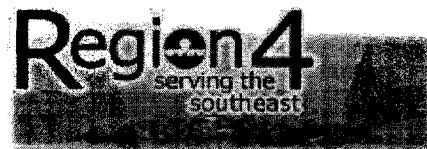


**TOTAL MAXIMUM DAILY LOAD (TMDL)**  
**For**  
**Dissolved Oxygen and Biochemical Oxygen Demand**  
**In**  
**St. Johns River above Sawgrass Lake(WBID 2893X)**  
  
***Middle St. Johns River Basin, Florida***

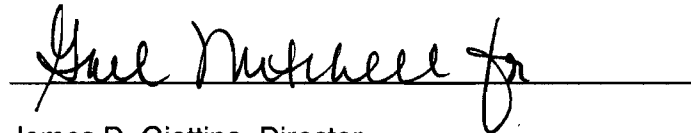
Prepared by:

US EPA Region 4  
61 Forsyth Street SW  
Atlanta, Georgia 30303

March 2006



Under the authority of Section 303(d) of the Clean Water Act, 33 U.S. Code §1251 et.seq., as amended by the Water Quality Act of 1987 (PL 100-4), the U.S Environmental Protection Agency is hereby establishing Total Maximum Daily Loads (TMDLs) for Dissolved Oxygen and Biochemical Oxygen Demand in St. Johns River above Sawgrass Lake (WBID 2893X) located in the Middle St. Johns River Basin. Subsequent actions must be consistent with this TMDL.



James D. Giattina, Director  
Water Management Division

03/23/06

Date

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James D. Giattina, Director  
Water Management Division

---

Date

Concurrences:

M. Davis \_\_\_\_\_

A. Godfrey *for AEC* \_\_\_\_\_

A. Bartlett *WOM* \_\_\_\_\_

G. Mitchell \_\_\_\_\_

J. Giattina \_\_\_\_\_

# Acknowledgments

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EPA would like to acknowledge that the contents of this report and the Total Maximum Daily Load (TMDL) contained herein were developed by the Florida Department of Environmental Protection (FDEP). For this reason, some of the text and figures may not read as though EPA is the primary author. EPA is officially establishing these TMDLs for Dissolved Oxygen and Biochemical Oxygen Demand in St. Johns River above Sawgrass Lake (WBID 2893X) in order to meet requirements pursuant to the Consent Decree entered in the case of Florida Wildlife Federation et al. v. Carol Browner, et al., Case No. 98-356-CIV-Stafford.

This study could not have been accomplished without substantial support and assistance from the St. Johns River Water Management District (SJRWMD) and the United States Environmental Protection Agency (USEPA).

**Editorial assistance provided by**

Daryll Joyner, Jan Mandrup-Poulsen, and Linda Lord

**For additional information on the watershed management approach and impaired waters in the Upper St. Johns Basin, contact**

Mary Paulic  
Florida Department of Environmental Protection  
Bureau of Watershed Management  
Watershed Planning and Coordination Section  
2600 Blair Stone Road, Mail Station 3565  
Tallahassee, FL 32399-2400  
xueqing.gao@dep.state.fl.us  
Phone: (850) 245-8464, SunCom: 205-8464  
Fax: (850) 245-8434

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

Xueqing Gao  
Florida Department of Environmental Protection  
Bureau of Watershed Management  
Watershed Planning and Coordination Section  
2600 Blair Stone Road, Mail Station 3565  
Tallahassee, FL 32399-2400  
xueqing.gao@dep.state.fl.us  
Phone: (850) 245-8464, SunCom: 205-8464  
Fax: (850) 245-8434

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## **Web sites**

### ***Florida Department of Environmental Protection, Bureau of Watershed Management***

**Total Maximum Daily Load (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>**

**2004 305(b) Report**

**[http://www.dep.state.fl.us/water/docs/2004\\_Integrated\\_Report.pdf](http://www.dep.state.fl.us/water/docs/2004_Integrated_Report.pdf)**

**Criteria for Surface Water Quality Classifications**

**<http://www.dep.state.fl.us/legal/legaldocuments/rules/ruleslistnum.htm>**

**Basin Status Reports**

**[http://www.dep.state.fl.us/water/tmdl/stat\\_rep.htm](http://www.dep.state.fl.us/water/tmdl/stat_rep.htm)**

**Water Quality Assessment Reports**

**[http://www.dep.state.fl.us/water/tmdl/stat\\_rep.htm](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

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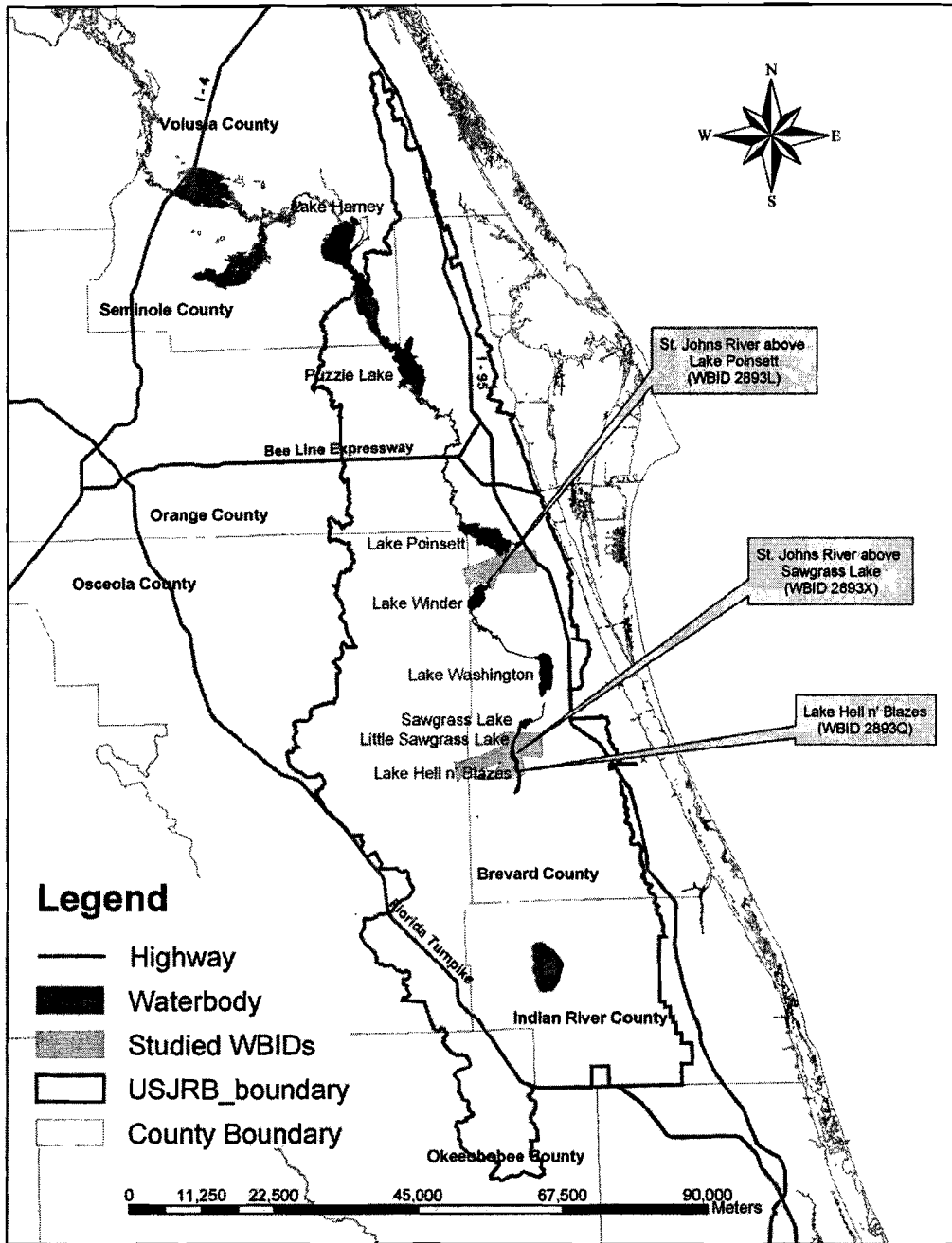
## 1.1 Purpose of Report

This report presents Total Maximum Daily Loads (TMDLs) for Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD) conditions in St. Johns River above Sawgrass Lake (SJR\_above\_SGL). This waterbody was verified as impaired for DO and BOD based on concentrations lower than 5.0 mg/L for DO, and exceeding the screening value of 2 mg/L for BOD. The WBID was included on the Verified List of impaired waters for the Upper St. Johns Basin that was adopted by Secretarial Order on June 17, 2005. According to the 1999 Florida Watershed Restoration Act (FWRA), Chapter 99-223, Laws of Florida, once a waterbody is included on the Verified List, a TMDL must be developed. The purpose of the TMDL is to establish the allowable loadings of pollutants that would restore water quality condition in the waterbody so it meets applicable water quality criteria. The State of Florida has narrative criteria for BOD based on meeting the DO criteria. EPA established a TMDL for nutrients in March 2004 that requires a 34 percent reduction in total phosphorus (TP) loadings. The BOD aspect of this TMDL may be important in improving the overall DO condition in this waterbody.

