TOTAL MAXIMUM DAILY LOAD (TMDL)

For

Turbidity and TSS

In the

Lake Okeechobee Watershed Tributaries

Palm Beach County, Florida

Prepared by:

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EPA United States Environmental Protection Agency

Region 4 serving the southeast

In compliance with the provisions of the Federal Clean Water Act, 33 U.S.C §1251 et. seq., as amended by the Water Quality Act of 1987, P.L. 400-4, the U.S. Environmental Protection Agency is hereby establishing the Total Maximum Daily Loads (TMDLs) for turbidity and total suspended solids for select tributaries in the Lake Okeechobee River Basin. Subsequent actions must be consistent with this TMDL.

/s/ 3/29/07

James D. Giattina, Director — Date

Water Management Division

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LIST OF ABBREVIATIONS

AWT	Advanced Waste Treatment
BMP	Best Management Practices
CFS	Cubic Feet per Second
DEM	Digital Elevation Model
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
F.A.C.	Florida Administrative Code
GIS	Geographic Information System
HUC	Hydrologic Unit Code
IAP	Interim Action Plan
IWR	Impaired Water Rule
LA	Load Allocation
LOPP	Lake Okeechobee Protection Plan
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
Rf3	Reach File 3
RM	River Mile
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USGS	United States Geological Survey
WAFR	Wastewater Facilities Regulation
WBID	Water Body Identification
WCA	Water Conservation Area
WLA	Waste Load Allocation
WMP	Water Management Plan
WWTP	Wastewater Treatment Plant

SUMMARY SHEET

Total Maximum Daily Load (TMDL)

1. Florida 1998 303(d) Listed Waterbody Information

WBID	Category	Parameter	County	HUC
3233	3F	Turbidity	Palm Beach	03090202
3238	3F	Turbidity, TSS	Palm Beach	03090202
3244	3F	Turbidity, TSS	Palm Beach	03090202
3247	3F	Turbidity, TSS	Palm Beach	03090202
3248	3F	Turbidity, TSS	Palm Beach	03090202
3251	3F	Turbidity	Palm Beach	03090202

2. Water Quality Standards:

Turbidity (62-302.530(70)): Levels shall be less than or equal to 29 NTU above natural background conditions.

3. TMDL Endpoints:

Turbidity Impacted WBIDs: The TMDL target is based on the numeric criteria of 29 NTUs above background conditions. Background is assumed to equal the tenth percentile concentration of the measured turbidity samples, or 3 NTU; therefore, the turbidity target equals 32 NTU.

TSS Impacted WBIDs: TMDLs for TSS are addressed through controlling turbidity. A relationship between TSS and turbidity was developed and used to calculate the TSS concentration required to meet the turbidity target. For a turbidity of 32 NTU, the equivalent TSS target is 33 mg/l.

4. TMDL Allocations:

WBID	Parameter	TMDL	WLA	LA	Percent Reduction
3233	Turbidity (NTU)	32		32	52%
3238	Turbidity (NTU)	32	32	32	66%
	TSS (mg/l)	33	33	33	55%
3244	Turbidity (NTU)	32	32	32	12%

WBID	Parameter	TMDL	WLA	LA	Percent Reduction
	TSS (mg/l)	33	33	33	0*
3247	Turbidity (NTU)	32		32	0*
	TSS (mg/l)	33		33	0*
3248	Turbidity (NTU)	32	32	32	0*
	TSS (mg/l)	33	33	33	0*
3251	Turbidity (NTU)	32		32	0*

* The percent reductions are calculated by representing existing conditions as the 90th percentile concentration of all data measured in the WBID. While the TMDL for these waterbodies are being expressed as a zero percent reduction, BMPs should be implemented in the watersheds, as the instream concentrations may exceed the TMDL target concentrations during certain storm events.

5. Endangered Species (yes or blank): Yes

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

7. TMDL Considers Point Source, Non-point Source, or both: Both

8. Major NPDES Discharges to surface waters in the watershed:

MS4 Allocations:

MS4	Impacted WBID	NPDES ID	% Reduction in Turbidity and TSS Loads
City of Pahokee/ Palm Beach County	3244, 3238	FLS000018	Turbidity: 66%
			TSS: 55%
City of South Beach/ Palm Beach County	3248	FLS000018	Turbidity : 0 (see note 2)
			TSS: 0 (see note 2)

Notes:

1. When an MS4 covers more than one WBID, the largest percent reduction calculated for an impaired WBID is assigned to the MS4. The MS4 is responsible for controlling pollutant loads from the urban areas within its jurisdiction.

2. While the TMDLs for this WBID are being expressed as a zero percent reduction, BMPs should be implemented in the watersheds, as the instream concentrations may exceed the TMDL target concentrations during certain storm events.

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 the allowable loadings of pollutants or other quantifiable parameters for a waterbody based on the relationship between pollution sources and in-stream water quality conditions, so that states can establish water quality based controls to reduce pollution from both point and non-point sources and restore and maintain the quality of their water resources (USEPA, 1991). The TMDLs described in this report are being proposed 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).

Florida Department of Environmental Protection (FDEP) developed a statewide, watershed-based approach to water resource management. Under the watershed management approach, water resources are managed on the basis of natural boundaries, such as river basins, rather than political boundaries. The state's 52 basins are divided into 5 groups. Water quality is assessed in each group on a rotating five-year cycle. The TMDLs addressed in this report are in the Everglades basin in Group 5. FDEP established five water management districts (WMD) responsible for managing ground and surface water supplies in the counties encompassing the districts. The impaired WBIDs are managed through the South Florida Water Management District (SFWMD).

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"; each is assigned a unique Waterbody IDentification (WBID) number. A water segment usually contains only one unique waterbody type (stream, lake, cannel, etc.). The planning unit and basin group of each impaired water segment and the listed impairments are identified below in Table 1. All segments are classified as freshwater streams. WBID locations are shown in Figure 1.

Table 1. Planning Unit and Basin Group of Impaired WBIDs

WBID	Segment Name	Planning Unit	Basin Group	Impairment
3233	L-8	L-8	3	Turbidity
3238	W. Palm Beach Canal	Everglades Agricultural Area	5	Turbidity, TSS

3244	East Beach	Everglades Agricultural Area	5	Turbidity, TSS
3247	715 Farms	Everglades Agricultural Area	5	Turbidity, TSS
3248	N. New River Canal	Everglades Agricultural Area	5	Turbidity, TSS
3251	S-3	Everglades Agricultural Area	5	Turbidity

1.1 Purpose of Report

This document presents Total Maximum Daily Loads (TMDLs) for pollutants contributing to the 1998 listed impairments (i.e. turbidity and TSS) in the Lake Okeechobee tributaries. The TMDLs establish allowable turbidity and TSS values that should restore the tributaries to meet applicable water quality criteria.

