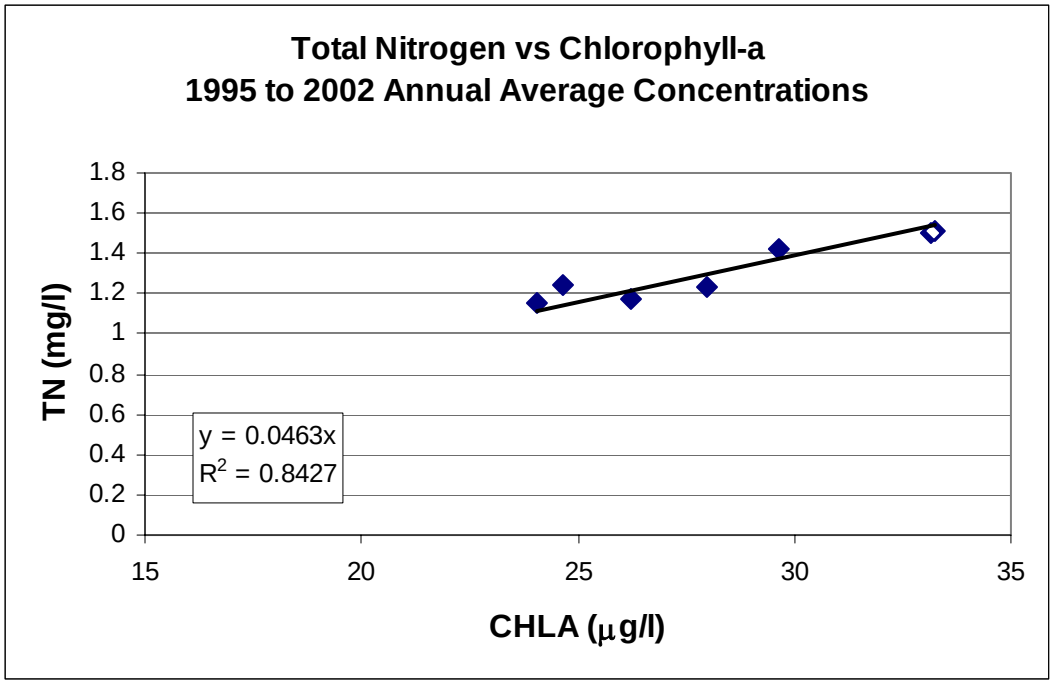

Figure 4. Relationship between Chlorophyll and Total Nitrogen

The proposed annual-average TN and TP concentrations for Rocky Creek are 0.51 mg/L and 0.09 mg/L, respectively. If these annual average concentrations are met, nutrients and D.O. standards should be achieved in Rocky Creek.

EPA acknowledges that TMDLs need only control the limiting nutrient to address a chlorophyll-a based impairment. As shown by these regressions and TN/TP ratios, the Agency concluded that nitrogen is limiting. However, given that there is also a correlation between phosphorus and chlorophyll-a, phosphorus may also be limiting. Therefore, EPA is proposing both a nitrogen and phosphorus TMDL for comment. EPA is interested in comments concerning nutrient limitations in Rocky Creek.

5. WATER QUALITY DATA ASSESSMENT AND DEVIATION FROM TARGET

Table 2 provides a list of monitoring stations used in the TMDL analysis. Each station is identified, and the time period of record for the individual stations is provided.

Table 2. Water Quality Stations in WBIDs 1507A and 1507 (Rocky Creek).

WBID	Station	Station Name	First Date	Last Date
1507A	21FLHILL102	Channel A at SR 580 Bridge	01/19/99	12/10/02
1507A	21FLHILL24040171	SR580 Bridge at Channel A	1/24/95	12/8/98
1507	112WRD 02306774	Rocky Creek at St Hwy 587 at Citrus Park, Fl	09/29/97	09/29/97
1507	112WRD 02307000	Rocky Creek near Sulphur Springs, Fl	06/14/95	09/28/97
1507	21FLTPA 280223708234300	Rocky Creek	09/09/03	12/16/03
1507	21FLTPA 280305908233390	Rocky Creek	09/09/03	12/16/03
1507	21FLTPA 280357008233568	Rocky Creek	09/09/03	12/16/03
1507	RO07	Rocky Creek at Gunn Hwy	02/24/03	08/25/03
1507	RO08	Rocky Creek at Mushinski Rd.	02/24/03	08/25/03
1507	RO09	Rocky Creek at Linebaugh Ave.	02/24/03	08/25/03

The State of Florida uses chlorophyll-a and D.O. to indicate the presence of nutrients. For fresh waters D.O. should not be less than 5.0 mg/l in more than 10% of the samples, and an annual average chlorophyll-a concentration that exceeds 20 μg/l is considered impaired. For marine waters the dissolved oxygen should not average less than 5.0 mg/L and should not be less than 4.0 mg/l at any time. Chlorophyll-a concentration of 11 μg/l has been found to correspond to a breakpoint between moderately and highly eutrophic conditions in estuarine waters (Janicki and Morrison, 2000). Tables 3 and 4 summarize water quality data collected during listing cycle for WBID 1507A and 1507, respectively. Appendix A provides plots of TP and TN samples collected in Rocky Creek.