## 1.2 Identification of Waterbody

SJR\_above\_SGL is a segment in the Upper St. Johns River Basin (USJRB). The USJRB extends from the southern boundary of Indian River County and the middle of Okeechobee County in the south to the confluence with the Econlockhatchee River near Lake Harney (Seminole County) in the north and southeast part of Volusia County in the northeast (**Figure 1.1**). The USJR flows from south to north and drains a watershed area of about 1,209,000 acres. The movement of the water in the first 30 miles (headwater area) of the river is dominated by sheet flow until reaching the discernable channel at the Three Forks Marsh area. The river then flows northward through about 90 miles of river channel and seven major lakes including Lake Hell n' Blazes, Little Sawgrass Lake, Sawgrass Lake, Lake Washington, Lake Winder, Lake Poinsett, and Puzzle Lake.

In the early 1900s, the 405,000 acre floodplain of the USJR was a broad shallow marsh. Within seven decades, however, about 70% of the wetlands were converted into agricultural fields to support the production of citrus, row crops, and beef cattle. The loss of wetland habitats due to floodplain encroachment by farming practices greatly reduced floodplain storage and conveyance capacities in the river and severely altered the natural hydrologic and ecological regime of the marsh ecosystem. Pollutant loads from the agriculture and urban areas also caused water quality problems in the USJRB. To address these problems, the State of Florida and the U.S. Army Corps of Engineers (USACE) started a USJRB restoration project. The project, which primarily focuses on the watershed area south of Lake Washington, is a combination of structural and operational modifications to the system that include water management areas, marsh conservation areas, and marsh restoration areas (**Figure 1.2**). The goals of these components are to improve flood control, improve water quality downstream, reduce freshwater inputs to the Indian River Lagoon, provide for water supply needs, and restore critical wildlife habitats. The SJR\_above\_SGL falls within the northern boundary of the USJRB restoration project.



**Figure 1.1. Locations of the USJRB and Sawgrass Lake**

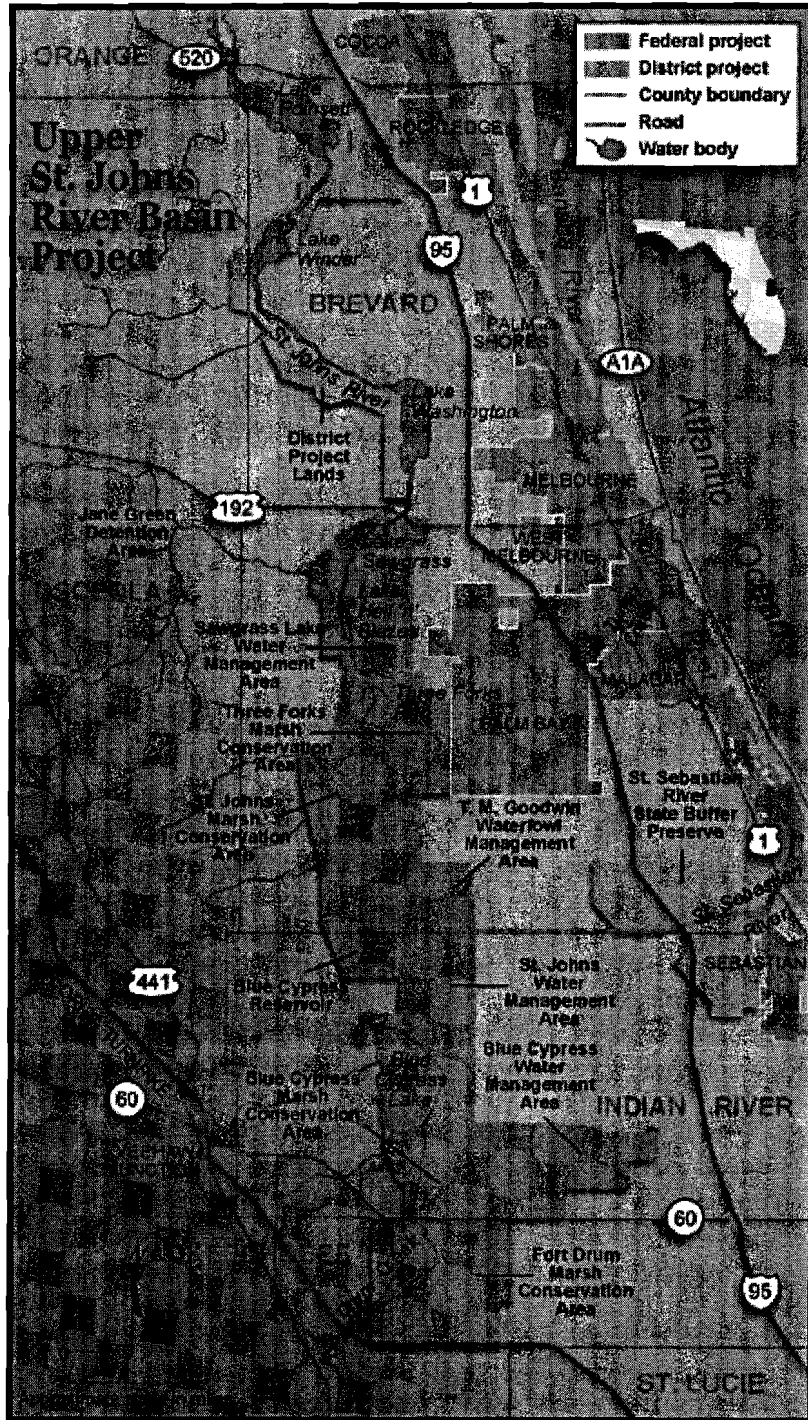


Figure 1.2. Areas of USJRB Restoration Project (from SJRWMD)

Seminole and Orange Counties are National Pollutant Discharge Elimination System (NPDES) Phase I municipal separate storm sewer system (MS4) permittees. The Department of Transportation (DOT) is the co-permittee in both of these counties for the Phase I MS4 permit. The other counties that are parts of the USJRB, including Volusia, Osceola, Brevard, Indian River, and Okeechobee counties, all hold Phase II MS4 permits. These counties and agencies will be potentially affected by the TMDL.

For assessment purposes, the Department has divided the USJRB into water assessment polygons with a unique waterbody identification (WBID) number for each watershed or stream reach. SJR\_above\_SGL is represented by WBID 2893X. This TMDL report addresses DO and BOD impairments of WBID 2893X.

### **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 FWRA.

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, and provide important water quality restoration goals that will guide restoration activities.

After analyzing the major pollutants that control the DO concentrations in the WBID, the Department found that BOD concentrations exceed the screening level in the WBID. The spatial distributions of DO and BOD concentrations across the Upper St. Johns River Basin (USJRB) suggest that BOD could be an important pollutant, besides phosphorus, causing the low DO concentrations in these waterbodies. BOD loadings into this waterbody therefore need to be calculated.

This TMDL report will be followed by the development and implementation of a Basin Management Action Plan, or BMAP, to reduce the amount of pollutants that caused verified impairments of the waterbody. These activities will depend heavily on the active participation of the St. Johns River Water Management District (SJRWMD), local governments, businesses, and other stakeholders. The Department will work with these organizations and individuals to undertake or continue reductions in the discharge of pollutants and achieve the established TMDLs for the impaired waterbody.

## Chapter 2: DESCRIPTION OF WATER QUALITY PROBLEM

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### 2.1 Statutory Requirements and Rulemaking History

Section 303(d) of the Clean Water Act requires states to submit to the EPA a list of surface waters that do not meet applicable water quality standards (impaired waters) and establish a TMDL for each pollutant source in each of these impaired waters on a schedule. The Department has developed these lists, commonly referred to as 303(d) lists, since 1992. The list of impaired waters in each basin is also required by the FWRA (Subsection 403.067[4]) Florida Statutes [F.S.]), and the list is amended annually to include updates for each basin statewide.

Florida's 1998 303(d) list included 17 waterbodies in the USJRB. However, the FWRA (Section 403.067, F.S.) stated that all previous Florida 303(d) lists were for planning purposes only and directed the Department to develop, and adopt by rule, a new science-based methodology to identify impaired waters. After a long rulemaking process, the Environmental Regulation Commission adopted the new methodology as Chapter 62-303, Florida Administrative Code (F.A.C.) (Identification of Impaired Surface Waters Rule, or IWR), in April 2001. The list of waters for which impairments have been verified using the methodology in the IWR is referred to as the Verified List.