1.2 Previous Studies in the Lake Okeechobee Watershed

Lake Okeechobee Protection Program: Lake Okeechobee Protection Plan

The Lake Okeechobee Protection Act (LOPA, Chapter 00-103, Laws of Florida) was passed by the 2000 Legislature, to establish a restoration and protection program for Lake Okeechobee. This is to be accomplished by achieving and maintaining compliance with State water quality standards in Lake Okeechobee and its tributary waters, through a watershed-based, phased, comprehensive and innovative protection program. This program sets forth a series of activities and deliverables for the coordinating agencies including: the South Florida Water Management District, the Florida Department of Environmental Protection, and the Florida Department of Agriculture and Consumer Services. Elements specifically required by the legislation include a formal Lake Okeechobee Protection Plan (SFWMD, 2004).

Comprehensive Everglades Restoration Plan (CERP)

The Comprehensive Everglades Restoration Plan (CERP) provides a framework and guide to restore the south Florida ecosystem including the Everglades. The conceptual plan for the Lake Okeechobee watershed consists of construction of stormwater treatment areas (STAs) and reservoirs; restoration of wetlands. Details on CERP projects can be found at: (www.evergladesplan.org).

1.3 Identification of Impaired Waterbodies

The waterbodies impaired for turbidity and TSS are located south of Lake Okeechobee in Palm Beach County. Land cover distribution in the impaired WBIDs is derived from 1999 color infrared imagery and is summarized in Table 3. The following watershed descriptions of the L-8 Basin and the Everglades Agricultural Area (EAA) are taken from the Lake Worth Lagoon – Palm Beach Coast Basin Status Report (FDEP, 2003).

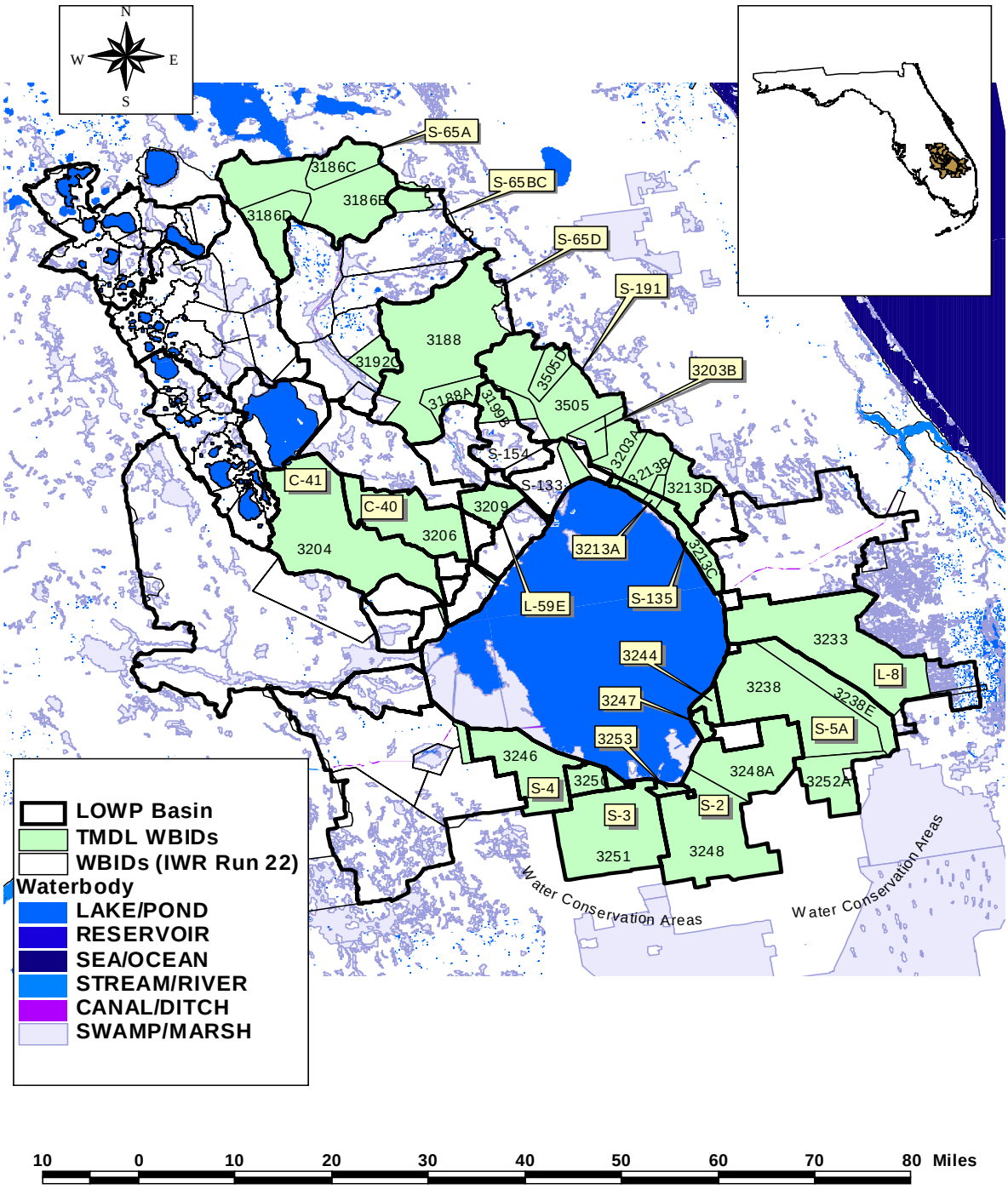

Figure 1. Location of Impaired WBIDs

1.3.1 L-8 Basins

WBID 3233 is the only waterbody in the L-8 Basin addressed in this report. Drainage from WBID 3233 discharges into the L-8 Canal located on the southeastern shore of Lake Okeechobee. The L-8 canal is a conveyance for excess stormwater from Lake Okeechobee and agricultural areas. The canal starts at Sand Cut and ends at the intersection with the West Palm Beach Canal. Before discharging into the West Palm Beach Canal, the L-8 Canal connects to several other canals and waterways, including the M-Canal, the M-0 and M-1 canals, and the L-40 Canal. Land cover in WBID 3233 is predominately wetlands (44%) and forest (23%). Agriculture accounts for about 16 percent of the land cover, predominately citrus groves, sugarcane, and corn. Most of the undeveloped area in the WBID is within the J.W. Corbett National Wildlife Refuge.