Table 3. Water Quality Data for Rocky Creek WBID 1507A

Parameter	Obs	Max	Min	Mean	StDev	Median
Dissolved Oxygen (mg/l)	269	9.8	0.0	4.0	2.1	4.0
Chlorophyll A (μg/l)	110	226	4	34	31	25

Parameter	Obs	Max	Min	Mean	StDev	Median
Phosphorus Total as P (mg/l)	98	0.510	0.020	0.224	0.099	0.215
Phosphorus, Dissolved (mg/l)	92	0.270	0.010	0.112	0.057	0.110
Nitrogen Ammonia as N (mg/l)	98	0.35	0.01	0.06	0.07	0.03
Organic Nitrogen (mg/l)	98	2.54	0.69	1.28	0.42	1.26
Nitrate Nitrite (mg/l)	60	0.32	0.00	0.05	0.07	0.01
Nitrogen Kjeldahl as N (mg/l)	98	2.56	0.72	1.33	0.41	1.27
Total Nitrogen (mg/l)	98	2.57	0.74	1.38	0.41	1.32
BOD, carbonaceous 5-day (mg/l)	96	8.80	0.80	4.02	2.08	3.55

Notes:
1. Values below the practical quantification or reporting limit were left as the reported limit.
2. Obs= number of observations; Max= maximum value; Min= minimum value; Mean= average value; StDev= standard deviation; Median= median value.

Table 4. Water Quality Data for Rocky Creek WBID 1507

Parameter	Obs	Max	Min	Mean	StDev	Median
Dissolved Oxygen (mg/l)	36	9.0	1.5	5.6	1.7	5.4
Chlorophyll A (μg/l)	21	22.0	0.85	2.1	4.6	1.0
Phosphorus Total as P (mg/l)	32	0.170	0.029	0.095	0.045	0.100
Phosphorus, Dissolved (mg/l)	9	0.110	0.010	0.048	0.031	0.052
Nitrogen Ammonia as N (mg/l)	32	0.9	0.0	0.2	0.2	0.1
Nitrate Nitrite (mg/l)	32	5.9	0.0	0.7	1.1	0.2
Nitrogen Kjeldahl as N (mg/l)	32	1.6	0.5	0.9	0.2	0.9
Total Nitrogen[1] (mg/l)	32	6.6	0.7	1.6	1.1	1.2
BOD, carbonaceous 5-day (mg/l)	9	2.8	0.5	1.5	0.7	1.5

Notes:
1. Values of total nitrogen were estimated as TKN + NO_3O_2 for each sample.

Chlorophyll is the green pigment in plants that allows them to create energy from light. Chlorophyll is indicative of the presence of algae, and chlorophyll-a is simply a measure of the active portion of total chlorophyll. Chlorophyll-a data for WBID 1507 ranged from 0.85 to 22.0 μg/l, with a mean value of 2.1 μg/l and a median of 1.0 μg/l. Data available for WBID 1507A indicate that chlorophyll-a levels have a broad range in the estuary, ranging from 4.2 to 226 μg/l and averaging 33.8 μg/l (the overall median is 25.0 μg/l; see Figure 5). In WBID 1507, the freshwater portion of Rocky Creek, one of the twenty-one Chlorophyll-a measurements was above 20 μg/l. Figure 6 illustrates chlorophyll measurements for stations in WBID 1507.