### 2.2 Information on Verified Impairment

The Department used the IWR to assess water quality impairments in the USJRB and verified impairments for SJR\_above\_SGL (**Table 2.1**). The SJR\_above\_SGL was assessed as being impaired for low DO based on the observation that 17 out of 34 DO measurements taken in the Verified Period were lower than 5.0 mg/L. Since the median value of BOD measurements of this waterbody was higher than the 2.0 mg/L screening value for streams, BOD was considered the causative pollutant. **Table 2.2** summarizes the water quality parameters that put the waterbody on the Verified List.

**Table 2.1. Verified impaired waterbody and listed parameters**

WBID	Waterbody Segment	Parameters of Concern
2893X	St. Johns River above Lake Sawgrass	DO and BOD

**Table 2.2. Summary of DO Monitoring Data in the verified period**

WBID	Parameter	Summary of observation
2893X	Total number of samples	34
	IWR required number of exceedances for the verified list	7
	Number of observed exceedances	17
	Number of observed exceedances	17
	Number of seasons during which samples were collected	4
	Highest observation (mg/L)	8.6
	Lowest observation (mg/L)	0.1
	Median observation (mg/L)	4.8
	Mean observation (mg/L)	4.6
	Median value for 20 BOD observations (mg/L)	2.8
	Median value for 14 TN observations (mg/L)	1.69
	Median value for 19 TP observations (mg/L)	0.08
	Possible causative pollutant by IWR	BOD
	<b>FINAL ASSESSMENT</b>	Impaired

### 2.3 Seasonal variations DO concentrations in studied waterbodies

Seasonal variations of DO concentrations were analyzed using the data collected during the verified period. Limited amount of data were available for the SJR\_above\_SGL for the Verified Period. Therefore, data before the Verified Period were included in the trend analyses. The seasonal trend of DO at this river segment was not clear. A general trend is that most of the low DO concentrations appeared between May and October. The opposite trends of DO and TP seasonal distribution implies that phosphorus could be one of the most important factors that control DO concentrations in the waterbodies under study.

## Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

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### 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:

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

The SJR\_above\_SGL is a Class I waterbody with the designated use of drinking water supplies. The Class I water quality criteria applicable to the impairment addressed by this TMDL report are dissolved oxygen concentrations.

### 3.2 Applicable Water Quality Standards and Numeric Water Quality Target

#### Dissolved Oxygen

Based on Florida's Water Quality Criteria for Surface Water (62-302, F.A.C), the DO concentration for Class I freshwater bodies "shall not be less than 5.0 mg/L, and the normal daily and seasonal fluctuations above this levels shall be maintained."

DO concentration in ambient waters can be controlled by many factors including the DO solubility controlled by temperature and salinity; DO enrichment processes influenced by reaeration and photosynthesis, which are controlled by flow velocity and activities from phytoplankton, periphyton, and other aquatic plants; DO consumption caused by the decomposition of organic materials in the water column and sediment and oxidation of some reductants such as ammonia and metals; and respiration by aquatic organisms.

The St. Johns River is a blackwater system (Whitney et al. 2004) in which the DO concentration in some seasons could be naturally low because of the high bacteria respiration supported by a large and constant supply of dissolved organic carbon (DOC) originating from the wetland areas that discharge into the river. Although the majority portion of the DOC pool is usually recalcitrant to many bacteria species, many other bacteria species adapted to living in the blackwater system can readily use this DOC pool to support their growth. Bacteria activities can be significantly stimulated if nitrogen and phosphorus are added into the system because they provide bacteria with nutrients. Further stimulation of bacteria activities can be observed if DOCs of human origin (usually represented with the biochemical oxygen demand – BOD) are added into the system. Human DOCs are usually easy to decompose and can be easily used by bacteria. These DOCs not only can enhance the metabolic activities of bacteria species that use recalcitrant DOCs, but also provide the carbon source to those bacteria species that cannot

use recalcitrant DOCs. Therefore, input of human DOC into the blackwater system should be properly controlled to improve the DO condition in these waters. Another source of DO consumption may originate from the organic materials accumulated in the floodplain of the river and at the bottom of contributing wetlands.

Due to the limited amount of time available to this study, factors controlling DO concentration in the waterbody was not examined by measuring the actual DO consumption rate from each source. Instead, TN, TP, and BOD concentrations were treated as the focus of this study. Possible impacts of these nutrients and organic carbon on the DO level was analyzed through examining the correlations between DO and TN, TP, and BOD concentrations.

In this study, correlations between DO and nutrients were analyzed through examining the seasonal variation, annual variation, and spatial variation. Because of the lack of data, possible influence of BOD on DO concentration was only analyzed through examining the spatial distribution of DO and BOD.

### 3.3 Seasonal Correlation between DO and Nutrients

Figure 3.1 shows the correlations between long-term monthly average DO and monthly average TP concentrations in the studied waterbodies. Because the DO concentration in ambient waters usually does not respond to the change of nutrient concentrations in an instantaneous manner, monthly average DO and TN and TP concentrations were calculated using available data. For WBID 2893X, data collected in the verified period were limited; therefore, data in the period from 1993 through 2003 were used for the analysis. Because, in many cases, each month had only one set of DO and nutrient data, monthly DO and TN and TP concentrations from all years were averaged and used to create a set of long-term monthly average DO and TN and TP concentrations.

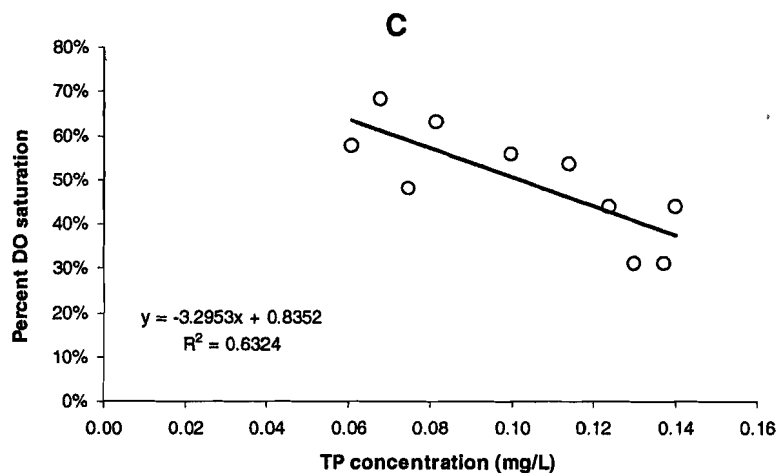


Figure 3.1. Correlation between percent DO saturation and TP

The long-term monthly average results were then used for the correlation analyses. To avoid the potential influence from the differences in temperature in different months, percent DO saturation, instead of DO concentration, for each month was used in the correlation analysis.

Significant negative correlations ( $P < 0.05$ ) between the long-term monthly average DO and TP concentrations were found for the waterbody. Based on **Figure 3.1**, it appears that between 44 – 63% of the DO variance can be explained by the variance of the TP concentration. Correlation between DO and TN concentrations was statistically insignificant.

### 3.4 Annual correlation between DO and nutrients

The influences of TP on the DO concentrations in the waterbody were also examined on an annual average basis. The annual average DO and TP concentrations were calculated for each year using the monthly averages. To ensure that a reasonably wide range of DO and TP variations were included in the correlation analyses, the periods of record were expanded from only the data from the verified period to including all the data available to the Department from the Impaired Waters Rule (IWR) database (Run20\_1), which fell in the period between 1992 and 2003. **Table 3.1** shows the correlation coefficients between DO and TP concentrations for SJR\_above\_SGL.

**Table 3.1. Correlation between annual DO and TP concentrations**

Segment	Equation	R <sup>2</sup>	P	Years of data used in the analysis
SJR_above_SGL (WBID 2893X)	$Y = -23.68X + 6.94$	0.73	0.05	1993 through 1997, and 2003. There were no data in 1999 through 2002. 1998 data were not used to calculate the annual mean because there were only two data points for the entire year