1.3.2 Everglades Agricultural Area (EAA)

The EAA is located on the southern tip of Lake Okeechobee and is one of the most productive agricultural regions in the State. Over 505,000 acres of the EAA are under production with sugar cane that accounts for over 80 percent of total crop coverage. In addition, farmers grow vegetables, sod, and rice during the winter months. The EAA is the largest single source of phosphorus to the Everglades. Six major canals were built in the 1920's to drain and irrigate the EAA, many of which are included on the 1998 303(d) list as impaired for turbidity and TSS. These canals underwent major renovations in the 1960's as part of the Central and South Florida Project (C&SF Project). As part of the C&SF Project, the U.S. Army Corps of Engineers (USCOE) constructed a network of canals, levees, control structures, and pumps to control flooding and provide water supply to the EAA. This project resulted in the back pumping of nutrient and sediment-rich water into Lake Okeechobee, exacerbating water quality problems in the lake.

In 1979, the Florida Department of Environmental Regulation (now the Department of Environmental Protect (DEP)) approved the Interim Action Plan (IAP), an operating permit issued to the SFWMD to regulate back pumping into Lake Okeechobee. The IAP states that EAA drainage water can only be discharged into the lake under declared emergency conditions for water supply or flood control purposes. Runoff from the EAA produced by normal rainfall is discharged into Water Conservation Areas (WCAs) to limit the amount of nutrient-rich water being released into the lake. Prior to the IAP, the northern one third of the EAA was routinely back pumped directly into Lake Okeechobee. Since implementation of the IAP, back-pumping for water supply has occurred four times, the most recent in 2001 (Audubon of Florida, 2005). Back-pumping is associated with dry periods. Water management during droughts is essential from preventing lake levels from getting too low and needing back pumping.

The 1994 Everglades Forever Act required EAA landowners to reduce the total phosphorus in the runoff from their land by 25 percent (Rule 40E-63). Landowners are implementing Best Management Practices (BMPs) to manage water, sediments, and nutrients that balance water quality improvements and agricultural productivity. Since January 1995, the EAA basin reductions have exceeded those required by state law.

There are 5 WBIDs in the EAA included on the 1998 303(d) list as impaired for turbidity and TSS: WBID 3238 (West Palm Beach Canal); 3248 (North New River Canal); 3244 (East Beach); 3247 (715 Farms); and 3251 (S-3). Land cover for the impaired WBIDs is predominately agriculture. The following discussions of each WBID are summarized from Ecosummary reports prepared by the Florida Southeast District Assessment and Monitoring Program (SFWMD, 1999a; SFWMD, 1999b; SFWMD, 1999c; SFWMD, 1999d; and SFWMD, 1999e).

The West Palm Beach Canal (WBID 3238), also known as the C-51 Canal, was originally dug in the early 1900's to lower Lake Okeechobee and drain a part of the Everglades in order to farm the land. Today, the canal is part of the Central and South Florida flood control system. The canal starts at Lake Okeechobee at structure S-352 (S5A basin) and flows southeast before emptying into the Lake Worth Lagoon in Palm Beach County. About 96 percent of land cover in the WBID is agriculture and is used primarily for growing sugarcane.

The North New River Canal (WBID 3248) was created to provide drainage as well as a navigable connection between the Gulf of Mexico to the Atlantic Ocean via Lake Okeechobee and the Caloosahatchee River. The North New River Canal is one of the major canals in Southeast Florida. The canal starts at the southeastern corner of Lake Okeechobee's Rim Canal at South Bay's Pump Station S-2. It then runs south through the EAA, WCA2 and WCA3. WBID 3248 includes the northern portion of the canal. Land cover in the WBID is primarily agriculture.

East Beach (WBID 3244) is located on the southeast shore of Lake Okeechobee. There are four main canals, C-1 through C-4, in the WBID that are connected to a complex network of smaller lateral canals. When an excess amount of stormwater collects in the canal system, water can be back-pumped to Lake Okeechobee by Pump Station #1 or to the West Palm Beach Canal by Pump Station #3. A component of the Everglades Forever Act required 80 percent of the drainage from East Beach to be diverted away from Lake Okeechobee by December 2000. The East Shore Drainage Canal was constructed to transport water away from Lake Okeechobee to the Hillsboro Canal for discharge into Stormwater Treatment Area (STA) 1-West and 1-East at the northern tip of WCA-1. East Beach operates under a 40E-63 permit, issued by SFWMD. Land cover in WBID 3244 is primarily agriculture followed by residential.

Closter Farms, also known as 715 Farms (WBID 3247), is located on the southeast shore of Lake Okeechobee south of East Beach. There are approximately 4 miles of main draw canals and 37 miles of lateral canals. A major element of the drainage works is a pump station at culvert 12-A. The pump station contains three pumps and is used to back-pump stormwater collected by the network of canals to Lake Okeechobee whenever excessive water levels occur. Closters Farms drainage system is included in the Everglades Best Management Practices Program and was issued a 40E-63 by SFWMD. Under the permit, Closter Farms discharges into the EAA and STAs through the North New River and Hillsboro Canals with discharge from the agricultural areas going into Lake Okeechobee only as a backup.

WBID 3251 (S-3) includes the S-3 pump station located on the southern end of Lake Okeechobee at Lake Harbor. The S-3 pump station constitutes the beginning of the Miami Canal at the Lake's Rim Canal. Prior to implementation of the IAP, the northern one third of the EAA was routinely back-

pumped directly into Lake Okeechobee through pump stations S-2, S-3, and S-4. Under the current IAP, the S-2 and S-3 basins are routed south to the WCAs. Land cover in the S-3 basin is primarily agriculture.

2. STATEMENT OF WATER QUALITY PROBLEM

Section 303(d) of the Clean Water Act requires states to submit to the Environmental Protection Agency (EPA) lists of waters that are not fully meeting their applicable water quality standards. FDEP has developed such lists, commonly referred to as § 303(d) lists, since 1992. As part of that process, tributaries in the Lake Okeechobee watershed were included on Florida's 1998 § 303(d) list impaired by turbidity and TSS.

3. WATER QUALITY STANDARDS AND TARGET

Water quality criteria established by the State of Florida are described in the Florida Administrative Code (F.A.C.), Section 62-302.530. 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.

3.1 Classification of the Lake Okeechobee Watershed Tributaries

The impaired WBIDs are Class III fresh waters, with a designated use of recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife. The Class III water quality criteria applicable to the impairments addressed by this TMDL are turbidity and TSS.