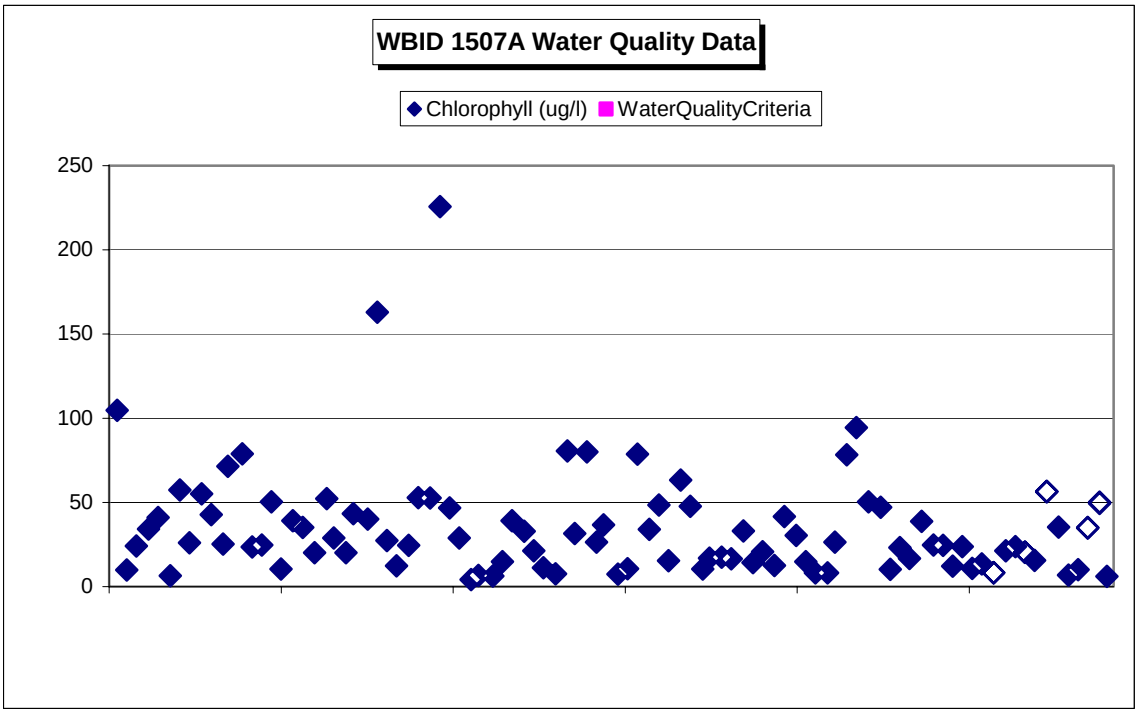

Figure 5. Chlorophyll Measurements for Rocky Creek (WBID 1507A)

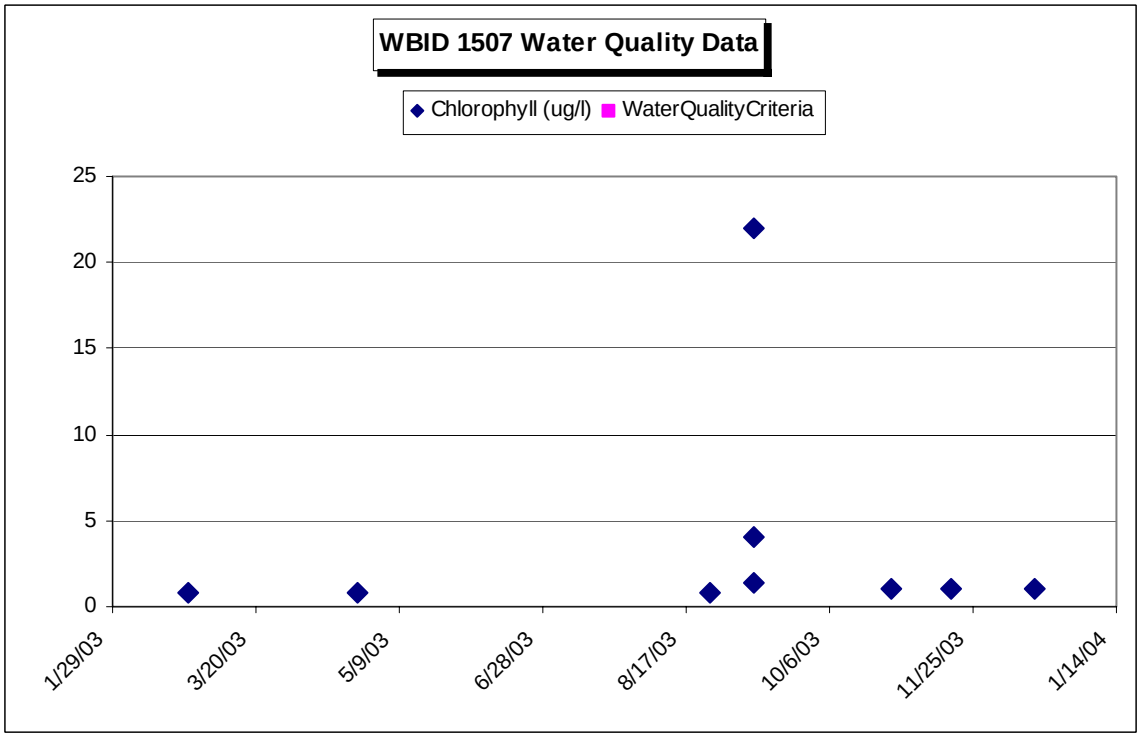

Figure 6. Chlorophyll Measurements for Rocky Creek (WBID 1507)

Natural D.O. levels in a waterbody are a function of water temperature, salinity, water depth and velocity, and the relative contributions of groundwater. Groundwater naturally has low D.O. concentrations because it is not in contact with air. Oxygen can be introduced to waters by wind, diffusion, tributaries, and photosynthesis. D.O. levels naturally fluctuate over the course of a day. During the daylight, aquatic plants produce oxygen as a by-product of photosynthesis. At night, respiration may consume D.O. Decomposition of organic matter, such as dead plants and animals, also deplete D.O. from water. Available D.O. data indicate concentrations in Rocky Creek are frequently below 5 mg/L, ranging between 9-10 mg/l. In WBID 1507A, the average D.O. was 4.0 mg/L and in WBID 1507, the average D.O. was 5.6 mg/l (see Figure 7 and Figure 8).

While both WBIDs 1507 and 1507A have some high chlorophyll-a values and low D.O. concentrations, it is apparent that the downstream WBID (1507A) is the more impaired segment. Approximately half of the D.O. observations in WBID 1507A were below the 4 mg/L numeric criterion. While there is a generally decreasing trend in D.O. concentrations as depth increases, exceedances of the criterion occurred at all depths from surface to bottom and in all months of the year. Exceedances were more common in the hotter months.