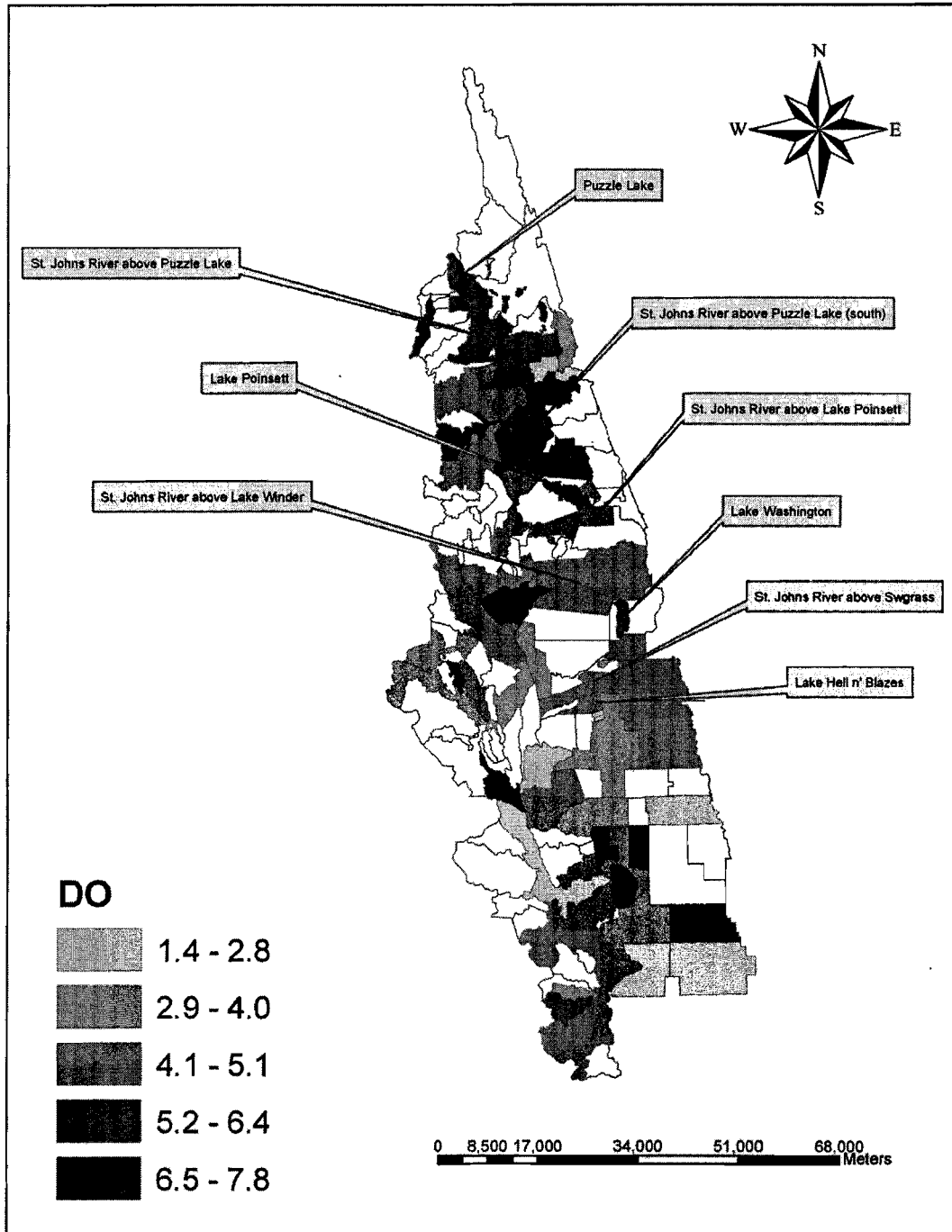
DO-TP correlation for the St. Johns River above Sawgrass is statistically significant ( $P = 0.050$ ). The correlation coefficient is about 0.73. The correlation between DO and TN concentrations was statistically insignificant.

### 3.5 Spatial correlation between DO and nutrients

The impacts of TP on the DO concentration in the USJRB were also examined by analyzing the spatial distribution of long-term average DO and TP concentrations across the basin on WBIDs that have data. **Figure 3.2 A** and **B** show the spatial distribution of long-term average DO and TP concentrations in the basin. Except for several isolated waterbodies in the southern part of the basin that had high DO and low TP concentrations, there was a general trend of gradual

increase of DO concentration from the south to the north and an opposite trend, the decrease of TP concentration from the south to the north. The majority of the USJR segments located on the northern end of the basin, such as Lake Poinsett (WBID 2893K), St. Johns River above Puzzle Lake South (WBID 2893), St. Johns River above Puzzle Lake (WBID 2893I), and Puzzle Lake (WBID 2964B), had long-term average DO concentrations above 5.0 mg/L. Long-term TP concentrations of these waterbodies were all at or below 0.09 mg/L.

**Table 3.2** lists the long-term average DO and TP concentrations in waterbodies along the main channel of the USJR from the central part of the basin, where a distinct river channel begins, to the northern end of the basin. Based on this table, long-term average DO concentrations for lakes south of Lake Poinsett were usually lower than 5.0 mg/L except for Lake Washington, while the long-term average DO concentrations of those waterbodies north of Lake Poinsett, including Lake Poinsett, were usually higher than 5.0 mg/L. Long-term TP concentrations showed the opposite trend. Waterbodies south of Lake Poinsett usually had long-term TP concentration higher than 0.11 mg/L, while in waterbodies north of Lake Poinsett, long-term TP concentrations were usually lower than 0.09 mg/L. Plotting the long-term DO concentrations in these waterbodies (except Lake Washington) against the TP concentrations shows a reasonably tight correlation between DO and TP concentrations ( $R^2 = 0.49$ ,  $P = 0.035$ ), suggesting that a significant portion of the DO spatial variation can be explained by the spatial variation of the TP concentration. Why the DO concentration in Lake Washington was significantly higher than the other waters south of Lake Poinsett remains unknown. SJRWMD suggested that the difference could result from the larger depth of Lake Washington than lakes south of it, i.e. Lake Hell n' Blazes and Sawgrass Lake.



**Figure 3.2- A. Spatial distribution of DO in the USJRB**

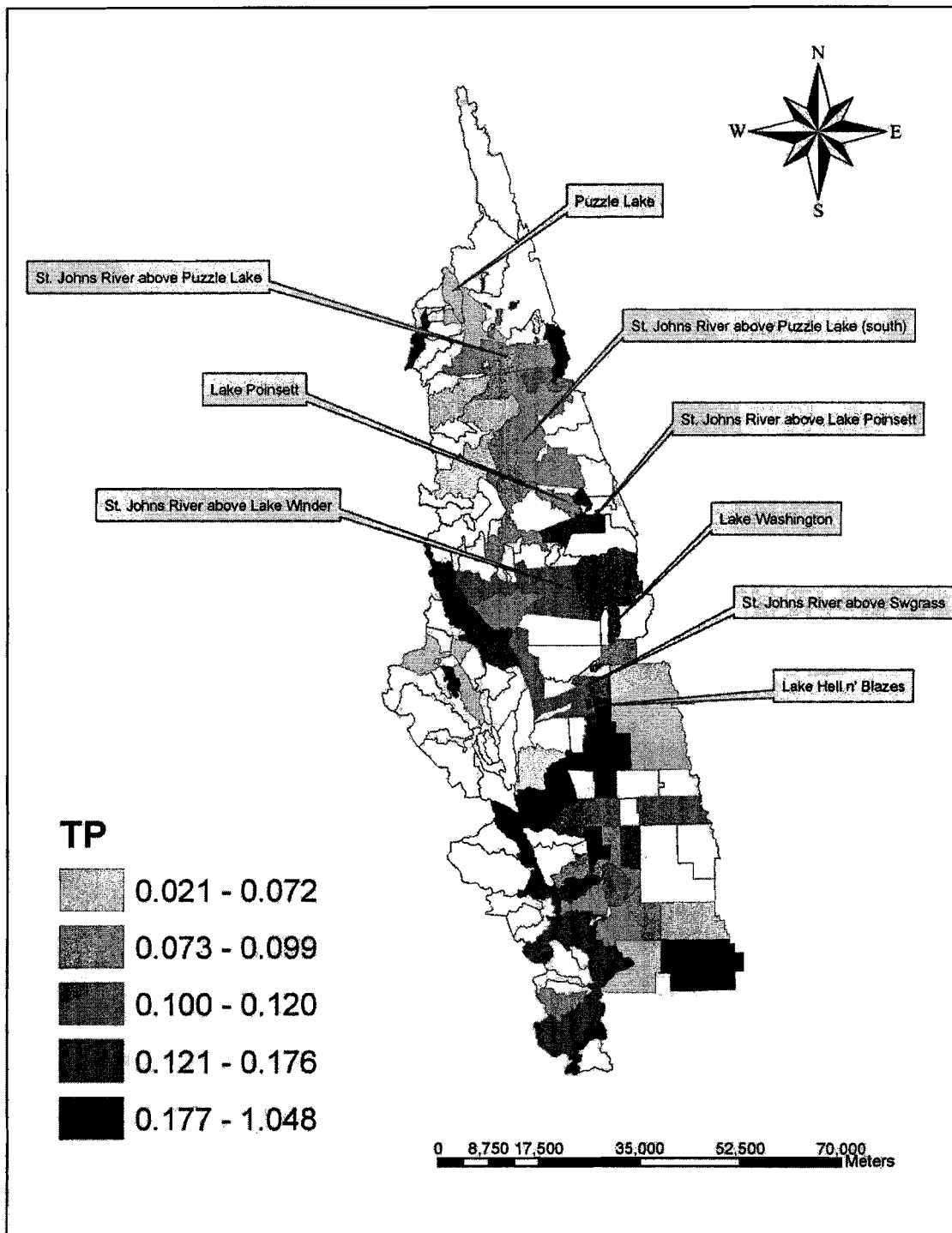


Figure 3.2 – B. Spatial distribution of TP concentration in the USJRB

**Table 3.2. Long-term average DO and TP concentrations of waterbodies from the central to the northern parts of the basin**

	DO (mg/L)	TP (mg/L)	Correlation Equation	R <sup>2</sup>	P
Lake Hell n' Blazes	3.96	0.16	Y = -16.44X + 6.53	0.49	0.035
St. Johns River above Sawgrass	4.59	0.12			
Sawgrass Lake	4.10	0.11			
St. Johns River above Lake Winder	4.20	0.11			
Lake Washington	6.42	0.10			
St. Johns River above Lake Poinsett	4.98	0.11			
Lake Poinsett	5.53	0.09			
St. Johns River above Puzzle Lake (WBID 28935)	5.51	0.09			
St. Johns River above Puzzle Lake (WBID 2893I)	5.46	0.09			
Puzzle Lake	5.24	0.06			

No significant correlation was observed between long-term DO and TN concentrations.