3.2 Target Identification

The target turbidity concentration used to calculate the TMDLs is equal to the water quality criterion of 29 NTUs plus an estimate of background concentration. Background is assumed to equal the tenth percentile concentration of the measured turbidity samples, or 3 NTU. Percentile concentrations calculated using all available turbidity data in the impaired WBIDs are provided in Appendix A. Using the tenth percentile concentration to represent background conditions is considered conservative, as 10 percent of the time the turbidity levels measured in the streams are less than or equal to this concentration. The turbidity target in these TMDLs equals 32 NTUs (i.e., 29 + 3 = 32 NTU).

The TSS target concentration was determined by developing a correlation between TSS and turbidity using all data collected in the impaired WBIDs. This correlation is shown in Appendix A. A trendline was drawn through the data points and the equation of the line was used to calculate the TSS concentration associated with the target turbidity concentration of 32 NTU. The resulting TSS concentration is equivalent to 33 mg/l. The calculation of the target TSS concentration is provided in Appendix A.

3.3 Water Quality Results

Turbidity and TSS data collected between 1997 and 2006 were used to assess water quality in the impaired waterbodies. Data compiled in Impaired Water Rule (IWR) Run 23 were used in the analysis and is summarized in Table 2.

Table 2. Summary of Turbidity and TSS Data for Impaired WBIDs

WBID	Turbidity (NTU)			TSS (mg/l)		
	Obs	Mean	Max	Obs	Mean	Max
3233	182	29	236			
3238	210	40	361	102	27	153
3244	107	19	200	72	19	363
3247	211	8	95	141	7	75
3248	159	11	54	94	11	101
3251	65	11	41			

Table 3. Summary of Land Cover in Impaired WBIDs

WBID	Residential		Commercial, Industrial, Public		Agriculture		Rangeland		Forest		Water		Wetlands		Barren & Extractive		Transportation & Utilities		Total (acres)
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	
L-8 Canal																			
3233	5251	5.9	7	0.0	14199	16.0	4387	4.9	20143	22.7	5229	5.9	38786	43.7	777	0.9	20	0.0	88799
Everglades Agricultural Area																			
3228	318	0.4	343	0.5	70709	96.1	36	0.0	26	0.0	872	1.2	381	0.5	592	0.8	285	0.4	73561
3248	444	0.7	451	0.7	62306	95.4	168	0.3	4	0.0	476	0.7	454	0.7	439	0.7	593	0.9	65336
3244	699	13.3	122	2.3	4290	81.8	0	0.0	5	0.1	46	0.9	0	0.0	28	0.5	52	1.0	5243
3247	24	0.7	37	1.1	2903	85.0	3	0.1	3	0.1	139	4.1	6	0.2	93	2.7	209	6.1	3415
3251	65	0.1	43	0.1	63148	97.7	39	0.1	43	0.1	397	0.6	335	0.5	513	0.8	56	0.1	64638

4. SOURCE ASSESSMENT

An important part of the TMDL analysis is the identification of 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 non-point sources. Sediment enters surface waters from both point and non-point 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 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 runoff from agricultural fields and residential developments outside of MS4 areas. These sources generally, but not always, involve accumulation of sediments on land surfaces that wash off as a result of storm events.

4.1 Point Sources

A review of NPDES facilities in FDEP's Wastewater Facility Regulation (WAFR) database indicates two minor industrial wastewater point sources are located in the EAA. Okeelanta Power (FL0043737) is located in the West Palm Beach Canal watershed (WBID 3238) and Osceola Power (FL0043745) is located in the North New River Canal watershed (WBID 3248). Both facilities discharge cooling water to percolation ponds and do not discharge to surface waters. These facilities should have negligible impact on instream turbidity and TSS levels.

Municipal Separate Storm Sewer Systems (MS4s) may also discharge pollutants to waterbodies in response to storm events. Large and medium MS4s serving populations greater than 100,000 people are required to obtain a NPDES storm water permit under the Phase I storm water regulations. After March 2003, small MS4s serving urbanized areas are 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. Each permittee is ultimately responsible for the MS4 discharges resulting from their jurisdiction, including TMDLs and WLAs. Palm Beach County (FLS000018) is the only MS4 entity covering the drainage basins of the impaired WBIDs. The cities of Pahokee and South Beach are of sufficient population to be classified as Phase II MS4s and are covered in the Palm Beach County MS4 permit.

All future areas with populations meeting the MS4 requirements will be required to achieve the allocations presented in the TMDL.

4.2 Non-point Sources

Unlike traditional point source effluent loads, non-point source loads are diffuse sources that cannot be identified as entering a waterbody through a discrete conveyance at a single location. These sources generally, but not always, involve accumulation of sediments on land surfaces and wash off as a result of storm events. Based on the land cover in the impaired WBIDs, non-point sources of turbidity and TSS is predominately from sediment originating from agricultural lands (cattle and crops) and transported in stormwater runoff.

4.2.1 Agriculture

Agricultural activities are the principle land uses in the impaired WBIDs and are responsible for discharging turbidity and TSS to the waterbodies through stormwater runoff. Sediments on the land surface are transported to the waterbodies during rain events and adversely affect the clarity of the water. Due to the flat topography of the area, the water moves slowly causing sediments to settle out of the water column and accumulate on the channel beds.

4.2.2 Stormwater Runoff

Stormwater runoff from urban land cover represents a portion of the turbidity and TSS loadings to the impaired streams. Numerous Best Available Technologies (BATs) projects have been initiated in the EAA to reduce sediment loadings in stormwater runoff. Reducing sediments from entering stormwater is essential to achieving the restoration goals of Lake Okeechobee and the Everglades.

5. DEVELOPMENT OF THE TMDL

The approach for calculating the TMDLs depends on the number of water quality samples and the availability of flow data. When long-term records of water quality and flow data are not available, the TMDLs are expressed as concentrations and the percent reduction necessary to achieve water quality standards. Flow data are not available in the impaired WBIDs; therefore, the TMDLs are expressed in terms of concentration and percent reductions necessary to achieve the turbidity and TSS targets of 32 NTUs and 33 mg/l, respectively.

Under the "percent reduction" method, the reduction needed to meet the applicable criterion is calculated based on a percentile of all measured concentrations. The (p X 100) percentile is the value with the cumulative probability of p. For example, the 90^{th} percentile has a cumulative probability of 0.90. The 90^{th} percentile is also called the 10 percent exceedance event because it will be exceeded with the probability of 0.10. Therefore, considering a set of water quality data, 90 percent of the measured values are lower than the 90^{th} percentile concentration and 10 percent are higher.