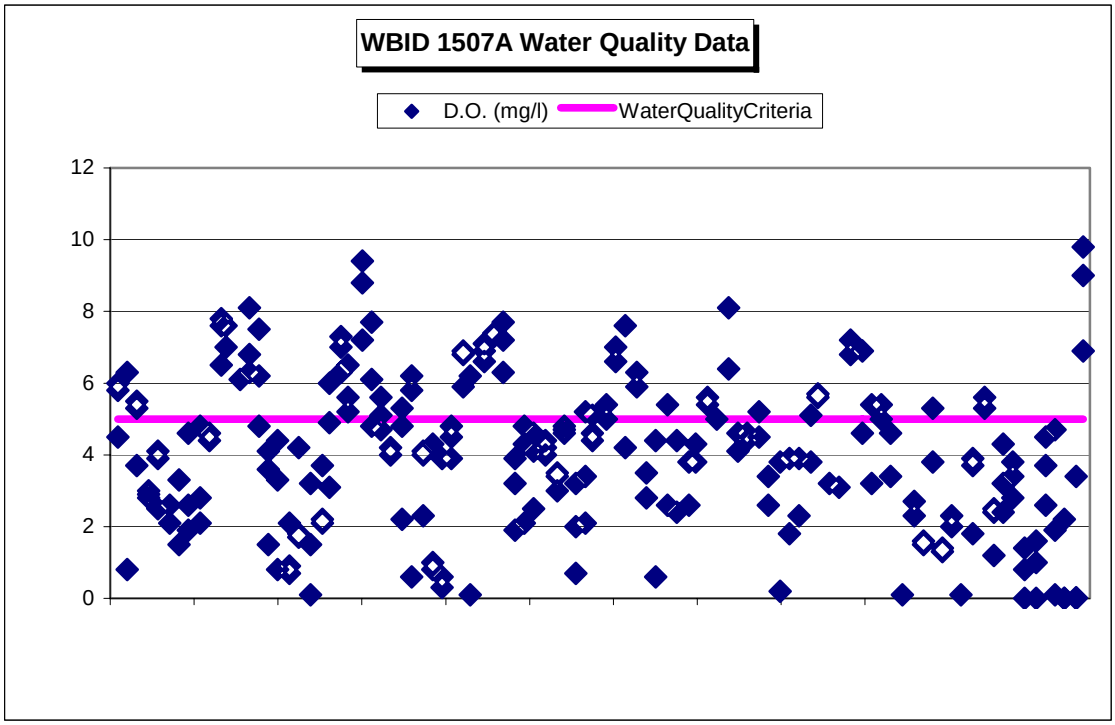

Figure 7. Dissolved Oxygen Measurements in Rocky Creek, WBID 1507A

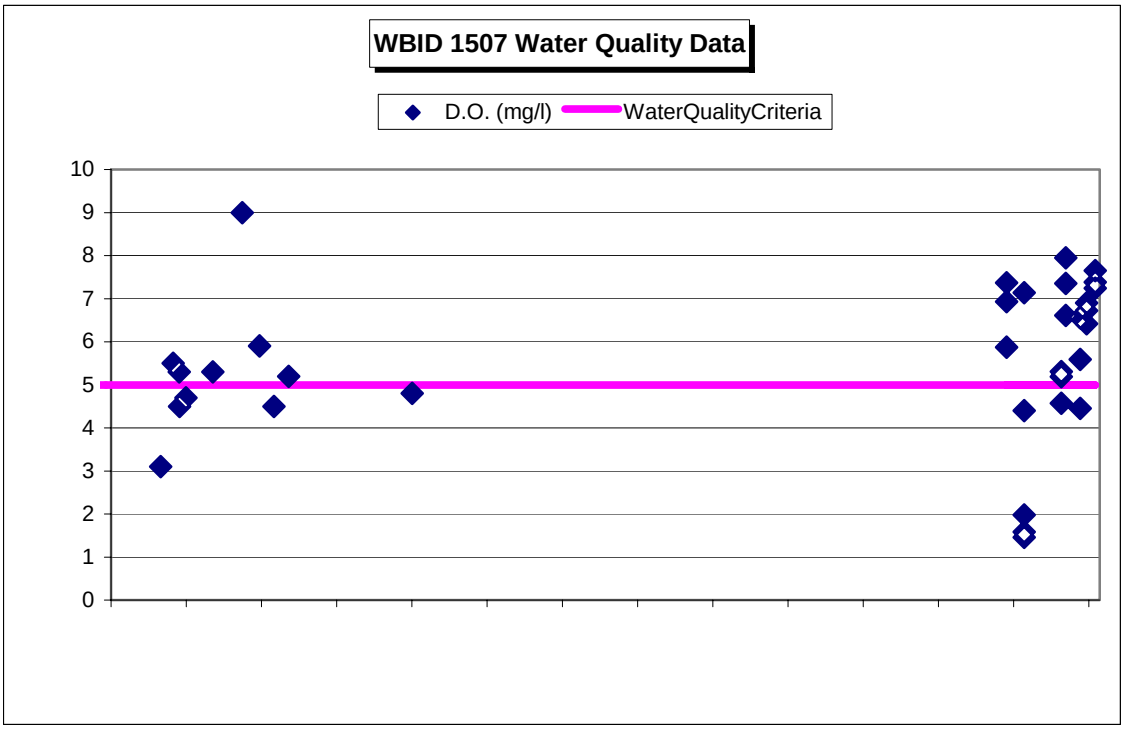

Figure 8. Dissolved Oxygen Measurements in Rocky Creek, WBID 1507

6. SOURCE ASSESSMENT

An important part of the TMDL analysis is the identification of pollutant source categories, source subcategories, or individual sources of pollutants in the watershed and the amount of loading contributed by each of these sources. Sources are broadly classified as either point or nonpoint sources.