One interesting observation was that DO-TP correlation equations derived from various correlation analyses all indicated the similar target TP concentration, if the annual or long-term average DO target was set at 5.0 mg/L. For example, an annual average DO concentration can be translated into an annual average percent DO saturation of about 59%. To achieve this target, the DO-TP correlations shown in **Figure 3.1 C** require a TP concentration of 0.07 mg/L for the SJR\_above\_SGL WBID. Using the DO-TP correlation equations shown in **Table 3.1**, and assume an annual average DO of 5.0 mg/L, the target TP concentrations for the SJR\_above\_SGL should be 0.08 mg/L. Using the equation shown in **Table 3.2**, and assuming a long-term average DO concentration of 5.0 mg/L, the target TP concentration is 0.09 mg/L. As long as long-term average TP concentrations in the WBID is at or below 0.09 mg/L, the long-term DO concentration appears to be higher than 5.0 mg/L. This TMDL assumes that if the phosphorus concentration can be effectively controlled in the upper St. Johns River basin, the low DO condition in the USJRB should be ameliorated.

DOC with human origin, which is usually represented by BOD concentration, could also impact the DO concentration in the study waters. As it was shown in **Table 2.3**, the median BOD concentrations of SJR\_above\_SGL are higher than 2.0 mg/L screening levels used by the Department. BOD is considered as one of the causative pollutants for the low DO condition in the waterbody. Because there were only limited BOD measurements available at the time this study was conducted and all measurements were collected in 2003, only once or twice for each quarter, it was not feasible to conduct any statistical analysis. However, when the long-term average BOD concentrations for all waterbodies in the USJRB were calculated using available data, there was a trend of declining BOD concentration from the southern to the northern parts of the basin (**Figure 3.3**), apparently opposite to the spatial distribution of long-term average DO concentration in the basin (**Figure 3.2-A**). The spatial variation of BOD in the basin is most likely not caused by the change of humic DOC input from the natural environment because, as shown in **Figure 3.4**, the water color of the main channel of USJR did not decrease significantly

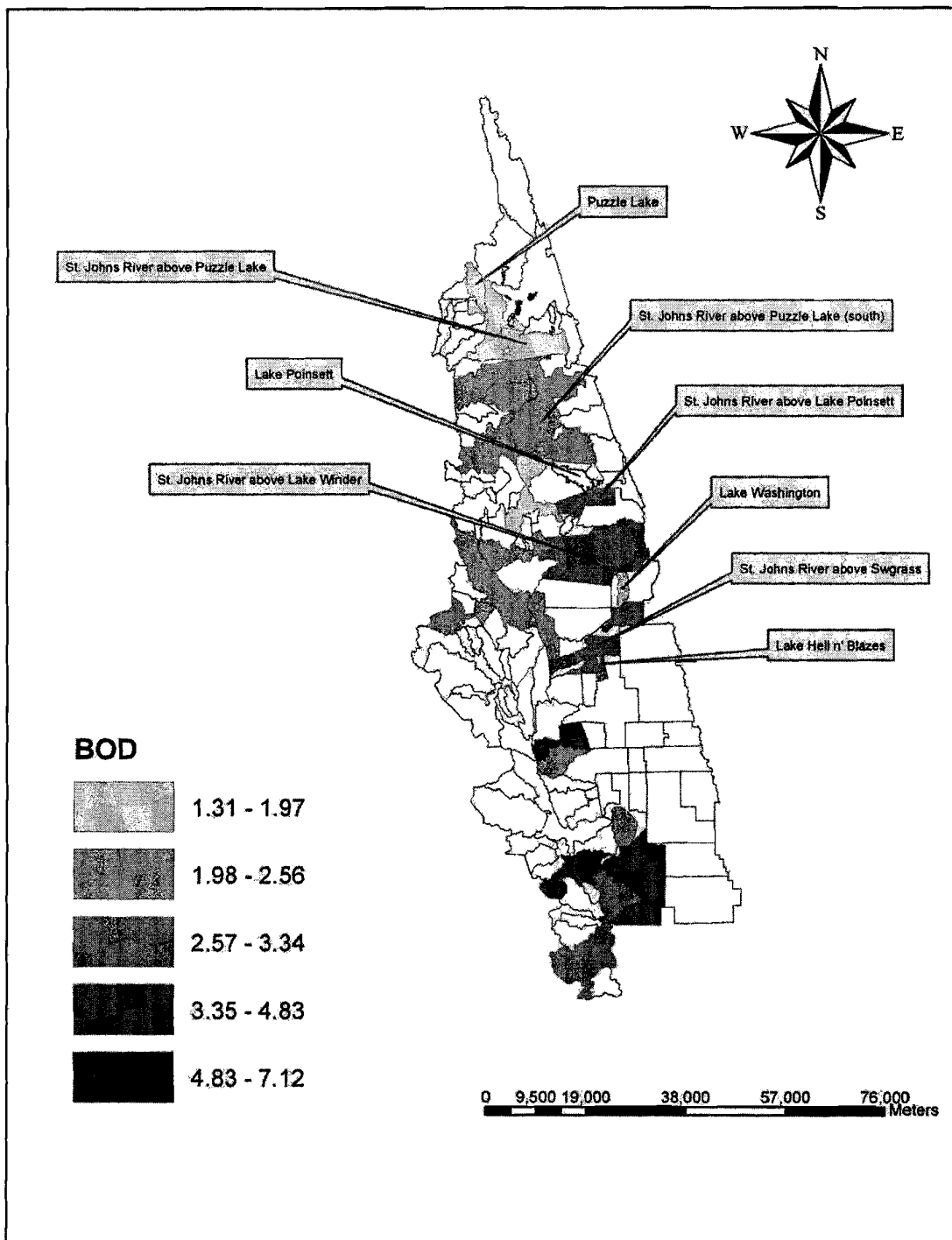
from the south to the north. The spatial variation of BOD in the basin likely reflects the extent of the human impact in the basin, which is heavier in the southern part than the northern part of the basin.

**Table 3.3** lists long-term average DO and BOD concentrations of several waterbodies along the USJR from the central part to the northern end of the basin. These average concentrations were calculated using the entire period of record of each waterbody. Because of the limited amount of data available, the periods of record of listed waterbodies are not all the same.