The 90^{th} percentile concentrations were calculated using the available turbidity and TSS data collected in the WBIDs and assumed to represent existing conditions. These concentrations are shown in Table 4 and are considered conservative, as 90 percent of the time the turbidity and TSS

concentrations measured in the streams are less than or equal to these concentrations. The percent reduction necessary to achieve standards was calculated using the concentrations representing existing and target conditions.

Table 4. Summary of Turbidity and TSS Levels for Existing Conditions

WBID	90% Turbidity Concentration (NTU)	90% TSS Concentration (mg/l)
3233	67	-
3238	94	74
3244	36	29
3247	15	13
3248	26	19
3251	27	-

6. TMDL ALLOCATION

The TMDL process quantifies the amount of pollutant that can be assimilated in a waterbody and attain water quality standards. It identifies the sources of the pollutant, and recommends regulatory or other actions to be taken to achieve compliance with applicable water quality standards. The objective of a TMDL is to allocate loads among all of the known pollutant sources throughout a watershed so that appropriate control measures can be implemented.

6.1 Allocation

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

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

Federal regulations provide that TMDLs can be expressed in terms of mass per time (e.g. pounds per day), toxicity, or other appropriate measure. 40 C.F.R. § 130.2(i). TMDL components for the impaired WBIDs are provided in Table 5. The TMDLs are expressed in terms of turbidity and TSS concentrations and as percent reduction required to achieve the TMDL concentrations. The percent reduction applies to both point and non-point sources, and is calculated using the following

equation:

% Reduction = (existing concentration – TMDL) / (existing concentration) * 100

Table 5. TMDL Components for the Lake Okeechobee Tributaries

WBID	Parameter	TMDL	WLA (stormwater)	LA	Percent Reduction
3233	Turbidity (NTU)	32	-	32	52%
3238	Turbidity (NTU)	32	32	32	66%
	TSS (mg/l)	33	33	33	55%
3244	Turbidity (NTU)	32	32	32	12%
	TSS (mg/l)	33	33	33	0*
3247	Turbidity (NTU)	32	-	32	0*
	TSS (mg/l)	33	-	33	0*
3248	Turbidity (NTU)	32	32	32	0*
	TSS (mg/l)	33	33	33	0*
3251	Turbidity (NTU)	32	-	32	0*

* The percent reductions are calculated by representing existing conditions as the 90th percentile concentration of all data measured in the WBID. While the TMDL for these waterbodies are being expressed as a zero percent reduction, BMPs should be implemented in the watersheds, as the instream concentrations may exceed the TMDL target concentrations during certain storm events.

6.2 Load Allocation

The LA is expressed in terms of concentration and percent reduction necessary to achieve the water quality targets. The LA component includes background sources and pollutants transported to streams during storm events. The LA component does not take into account changes in non-point source loads due to projected changes in land use.

6.3 Wasteload Allocations

The WLA is a combination of the WLAs for all of the NPDES wastewater facilities and the stormwater discharge from MS4 entities. There are no NPDES wastewater facilities discharging to surface waters in the impaired WBIDs. The percent reduction assigned to the WBID applies to both the MS4 and non-point source loads.

6.4 Margin of Safety

An implicit MOS was provided in the TMDL analysis through the conservative selection of the low background concentrations.

6.5 Seasonal Variation

Seasonal variability was addressed in the selection of the target turbidity and TSS concentration by considering data collected during all season.

7. TMDL IMPLEMENTATION

The Clean Water Act [Section 303(d)(2)] directs that a TMDL established by the Environmental Protection Agency be implemented by a State pursuant to subsection 303(e). A State can establish its own procedures for implementation. Federal regulations provide direction on implementation of TMDLs in the permitting process. At a minimum, NPDES permits must include a permit limit consistent with the assumptions of an approved wasteload allocation. However, the State may also establish a compliance schedule to provide time for implementation of effluent limits more stringent than currently permitted.

8. REFERENCES

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SFWMD, 2000. Ecosummary, North New River Canal, West Palm Beach and Broward Counties. FDEP, Southeast District, Assessment and Monitoring Program, June 2000.

SFWMD, 1999a. Ecosummary, L-8 Canal, Palm Beach and Martin Counties. FDEP, Southeast District, Assessment and Monitoring Program, May 1999.

SFWMD, 1999b. Ecosummary, West Palm Beach Canal. FDEP, Southeast District, Assessment and Monitoring Program, July 1999.

SFWMD, 1999c. Ecosummary, SFWMD Pump Station S-3, Palm Beach County. FDEP, Southeast District, Assessment and Monitoring Program, December 1999.

SFWMD, 1999d. Ecosummary, East Beach Water Control District Palm Beach County. FDEP, Southeast District, Assessment and Monitoring Program, December 1999.

SFWMD, 1999e. Ecosummary, Closter Farms, Palm Beach County. FDEP, Southeast District, Assessment and Monitoring Program, December 1999.

USEPA, 1991. Guidance for Water-Quality Based Decisions: the TMDL Process. USEPA, Office of Water, Washington, DC EPA-440/4-91-001. April 1991.