A point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Point source discharges of industrial wastewater and treated sanitary wastewater must be authorized by National Pollutant Discharge Elimination System (NPDES) permits. NPDES permitted facilities, including certain urban stormwater discharges such as municipal separate stormwater systems (MS4 areas), certain industrial facilities, and construction sites over one acre, are storm-water driven sources that are considered "point sources" in this report.

Non-point sources of pollution are diffuse sources that cannot be identified as entering a waterbody through a discrete conveyance at a single location. These include nutrient runoff of agricultural fields, landfills, golf courses, and lawns, septic tanks, and residential developments outside of MS4 areas. These sources generally, but not always, involve accumulation of nutrients on land surfaces and wash off as a result of storm events.

6.1 Point Sources

There are three wastewater treatment plants (WWTP) discharging to surface waters in WBID 1507: Dale Mabry (FL0036820), Northwest Regional Water Reclamation Facility (WRF) (FL0041670), and River Oaks WWTP (FL0027821). The locations of these plants are shown in Figure 1. There are no NPDES industries discharging to surface waters in the Rocky Creek watershed.

A wasteload allocation (WLA) is given only to NPDES facilities discharging to surface waters and to permitted Municipal Separate Storm Sewer Systems (MS4s). **It should be noted that wastewater facilities permits authorize a discharge only if the applicant provides reasonable assurance that the discharge will not cause or contribute to violations of the water quality criteria**. Under the Grizzle-Figg legislation (Chapter 403.086, F.A.C.), all domestic facilities with surface water discharges in the Tampa Bay Basin are required to treat the wastewater to at least advanced waste treatment (AWT) standards. Permit information for these facilities are shown in Table 5.

Table 5. Municipal NPDES Facilities Discharging to Surface Waters

Facility Name	Permit Number	Flow (MGD)	Receiving Water	Permit Limits (effluent max conc.)[1]		
				TP	TN	DO
Dale Mabry	FL0036820	6	Brushy Creek	2 mg/L	6 mg/L	5 mg/L
NW Regional	FL0041670	5	Channel A	2 mg/L	6 mg/L	5 mg/L
River Oaks	FL0027821	10	Channel A	2 mg/L	6 mg/L	5 mg/L

Notes:

1. For all facilities, Total Phosphorus (TP) limits include daily minimum concentration of 1.25 mg/L, an average weekly concentration limit of 1.5 mg/L and an annual average concentration limit of 1 mg/L; Total Nitrogen (TN) limits include a daily minimum concentration limit of 3.75 mg/L, an average weekly limit of 4.5 mg/L, and an annual average concentration limit of 3mg/L.

A review of Discharge Monitoring Reports (DMRs) did not indicate violations of permit limits from either the Dale Mabry or River Oaks facilities. The Northwest Regional WRF reported elevated levels of total nitrogen above permit limits during the months June through August 2003 and from 2003 to 2004, the plant reported annual average TN concentrations above 3 mg/L. All facilities reported total phosphorus (TP) and D.O. levels were within permit limits. Annual average TP concentrations in plant effluent typically range between 0.2 and 0.4 mg/L.

Municipal Separate Storm Sewer Systems (MS4s) may also discharge nutrients to waterbodies in response to storm events. Currently, large and medium MS4s serving populations greater than 100,000 people are required to obtain a NPDES storm water permit. In March 2003, small MS4s serving urbanized areas will be required to obtain a permit under the Phase II storm water regulations. An urbanized area is defined as an entity with a residential population of at least 50,000 people and an overall population density of 1,000 people per square mile.

The City of Tampa (FLS000008) is the only municipality in the Rocky Creek watershed covered under the Phase I MS4 permit. Hillsborough County Public Works (FLS000006) and Pinellas County Government (FLS000005) are also permitted under the Phase I MS4 program. The Environmental Protection Commission (EPC) of Hillsborough County has been monitoring water quality at 52 bay stations and 42 tributary stations on a monthly basis since the early 1970s. Water

quality is monitored at two locations in Rocky Creek, Hillsborough Avenue and Waters Avenue, and one location in Channel A. EPC attributes improvements in domestic wastewater treatment, better pollution management and abatement of the phosphate industry, and better management of stormwater runoff for controlling nutrient levels in the Hillsborough County tributaries.

6.2 Nonpoint Sources

Nonpoint sources that ultimately contribute to depletion of in-stream dissolved oxygen include sources of nutrients such as animal waste, waste-lagoon sludge, fertilizer application to agricultural fields, lawns, and golf courses, malfunctioning onsite sewage treatment and disposal systems or septic tank systems and atmospheric deposition. Residential areas are the predominate landuse in the Rocky Creek watershed.