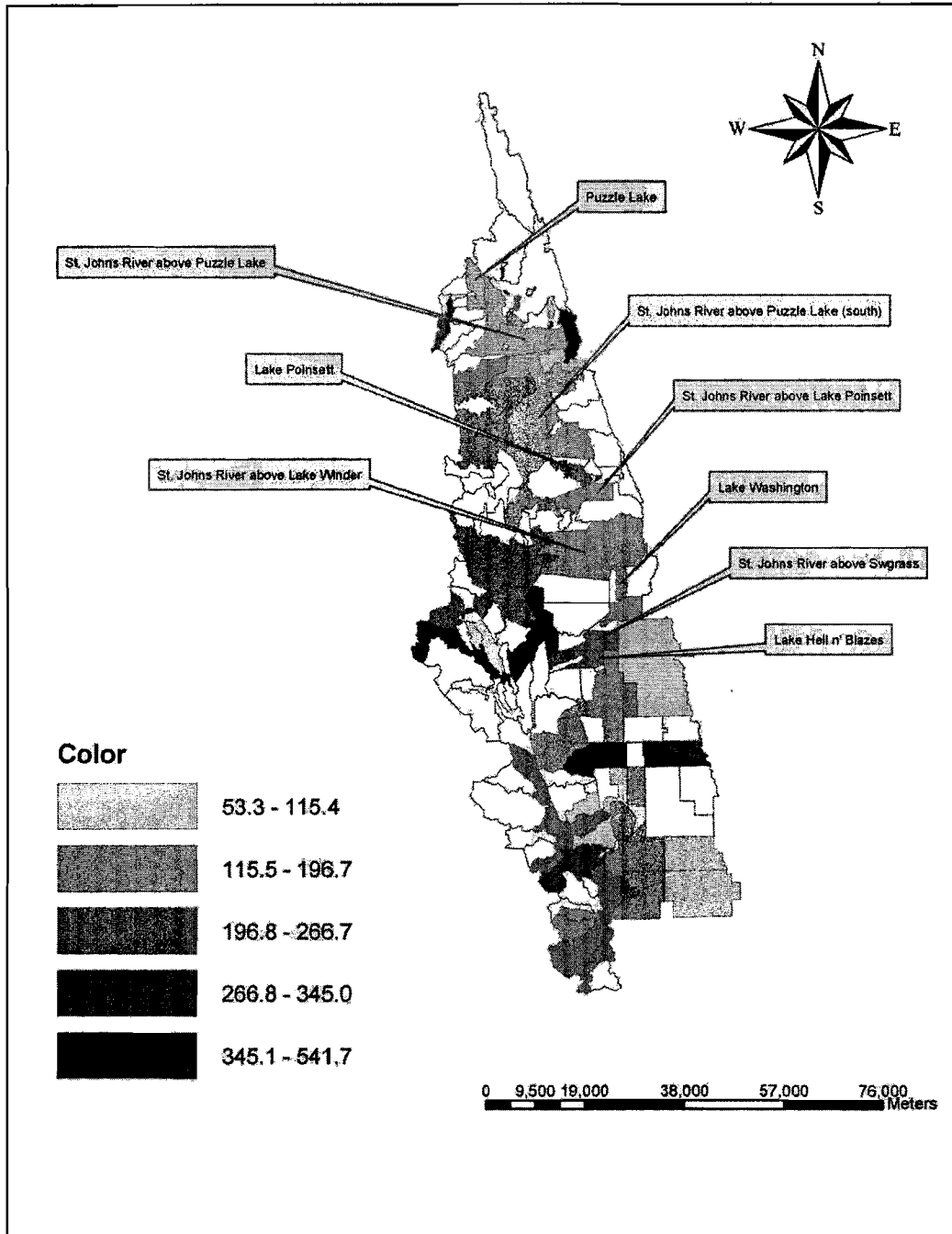
**Table 3.3. Long-term average DO and TP concentrations of waterbodies from the central to the northern parts of the basin**

	DO (mg/L)	BOD (mg/L)
Lake Hell n' Blazes	3.96	N/A
St. Johns River above Sawgrass	4.59	3.22
Sawgrass Lake	4.10	3.34
St. Johns River above Lake Winder	4.20	2.76
Lake Washington	6.42	1.31
St. Johns River above Lake Poinsett	4.98	3.03
Lake Poinsett	5.53	N/A
St. Johns River above Puzzle Lake (WBID 28935)	5.51	2.25
St. Johns River above Puzzle Lake (WBID 2893I)	5.46	1.97
Puzzle Lake	5.24	1.93

As shown in **Table 3.3**, for most of the waterbodies along the main channel of the USJR, as long as the long-term average BOD concentration is close to or lower than 2.0 mg/L, the long-term average DO concentration is higher than 5.0 mg/L. Therefore, in this study, the target BOD concentration was set at 2.0 mg/L.



**Figure 3.3. Spatial distribution of BOD concentration in the USJR**



**Figure 3.4. Spatial distribution of color concentration in the USJRB**

### 3.6 Natural Conditions

It should be noted that even if both TP and BOD targets established in this study were achieved, periods in which DO concentration would be lower than 5.0 mg/L may still exist in the USJR waters, especially during seasons of high temperature, which may decrease the DO solubility and also stimulate the oxygen consumption rate. This could be one of the characteristics of blackwater systems. The constant DOC supply to bacteria and sediment oxygen demand (SOD) could all contribute to the naturally low DO in this system. Therefore, in this study, instead of establishing a single DO value as the target, a set of DO values were established for different seasons of the year.

DO, TP, and BOD data from two waterbodies located in the northern part of the basin: the St. Johns River above Puzzle Lake south (WBID 28935) and the St. Johns River above Puzzle Lake (WBID 28931) were used to establish the DO targets. These two WBIDs were selected because: (1) the long-term average DO concentrations of these two WBIDs are higher than 5.0 mg/L; (2) the long-term TP concentrations of these two WBIDs are all at 0.09 mg/L; and (3) BOD concentration for these WBIDs are close to or lower than 2.0 mg/L (Table 3.2 and 3.3). Puzzle Lake was not used in establishing the DO targets because its TP concentration was consistently lower than 0.07 mg/L, which was considered too stringent. Lake Poinsett, although its long-term average DO is higher than 5.0 mg/L and the long-term TP is at 0.09 mg/L, did not have any BOD measurements to judge the influence of DOC of human origin. Therefore, DO readings from this waterbody were not used either.

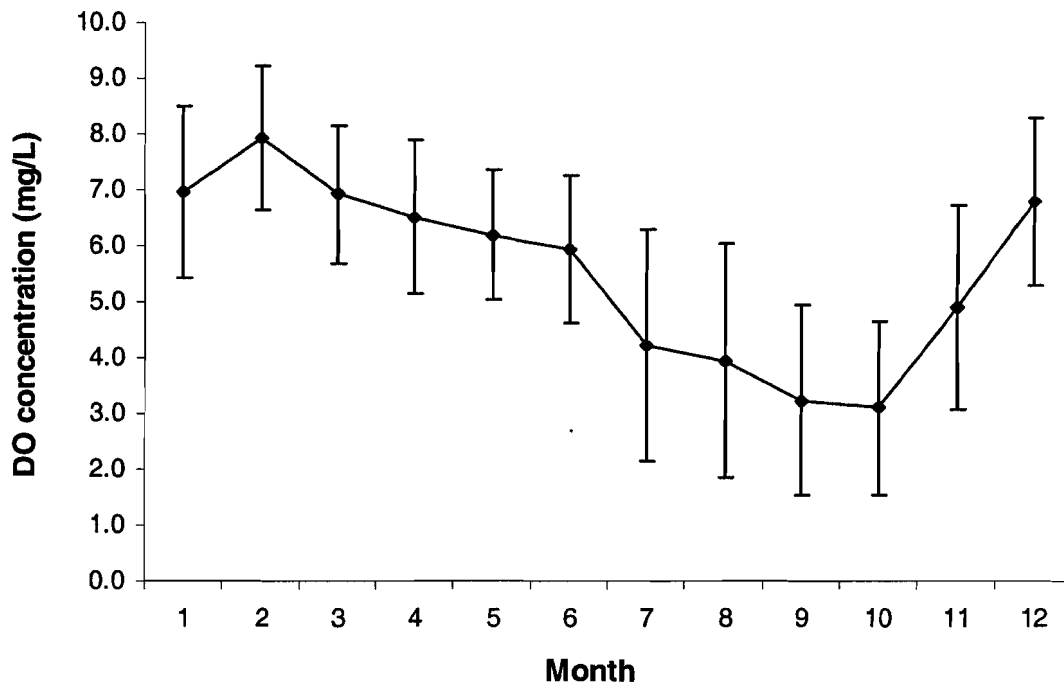
For the two waterbodies of which DO measurements were used for establishing DO targets, only DO measurements in years between 1996 and 2003 were used. This was because 1996 was the year when the majority of the USJRB restoration project became operational (Keenan et al, 2003). The year 2003 was the most recent year in which data were available to the Department. In addition, only DO concentrations in the year when the annual average TP concentrations were at or lower than 0.09 mg/L were used to avoid the possible impact of enhanced TP concentration on the seasonal pattern of the DO concentration. For example, DO concentrations from WBID 28935 in year 1999 were not used because in this year, the annual average TP concentration was 0.11 mg/L.

DO concentrations from aforementioned two WBIDs were combined and monthly average DO concentrations for each year were calculated. The monthly average DO concentrations of all years were further averaged to calculate a long-term monthly average DO for each month. A long-term standard deviation was also calculated for each long-term monthly mean. These long-term monthly average DO concentrations and associated standard deviation were used as the DO targets for this study. Table 3.4 tabulates the target DO concentrations and associated standard deviation. Figure 3.5 shows the seasonal variation of the target DO concentration and the standard deviation.

**Table 3.4. DO monthly target and standard deviation**

Month	Monthly DO (mg/L)	Standard Deviation (mg/L)
January	7.0	1.5
February	7.9	1.3
March	6.9	1.2

Month	Monthly DO (mg/L)	Standard Deviation (mg/L)
April	6.5	1.4
May	6.2	1.2
June	5.9	1.3
July	4.2	2.1
August	3.9	2.1
September	3.2	1.7
October	3.1	1.6
November	4.9	1.8
December	6.8	1.5



**Figure 3.5 DO targets for studied waterbodies**

### 3.7 Data Summary

In summary, DO appears negatively correlated with TP concentrations. The average TP concentrations to achieve an annual average DO concentration of 5.0 mg/L, based on correlation equations derived from different correlation analyses, were all 0.09 mg/L. This suggests that reducing the TP concentration to 0.09 mg/L may also ameliorate the low DO condition. Simultaneous reduction of BOD concentration to less than 2.0 mg/L would be another important aspect to improve the low DO condition in the waterbody.