APPENDIX A: Water Quality Plots

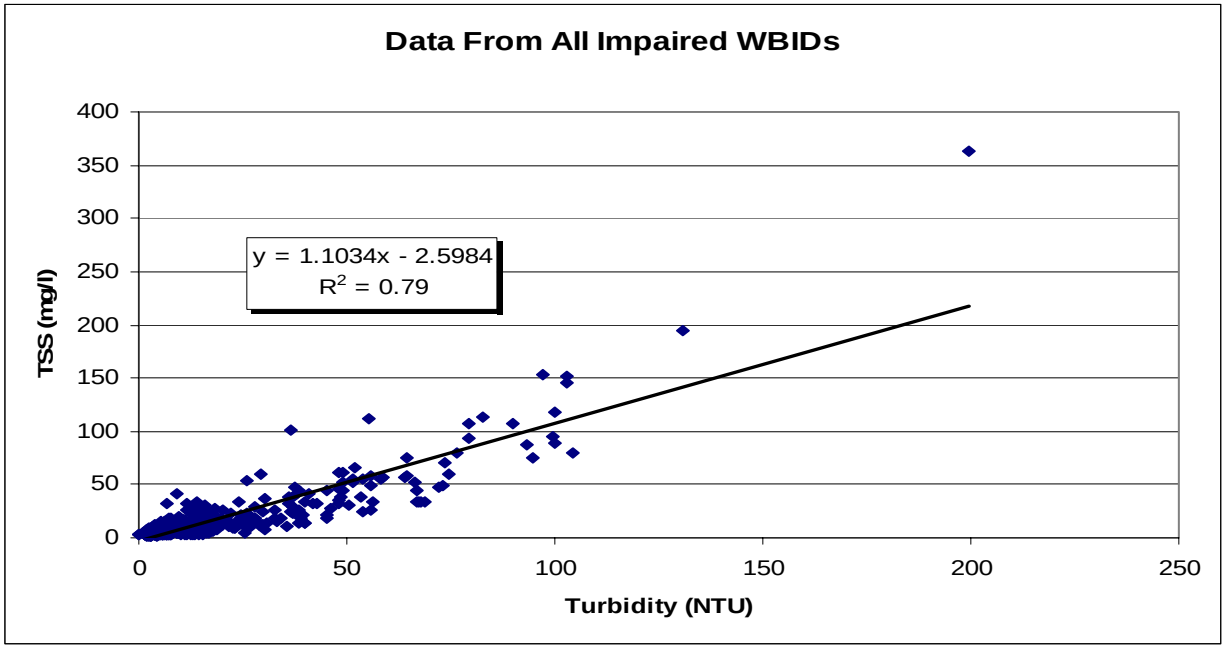

Figure A-1. Correlation Between TSS and Turbidity for the Listed WBIDs

The trendline equation in the above figure is used to calculate the target TSS concentration necessary to achieve the turbidity target of 32 NTU. The target TSS concentration is calculated as follows:

$$Y = 1.1034x - 2.5984$$

Where: Y = TSS concentration (mg/L) and X = turbidity concentration (NTU)

TSS (mg/L) = (1.1034 * 32) – 2.5984 = 33 mg/L

Table A- 1. Percentile Concentrations for Turbidity Using All Data from Impaired WBIDs