6.2.1 Wildlife

Wildlife deposit bacteria deposit their feces onto land surfaces where it can be transported during storm events to nearby streams. The nutrient load from wildlife is assumed background, as the contribution from this source is small relative to the load from urban and agricultural areas. In addition, any strategy employed to control this source would probably have a negligible impact on obtaining water quality standards.

6.2.2 Agricultural Animals

Agricultural activities, including runoff from pastureland and cattle in streams, can impact water quality. Agricultural lands (i.e., pasture and rangeland) account for about 8 percent of the land use in the watershed. The Florida Department of Agriculture and Consumer Services (FDACS), Office of Agricultural Water Policy developed a manual outlining best management practice for cow/calf operations (FDACS, 1999). In this report the authors state “implementation of the practices described in this manual provides a good argument that you have made reasonable efforts to reduce pollutants from your ranch by the maximum practicable amount”. The manual acknowledges “after implementation of these BMPs it may be necessary to add more stringent guidelines for site specific areas that continue to exceed water quality standards”.

6.2.3 Onsite Sewerage Treatment and Disposal Systems (Septic Tanks)

Onsite sewage treatment and disposal systems (OSTDs) including septic tanks are commonly used where providing central sewer is not cost effective or practical. When properly sited, designed, constructed, maintained, and operated, OSTDs are a safe means of disposing of domestic waste. The effluent from a well-functioning OSTD is comparable to secondarily treated wastewater from a sewage treatment plant. When not functioning properly, OSTDs can be a source of nutrient (nitrogen and phosphorus), pathogens, and other pollutants to both ground water and surface water.

The State of Florida Department of Health (www.doh.state.fl.us/environment/statistics) publishes septic tanks data on a county basis. Table 6 summarizes the number of septic systems installed since the 1970 census and the total number of repair permits issued between 1996 and 2001. The data do not reflect septic tanks removed from service.

Table 6. County Estimates of Septic Tanks and Repair Permits (FDEP, 2002)

County	Number of Septic Tanks (2002)	Number of Repair Permits Issued (1996 – 2002)
Hillsborough	100,483	1,651

6.2.4 Urban Development

Hillsborough County EPC identified population pressures to presents the biggest challenge to nutrient management (Hillsborough County EPC, 2001). The vast amount of developed land with its associated increase in impervious surfaces and its reduction in terrestrial vegetation has fundamentally redirected nutrient assimilations to aquatic ecosystems. Further, as the area's population continues to increase, so does the demand for electricity and transportation. Emissions from electric power plants and automobiles are both sources of airborne nitrogen oxides. These pollutants can become a major source of nitrogen loadings to surface waters.

6.2.5 Atmospheric Deposition

Atmospheric deposition refers to air pollutants that are deposited directly to an aquatic system. The role of atmospheric deposition as a source of water pollution is not well understood. However, as methods of research continue to evolve and near-field and far-field air pollution transport models become more sophisticated, it is becoming clearer that atmospheric deposition can be a significant source of water pollution (Hillsborough County EPC, 2001).

Nitrogen is oxidized (NO_x) by high temperature combustion. Power plant smokestacks and waste incinerators produce most NO_x though automobiles also contribute to this form of air pollution. Through rainfall and dry-fall, this type of nitrogenous air pollution enter surface waters. This process represents a large proportion of the way nitrogen loading occurs.

7. DEVELOPMENT OF TOTAL MAXIMUM DAILY LOADS

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 in-stream water quality conditions. A TMDL can be expressed as the sum of all point source loads (Waste Load Allocations), nonpoint source loads (Load Allocations), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$TMDL = \Sigma WLAs + \Sigma LAs + MOS$$

The objective of a TMDL is to allocate loads among the known pollutant sources throughout a watershed so that appropriate control measures can be implemented and water quality standards achieved. 40 CFR §130.2 (i) states that TMDLs can be expressed in terms of mass per time (e.g. pounds per day), toxicity, or other appropriate measure. The TMDLs for Rocky Creek are

expressed as annual average loads of TP and TN in units of lbs/day. The equation for calculating the loads is:

Load = concentration (mg/L) x flow (cfs) x CF
Where: CF is a unit conversion factor equal to 5.39.

7.1 Existing Conditions

The average flow in the Rocky Creek watershed, based on USGS gage 02307000, Rocky Creek near Sulphur Springs, Florida, is 39.4 cfs. The drainage area for this gage represents approximately 66 percent of the watershed. Based on a weighted drainage area ratio, the average annual flow for the entire watershed (i.e., at outlet of WBID 1507A) would be about 59 cfs.

During the listing cycle, the annual average TN concentration in WBID 1507A is 1.32 mg/L, which equates to a load of about 420 lbs/day. The annual average TP concentration for the same period is 0.224mg/L, which is a load of about 70 lbs/day. For this time period the municipal NPDES facilities contributed annual average loads of about 123 lbs/day TN and 24 lbs/day TP. Annual average loads from nonpoint sources are about 297 lbs/day TN and 46 lbs/day TP.