With the TP and BOD targets achieved, periodical DO concentrations lower than 5.0 mg/L may still be possible during a typical year. This may be a natural phenomenon of the blackwater systems. Therefore, instead of establishing one single DO value as the target, this study established a set of DO targets to reflect the natural fluctuation of DO over a typical year. These targets were established using the data from the segment of the St. Johns River above Puzzle Lake, of which the long-term TP concentration is 0.09 mg/L and the BOD concentration close to 2.0 mg/L. The combination of the TP and BOD concentration of this water segment suggested that it is relatively unimpacted by human activities.

## Chapter 4: ASSESSMENT OF SOURCES

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### 4.1 Types of Sources

An important part of the TMDL analysis is the identification of pollutant source categories, source subcategories, or individual sources of the pollutant of concern in the target 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 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 (see **Section 6.1 on Expression and Allocation of the TMDL**). However, the methodologies used to estimate nonpoint source loads do not distinguish between NPDES and non-NPDES stormwater discharges, and as such, this source assessment section does not make any distinction between the two types of stormwater.

### 4.2 Potential Sources of TP and BOD discharging to WBID 2893X

#### 4.2.1 Point Sources

##### 4.2.1.1 Wastewater Point Sources

There are no NPDES permitted facilities discharging to surface waters in the SJR\_above\_SGL WBID.

##### 4.2.1.2 Municipal Separate Storm Sewer System Permittees

Within the USJRB, the stormwater collection systems owned and operated by Seminole and Orange Counties and those systems owned by DOT within Seminole and Orange Counties are covered by an NPDES MS4 Phase I permit. The other counties that are parts of the USJRB, including Volusia, Osceola, Brevard, Indian River, and Okeechobee counties, all hold Phase II MS4 permits.

## 4.2.2 Nonpoint Sources

In addition to the loading from point sources, majority of the TP and BOD loadings came from nonpoint sources, which include surface runoff, groundwater input, nutrient sediment release, and atmospheric deposition directly on to the surface of studied waters, especially on to the surface of lakes.

### 4.2.2.1 Land Uses

Surface runoff could be a very important source of pollutants in the basin. The amount of surface runoff and pollutant concentrations of the surface runoff are significantly influenced by the landuse types of the basin. The landuses in the part of the USJRB that discharges to the WBID were classified based on the Level 1 Florida Land Use, Cover and Forms Classification System (FLUCCS) using the SJRWMD's 2000 landuse GIS coverage (**Table 4.1**).

**Table 4.1. Land use distribution in SJR above Sawgrass Lake**

Land Use	Acreage	Percent
Urban and Built-Up	0	0
Agriculture	962	8.4
Rangeland	2593	23.4
Upland Forest	1755	15.9
Water	110	1.0
Wetlands	5582	50.4
Barren Land	45	0.4
Transportation, Communication, and Utilities	58	0.5
Total	11,069	100%

Wetlands have the highest acreage among all the landuse types and accounts for about 50% of the area (**Table 4.1**). Although wetlands can help to remove pollutant loadings from the human landuse categories, decay of wetland aquatic plants, oxygen consumption from the organic materials accumulated at the bottom, and a consistent supply of humic organic carbon from these areas could significantly contribute to the naturally low DO condition in the USJR for some periods of a given year. Rangeland is the second highest landuse area in the watershed, accounting for about 23% of the area. The watershed is not extensively urbanized, although growth may have occurred in the last five years. Citrus groves are an important agricultural landuse, accounting for about 8% of the area. Citrus groves are usually intensively managed. Nutrient and BOD loadings from these landuse areas could be substantial.

### 4.2.2.2 Estimating TP and BOD loadings under existing condition

Annual TP and BOD loadings to the studied waters under existing condition were calculated through aggregating the monthly TP and BOD loadings. Monthly loadings were estimated by multiplying monthly TP (Keenan et al. 2003, EPA 2004) and BOD concentrations with the average monthly flow. In this study, mean total monthly flows were calculated using validated

flow measurements obtained from Station 02232000, located on the main river channel downstream of Sawgrass Lake, between 1996 and 2002 from three USGS gauging stations. Monthly TP loadings under existing condition were calculated by multiplying the mean monthly TP concentrations by the monthly inflows into the waterbody. To avoid the load underestimation that may be caused by the TP sedimentation within a given waterbody, TP concentrations at the inlet and outlet of the waterbody were analyzed. If the TP concentration at the outlet of the waterbody was significantly lower than the inlet concentration, only the inlet TP concentration would be used in calculating the TP loading into the waterbody. For example, the TP concentration for the SJR\_above\_SGL was significantly lower than the TP concentration at the outlet of the waterbody immediately upstream of this water segment (Lake Hell 'n Blazes). Therefore, the TP concentration at the outlet of Lake Hell 'n Blazes was used to calculate the TP loading into the SJR\_above\_SGL.

Mean monthly TP concentrations were calculated using the data retrieved from the Department's IWR database. The periods of record used for the calculation fell in between 1995 and 2002. Mean monthly TP concentrations calculated for different years were then averaged to get the long-term monthly averages for each waterbody. Long-term monthly average TP concentrations were then multiplied by the long-term monthly flows to obtain the month TP loadings. Monthly TP loadings were further aggregated to calculate the annual TP loadings into the studied waters.

In this study, as long as TP concentrations were found different between inlet and outlet, loading into each studied waterbody was calculated as the loading at the inlet of the waterbody. This loading was not influenced by whatever TP removal processes inside the waterbody and should approximate the actual loadings into studied waterbodies. **Table 4.2** shows the long-term mean monthly flow, long-term mean monthly TP concentrations, monthly TP loadings, and annual TP loadings under existing condition.

**Table 4.2. Long-term mean monthly flow and TP concentration and loads**

Month	SJR_above_SGL (WBID 2893 X)		
	Long-term Monthly flow (acre-ft/month)	Long-term monthly average (mg/L)	Monthly TP loading (tons/yr)
1	30654	0.19	7.2
2	29401	0.19	6.7
3	31533	0.16	6.3
4	29880	0.09	3.1
5	12772	0.13	2.1
6	12485	0.31	4.7
7	50251	0.12	7.4
8	78359	0.09	8.9
9	74830	0.13	12.1
10	78227	0.10	9.4
11	45546	0.13	7.1
12	39202	0.19	9.0
Annual total	513141		84

BOD measurements in SJR\_above\_SGL were collected in 2003, usually once every quarter of the year. Monthly mean BOD concentration was not calculated due to the lack of monthly BOD measurements for every month of the year. BOD annual loading was calculated by multiplying the annual average BOD concentrations by the annual flows (**Table 4.3**).

**Table 4.3. Annual BOD loadings into studied waterbodies**

Waterbodies	St. Johns River above Sawgrass (WBID 2893 X)
Annual average BOD concentration (mg/L)	3.19
Long-term annual average flow (ac-ft/y)	513141
BOD annual loading (tons/year)	2013

## Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

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### 5.1 Overall Approach

The goal of TMDL development is to identify the maximum allowable TP and BOD loadings to the waterbody so that it will meet water quality standards and maintain functions and designated uses as Class I waters. As discussed in Chapter 3, if the target TP concentration of 0.09 mg/L as proposed by the SJRWMD is achieved the part of the low DO impairment caused by TP of human origin should be addressed. In addition, based on the spatial distribution of DO and BOD concentrations in the USJRB, it appears that BOD of human origin could be another factor that controls the DO concentration in the basin. As the long-term average DO concentrations in most of the waterbodies located in the northern part of the basin are above 5.0 mg/L and BOD concentration in these waters were close to or lower than 2.0 mg/L, 2.0 mg/L was established as the target BOD concentration in this study. The target reductions for TP and BOD loadings were calculated based on these target concentrations.

### 5.2 Estimating the target TP and BOD loadings

Target TP and BOD loadings into the waterbody was estimated by multiplying 0.09 mg/L TP and 2.0 mg/L BOD by the annual flow into each waterbody. Since no sedimentation was considered using this approach, the estimated TMDLs could be lower than the TP and BOD loadings that can be assimilated in the waterbody. This makes the TMDL estimate conservative and adds to the margin of safety. **Table 5.1** lists TP and BOD loadings under existing condition, target TP and BOD loadings, and percent reduction required to achieve target TP and BOD loadings.