Percentile	Concentration (NTU)
10	3.1
20	4.61
30	6.0
40	7.3

Percentile	Concentration (NTU)
50	9.2
60	12.72
70	18
80	30.46
90	48.92

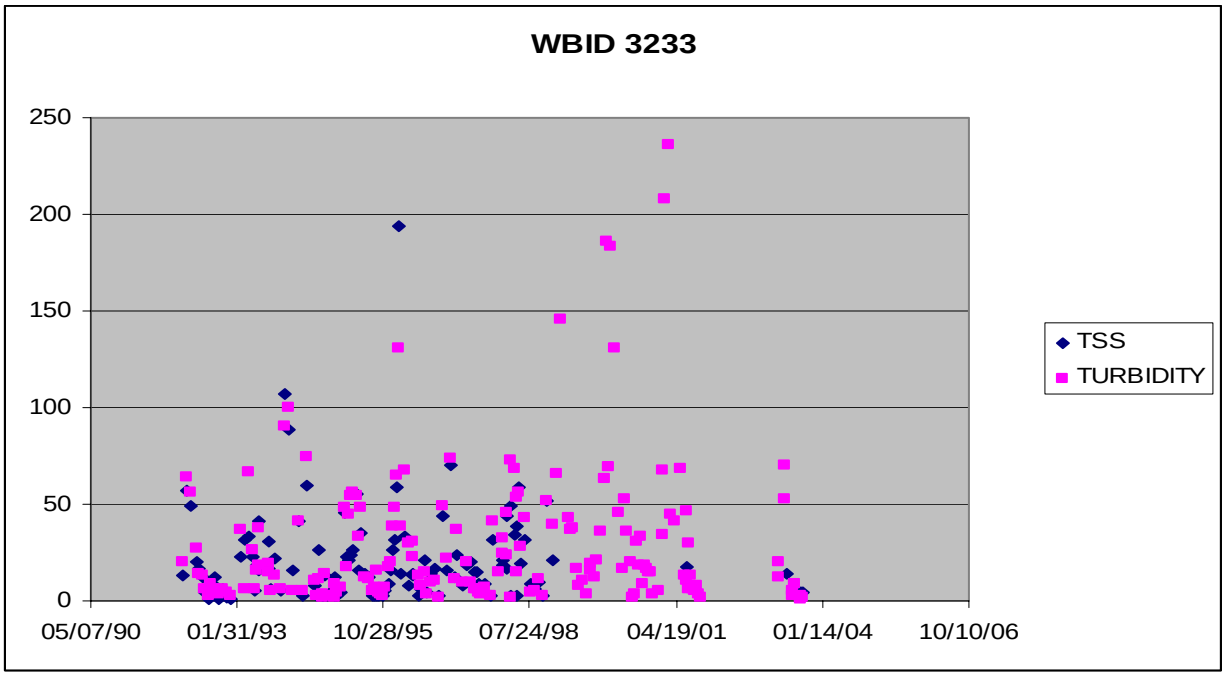

Figure A-2. Turbidity (NTU) and TSS (mg/l) Data for WBID 3233

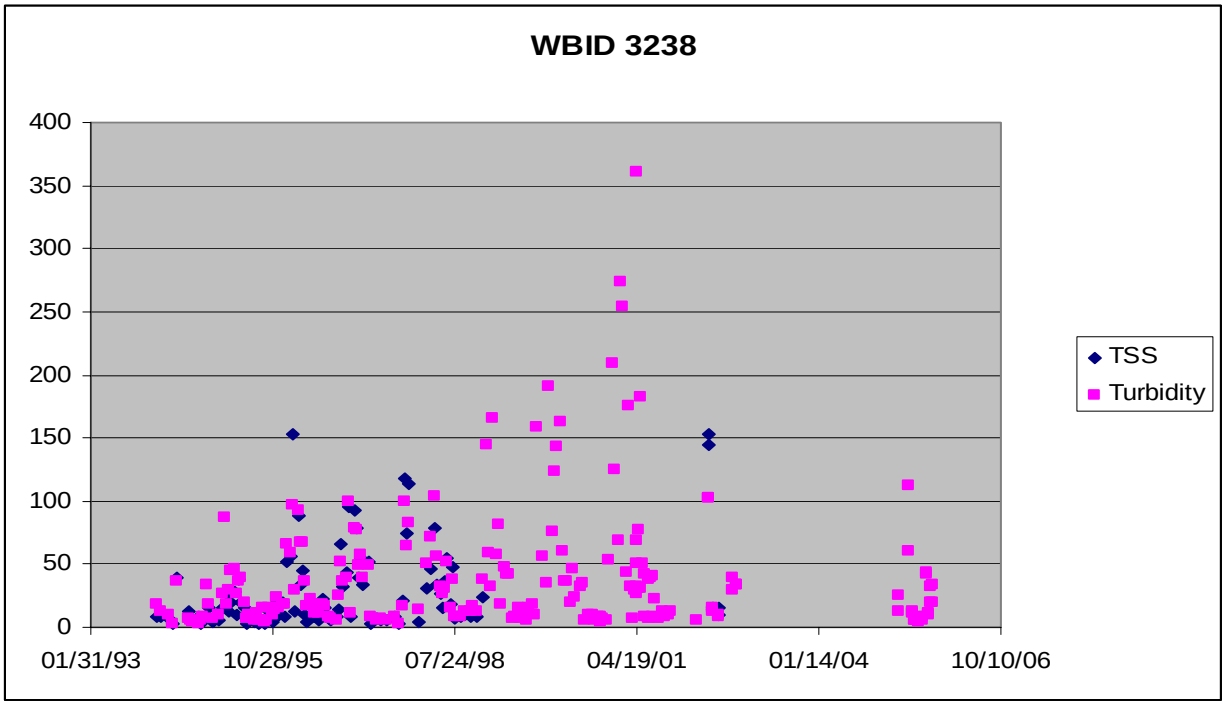

Figure A- 3. Turbidity (NTU) and TSS (mg/l) Data for WBID 3238

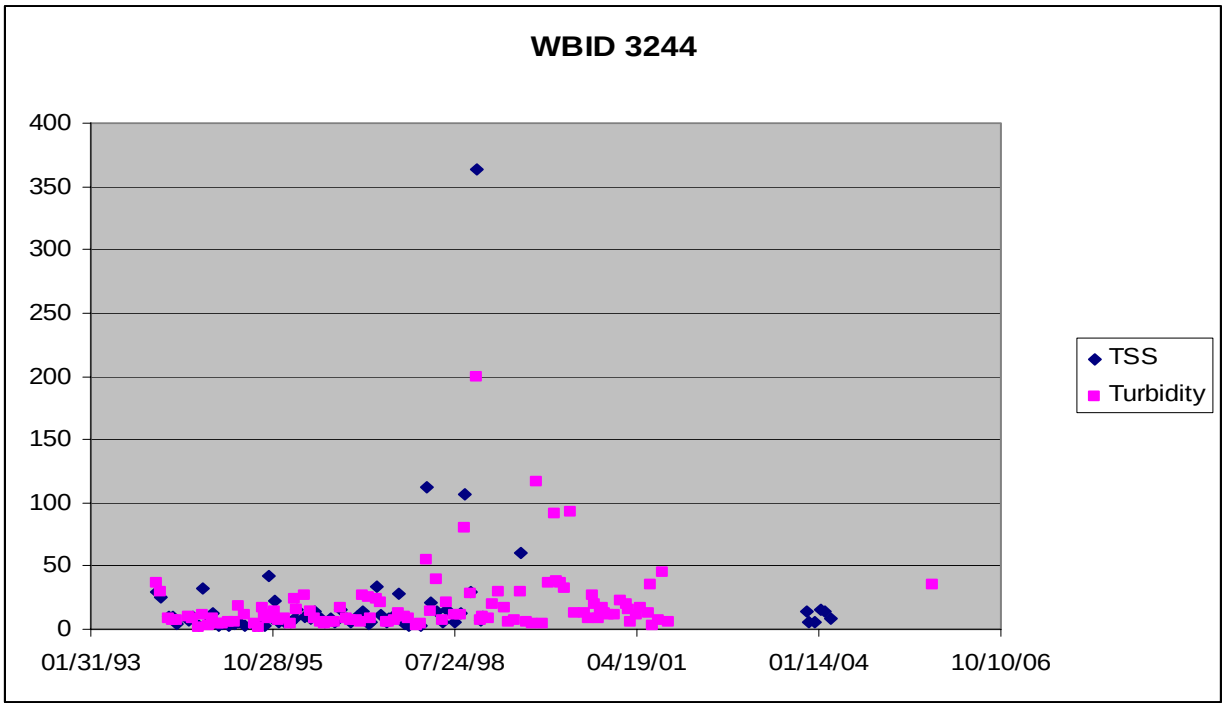