7.2 TMDL Conditions

The nutrient TMDL for Rocky Creek is expressed in terms of TN and TP. The TMDL requires a TN concentration of 0.51 mg/L, or an annual average load of 162 lbs/day, and a TP concentration of 0.09 mg/L, or an annual average load of 29 lbs/day. The TMDL components are provided in Table 7. The reductions shown in Table 7 are calculated as the percent difference between existing and target annual average loads (or concentrations). For example, the existing annual average TN concentration calculated from data collected during the listing cycle is 1.32 mg/L (see Table 3). The reduction required to achieve a target concentration of 0.51 mg/L at outlet of WBID 1507A is calculated as following:

TN Reduction = (1.32 – 0.51) /1.32 * 100 = 61%

Table 7. TMDL Components for Rocky Creek (annual average loads)

Pollutant	TMDL (lbs/day)	WLA[1]		LA (lbs/day)	MOS (lbs/day)	Percent Reduction[2]
		Continuous (lbs/day)	MS4 (%reduction)			
Total Phosphorus	29	10	59%	17.55	1.45	59%
Total Nitrogen	164	48	61%	107.8	8.2	61%

Notes:
1. The WLA component is separated into the load from continuous NPDES facilities (e.g., WWTP) and the load from MS4s.

EPA has chosen for this proposed TMDL to allocate an equal reduction in loads to all sources, including the continuous point source discharges (WWTPs), urban stormwater sources (MS4) and nonpoint sources. MS4 areas are regulated under the NPDES program and are, therefore, provided a wasteload allocation. EPA recognizes that the three existing WWTPs currently apply advance wastewater treatment and that further reductions in the load from these facilities may not be economically or technologically feasible. EPA has flexibility to change the allocation among sources in the final TMDL report as long as the total load (i.e., TMDL) is attained. EPA is requesting comments on the appropriate allocation of the loads based on technological and economical ability for sources of phosphorus and nitrogen to be reduced. EPA is also aware that control structures (i.e., salinity gates) may influence the production of algae by increasing the retention time of nutrients in the system, and that modifications in the operation of the control structures could potentially influence the TMDL and its allocation. EPA is specifically requesting comments on this aspect of the TMDL.

7.3 Margin of Safety

There are two methods for incorporating a MOS in the analysis: a) implicitly incorporate the MOS using conservative assumptions to develop allocations; or b) explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations**.** An explicit MOS is incorporated into the Rocky Creek TMDL by allocating 5 percent of the nonpoint source load (i.e., LA) to the MOS.

7.4 Critical Conditions and Seasonal Variation

The critical conditions can be defined as the environmental conditions requiring the largest reduction to meet standards. By achieving the reduction required for critical conditions, water quality standards should be achieved at all other times. Seasonal variation must also be considered to ensure that water quality standards will be met during all seasons of the year.

The critical condition for non-point source loadings are typically an extended dry period followed by a rainfall runoff event. During the dry weather period, pollutants build up on the land surface, and are washed off by rainfall. The critical condition for point source loading occurs during periods when dilution is minimized. Expression of a nutrient impairment (e.g. algal blooms) is more likely to occur during warmer months. However, because nutrients (especially phosphorus) can accumulate, nutrient loadings are usually considered over longer periods (e.g. annual averages).

Critical conditions and seasonal variation were incorporated into the TMDL development by using all available water quality data associated with the WBID to determine annual average loads (expressed in daily terms). These water quality data were collected in different years, during multiple seasons, at both high and low flows.

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APPENDIX A WATER QUALITY DATA

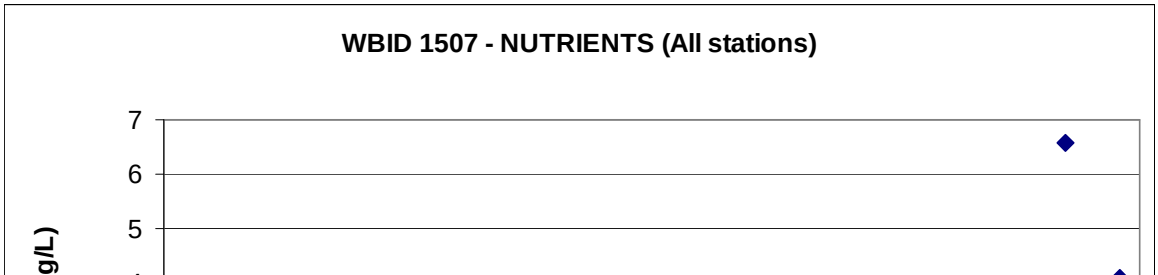

Figure A- 1. Total Phosphorus and Total Nitrogen in WBID 1507 (Rocky Creek)