**Table 5.1. Existing and target loadings for TP and BOD**

	TP	BOD
Existing annual loading (tons/year)	84	2013
Target annual loading (tons/year)	57	1264
Percent reduction required	32%	37%

The target TP loading for SJR\_above\_SGL (WBID 2893X) is 57 tons/year. This load represent about 32% reduction from the TP loadings under the existing condition. The target BOD loadings is 1264, representing about a 37% reduction from the BOD loadings under existing condition.

## Chapter 6: DETERMINATION OF THE TMDL

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### 6.1 Expression and Allocation of the TMDL

The objective of a TMDL is to provide a basis for allocating acceptable loads among all of the known pollutant sources in a watershed so that appropriate control measures can be implemented and water quality standards achieved. A TMDL is expressed as the sum of all point source loads (Waste Load Allocations, or WLAs), nonpoint source loads (Load Allocations, or LAs), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

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

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

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

It should be noted that the various components of the revised TMDL equation may not sum up to the value of the TMDL because 1) the WLA for NPDES stormwater is typically based on the percent reduction needed for nonpoint sources and is also accounted for within the LA, and 2) TMDL components can be expressed in different terms (for example, the WLA for stormwater is typically expressed as a percent reduction, and the WLA for wastewater is typically expressed as mass per day).

WLAs for stormwater discharges are typically expressed as “percent reduction” because it is very difficult to quantify the loads from MS4s (given the numerous discharge points) and to distinguish the loads from MS4s from other nonpoint sources (given the nature of stormwater transport). The permitting of stormwater discharges also differs from the permitting of most wastewater point sources. Because stormwater discharges cannot be centrally collected, monitored, and treated, they are not subject to the same types of effluent limitations as wastewater facilities, and instead are required to meet a performance standard of providing treatment to the “maximum extent practical” through the implementation of BMPs.

This approach is consistent with federal regulations (40 CFR § 130.2[1]), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or **other appropriate measure**. The TMDL is expressed in terms of tons per year (tons/year) and percent reduction of TP and BOD, and represent the maximum long-term annual average TP and BOD loadings the waterbody can assimilate and meet the DO criteria. There are no permitted point sources discharging to surface waters in the WBID, therefore, a value for the WLA component is not applicable (N/A). TMDL components are shown in Table 6.1.

**Table 6.1. TMDL Components**

WBID	Parameter	TMDL (tons/year)	WLA <sub>NPDES Stormwater</sub>	LA	MOS
2893X	TP	57	32%	32%	Implicit
2893X	BOD	1264	37%	37%	Implicit

## 6.2 Load Allocation

The TMDLs for TP and BOD were primarily assigned to the LA (and, as discussed below, to the MS4 as well). The long-term annual average LAs for TP into SJR\_above\_SGL is 57 tons/year. The long-term annual LA for BOD into the WBID is 1264 tons/year. Nonpoint sources (including the loadings from MS4 stormwater) are responsible for all of these loadings. The current long-term annual average TP loading into SJR\_above\_SGL is 84 tons/year. The current long-term annual BOD loading into SJR\_above\_SGL is 2013 tons/year. These figures include the loadings from all the possible sources including surface runoff, groundwater input, and sediment nutrient release.

To achieve the LA, current TP loadings into SJR\_above\_SGL require 32% reduction. BOD loadings into SJR\_above\_SGL require 37% reduction. The load reductions need to apply primarily to the surface runoff.

## 6.3 Wasteload Allocation

### 6.3.1 NPDES Wastewater Discharges

There are no permitted facilities discharging into surface waters in the WBID; therefore, assigning a value to the WLA component is not applicable.

### 6.3.2 NPDES Stormwater Discharges

Because no information was available to the Department at the time this study was conducted regarding the boundaries and locations of all the NPDES stormwater dischargers, the exact stormwater TP and BOD loadings from MS4 areas were not explicitly estimated. The USIRB covers parts of Seminole, Orange, Volusia, Osceola, Brevard, Indian River, and Okeechobee Counties. Among these counties, Seminole and Orange counties are lead permittees for Phase I MS4 permits that cover the stormwater facilities own and operated by these counties. DOT is the co-permittee for Phase I permit in both of these two counties. Volusia, Osceola, Brevard, Indian River, and Okeechobee counties do not have Phase I MS4 permits. Within the basin area that discharge to studied waterbodies, the stormwater collection systems owned and operated by Osceola, Brevard, Indian River, and Okeechobee counties and the Florida Department of Transportation are covered by MS4 Phase II permits. The WLA<sub>NPDES Stormwater</sub> was set as the same percent reduction required to achieve the TMDL as for the other conventional nonpoint sources, which is 32% for TP loadings, and 37% for BOD loadings.

## 6.4 Margin of Safety

Consistent with the recommendations of the Allocation Technical Advisory Committee (Florida Department of Environmental Protection, February 2001), an implicit MOS was used in the development of this TMDL. An implicit MOS was provided by the conservative decisions associated with a number of modeling assumptions, the development of site-specific alternative water quality targets, and the development of assimilative capacity.

This study estimated pollutant loadings by multiplying the pollutant concentrations by the flow. This process addresses the pollutant loadings that eventually reach studied waters after the attenuation during the overland transport. TMDLs estimated using this method could be significantly lower than the pollutant loadings that would be allowed to generate in the watershed, and is therefore very conservative and adds to the implicit margin of safety. In addition, estimating the TMDLs by multiplying the target concentrations by the flow could produce lower TMDL estimates because the multiplication method does not take into consideration of the part of assimilative capacity resulted from the pollutant deposition. The multiplication method not only makes the TMDL estimation more conservative, but also increases the percent load reduction requirement, which adds to the margin of safety of this TMDL.

## Chapter 7: Recommendations

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Following the adoption of this TMDL by rule, the next step in the TMDL process is to develop an implementation plan for the TMDL, referred to as the BMAP. This document will be developed over the next two years in cooperation with local stakeholders, who will attempt to reach consensus on detailed allocations and on how load reductions will be accomplished. The BMAP will include, among other things:

- Appropriate load reduction allocations among the affected parties,
- A description of the load reduction activities to be undertaken, including structural projects, nonstructural BMPs, and public education and outreach,
- A description of further research, data collection, or source identification needed in order to achieve the TMDL,
- Timetables for implementation,
- Confirmed and potential funding mechanisms,
- Any applicable signed agreement(s),
- Local ordinances defining actions to be taken or prohibited,
- Any applicable local water quality standards, permits, or load limitation agreements,
- Milestones for implementation and water quality improvement, and
- Implementation tracking, water quality monitoring, and follow-up measures.

An assessment of progress toward the BMAP milestones will be conducted every five years, and revisions to the plan will be made as appropriate, in cooperation with basin stakeholders.

## References

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

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

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

Florida Department of Environmental Protection. February 1, 2001. *A Report to the Governor and the Legislature on the Allocation of Total Maximum Daily Loads in Florida.*

Tallahassee, Florida: Bureau of Watershed Management, Division of Water Resource Management. Available: <http://www.dep.state.fl.us/water/tmdl/docs/Allocation.pdf>.

Harper, H. H. 1993. Stormwater loading rate parameters for Central and South Florida. Environmental Research & Design, Inc. Orlando, FL.

Keenan, L. W., E. F. Lowe, and D. R. Dobberfuhr. 2003. Pollutant load reduction goals for the Upper St. Johns River basin. St. Johns River Water Management District, Division of Environmental Sciences, Palatka, FL.

Whitney, E., D. B. Means, and A. Rudloe. 2004. Priceless Florida – Natural Ecosystems and Native Species. Pineapple Press, Inc. Sarasota, Florida Department of Environmental Protection

## Appendices

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### **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. In 1994, the Department's stormwater treatment requirements were integrated with the stormwater flood control requirements of the state's water management districts, along with wetland protection requirements, into the Environmental Resource Permit regulations.

Chapter 62-40, F.A.C., also requires the water management districts to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a SWIM plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL. To date, stormwater PLRGs have been established for Tampa Bay, Lake Thonotosassa, the Winter Haven Chain of Lakes, the Everglades, Lake Okeechobee, and Lake Apopka. No PLRG had been developed for Newnans Lake when this report was published.

In 1987, the U.S. Congress established Section 402(p) as part of the federal Clean Water Act Reauthorization. This section of the law amended the scope of the federal NPDES permitting program to designate certain stormwater discharges as "point sources" of pollution. The EPA promulgated regulations and began implementing the Phase I NPDES stormwater program in 1990. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific standard industrial classification (SIC) codes, construction sites disturbing 5 or more acres of land, and master drainage systems of local governments with a population above 100,000, which are better known as municipal separate storm sewer systems (MS4s). However, because the master drainage systems of most local governments in Florida are interconnected, the EPA implemented Phase I of the MS4 permitting program on a countywide basis, which brought in all cities (incorporated areas), Chapter 298 urban water control districts, and the Florida Department of Transportation throughout the 15 counties meeting the population criteria. The Department received authorization to implement the NPDES stormwater program in 2000.

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