Figure A- 4 Turbidity (NTU) and TSS (mg/l) Data for WBID 3244

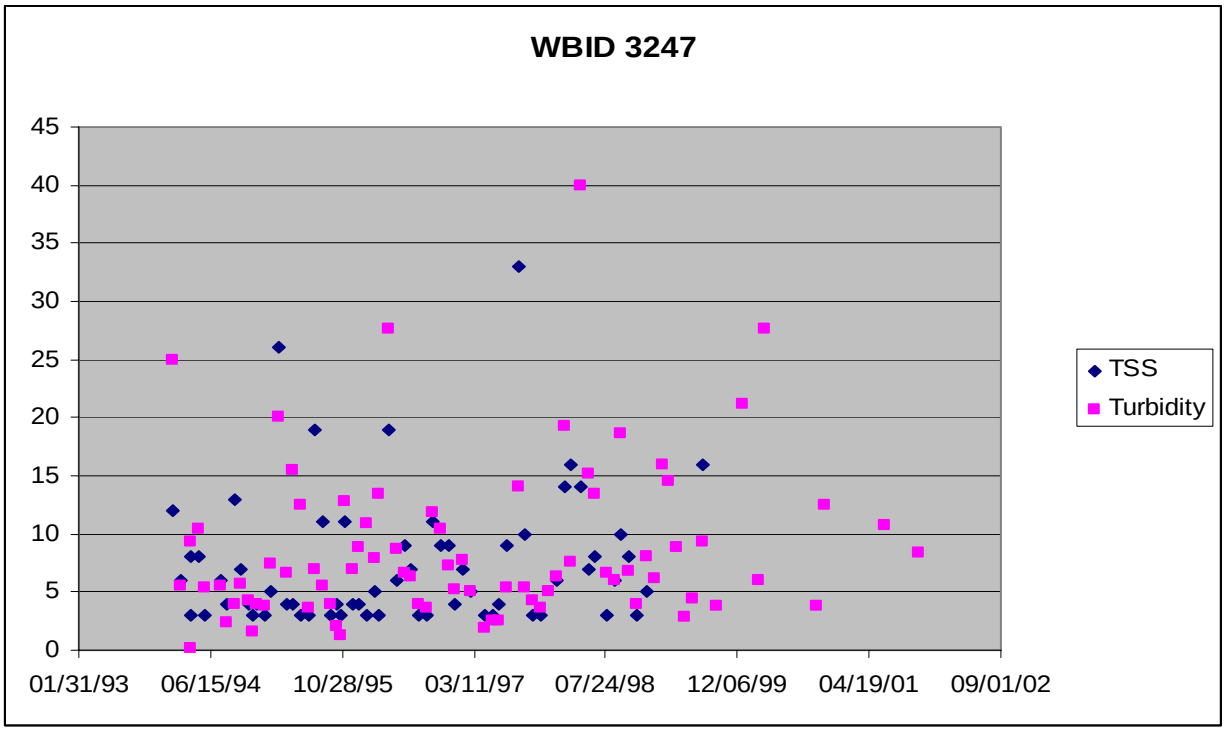

Figure A-5 Turbidity (NTU) and TSS (mg/l) Data for WBID 3247

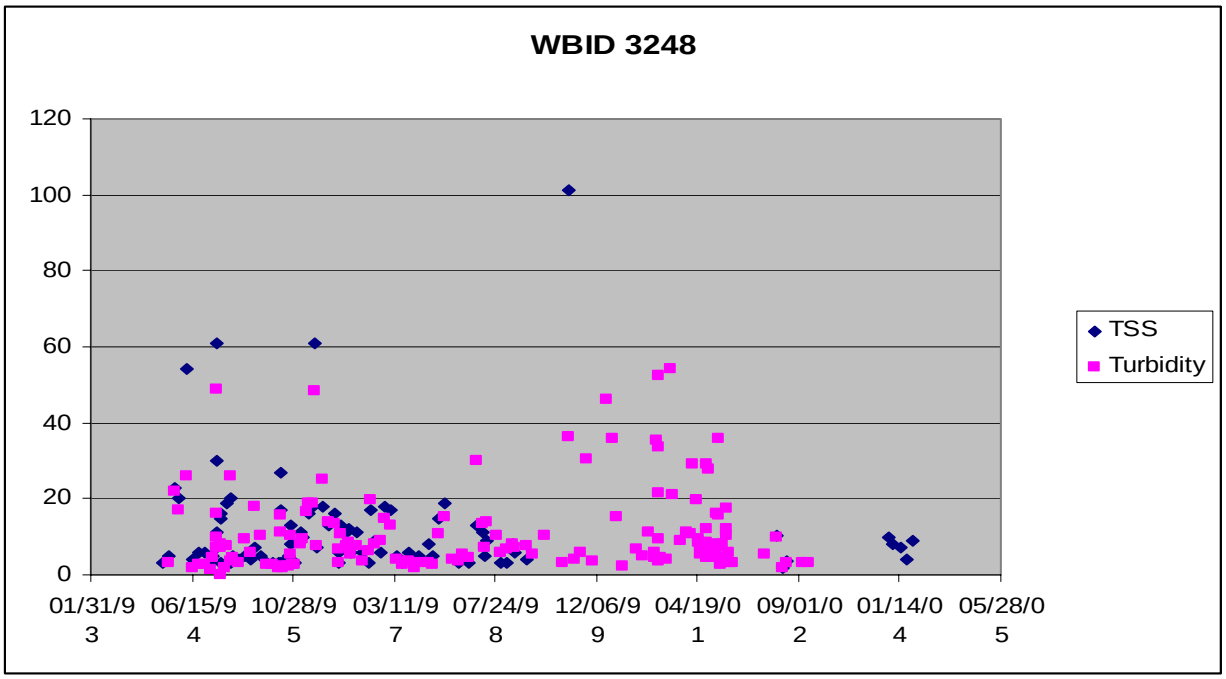

Figure A-6 Turbidity (NTU) and TSS (mg/l) Data for WBID 3248

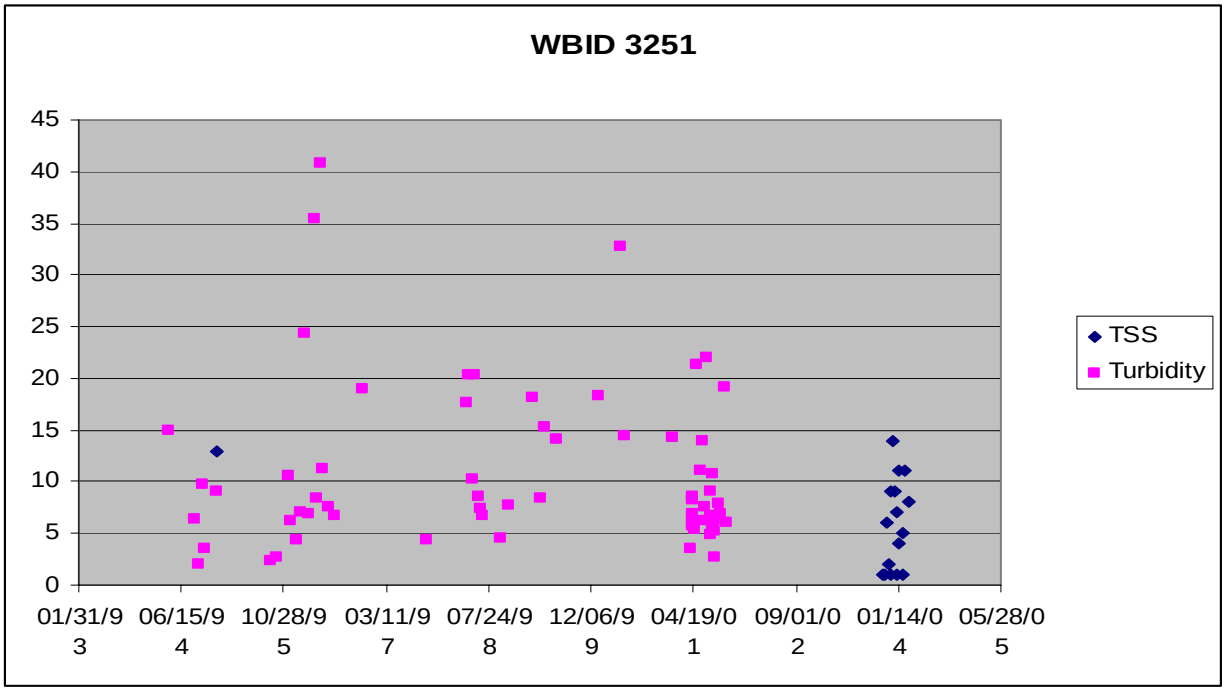

Figure A-6 Turbidity (NTU) and TSS (mg/l) Data for WBID 3251