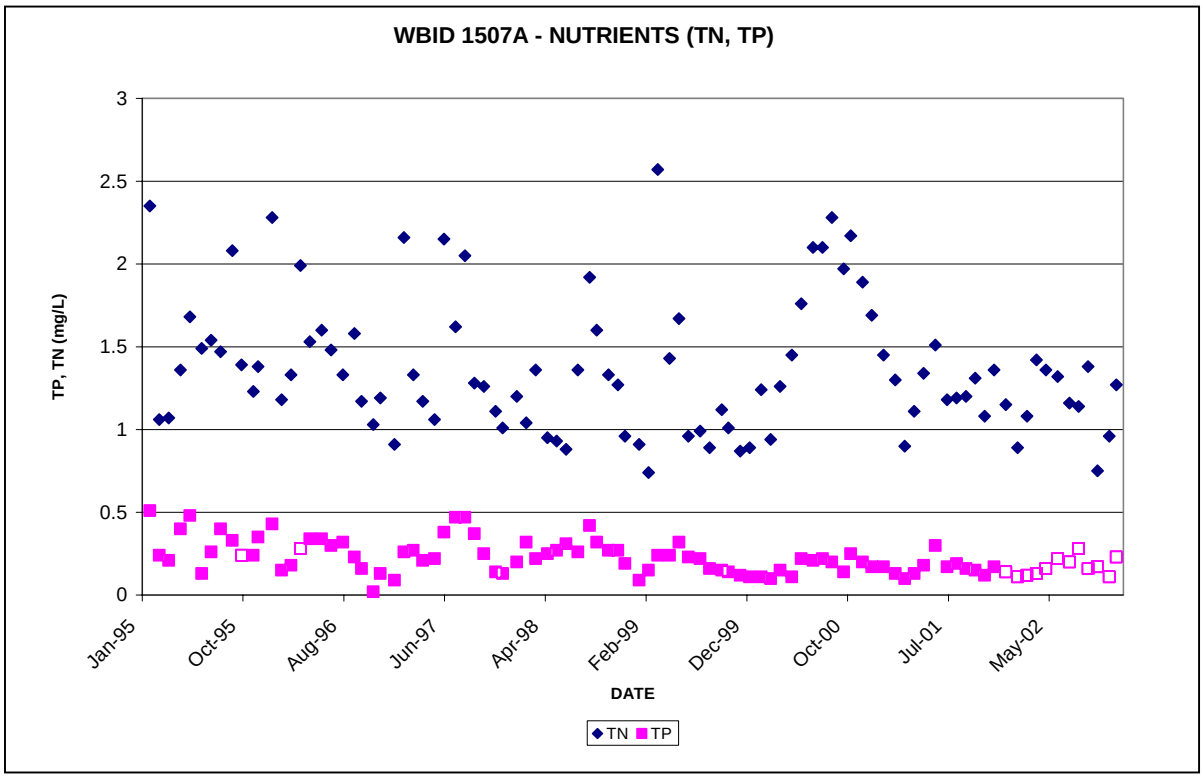

Figure A- 2. Total Phosphorus and Total Nitrogen in WBID 1507A (Rocky Creek)

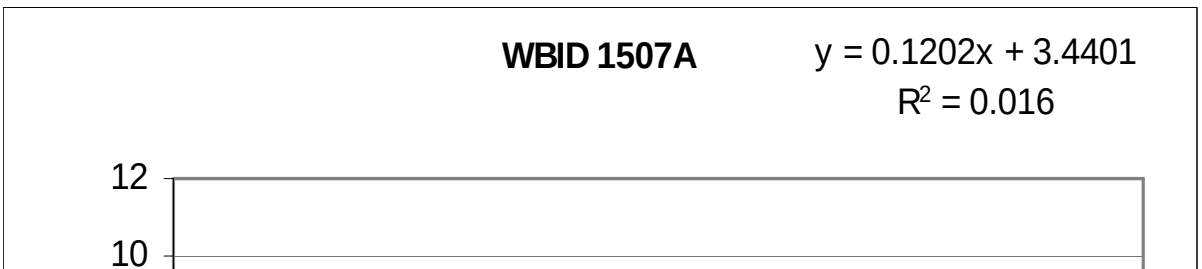

Figure A- 3. Relationship between BOD and D.O. (1995-2002 data)

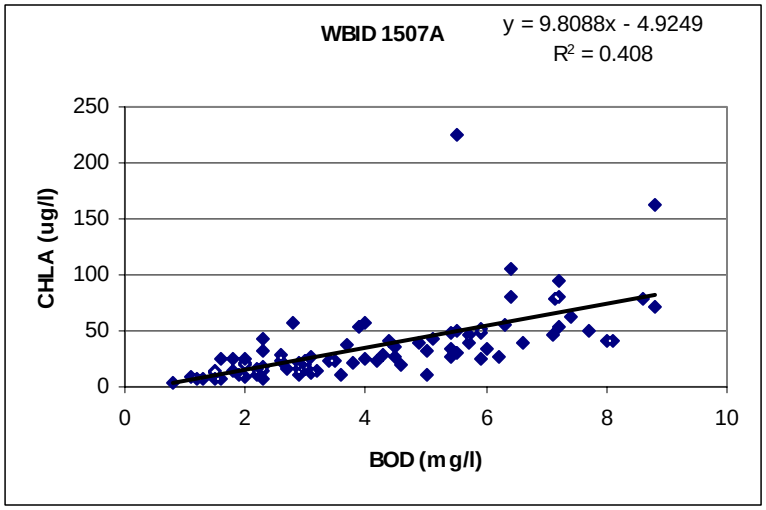

Figure A- 4. Relationship between BOD and Chlorophyll-a (1995-2002 data)