TMDLS FOR TURBIDITY, SEDIMENT, TSS, CHLORIDE, SULFATE, AND TDS FOR SUBSEGMENTS 100309, 100602, AND 100603 IN THE RED RIVER BASIN, LOUISIANA

REVISED DRAFT
July 5, 2006

TMDLS FOR TURBIDITY, SEDIMENT, TSS, CHLORIDE, SULFATE, AND TDS FOR SUBSEGMENTS 100309, 100602, AND 100603 IN THE RED RIVER BASIN, LOUISIANA

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EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to identify water bodies that are not meeting water quality standards, and to develop total maximum daily pollutant loads for those water bodies. A total maximum daily load (TMDL) is the amount of pollutant that a water body can assimilate without exceeding the established water quality standards for that pollutant. Through a TMDL, pollutant loads can be allocated to point sources and nonpoint sources discharging to the water body. This report presents TMDLs that have been developed for turbidity, total suspended solids (TSS), chloride, sulfate, and total dissolved solids (TDS) for Cross Bayou (subsegment 100309); and turbidity and sediment/siltation for Boggy Bayou (subsegment 100602) and Wallace Lake (subsegment 100603).

All three of these subsegments are located in the Red River basin in northwestern Louisiana. Cross Bayou (subsegment 100309) is located upstream of Cross Lake, west of Shreveport, Louisiana. The watershed for this subsegment is 38 mi^2, and is primarily forested. Boggy Bayou is a tributary to Wallace Lake, located south of Shreveport, Louisiana. The watershed for Boggy Bayou (subsegment 100602) is approximately 79 mi^2, and is also primarily forest land. The Wallace Lake subsegment (100603), located south of Shreveport, Louisiana is a little over half forested, with significant amounts of land in pasture and urban land uses.

These waterbodies were included on the Louisiana Department of Environmental Quality (LDEQ) final 2004 303(d) list as not supporting their fish and wildlife propagation designated use, and, for Cross Bayou, drinking water supply. These waterbodies were ranked as priority #1 for TMDL development. No suspected sources of impairment were identified for these water bodies.

LDEQ historical water quality data at four monitoring locations located in the subsegments were analyzed for long term trends, seasonal patterns, relationships between concentration and stream flow, and relationships between turbidity and TSS. No historical trends, seasonal patterns, nor relationships with flow were apparent in these data.

Because turbidity cannot be expressed as a mass load, the turbidity and sediment/siltation TMDLs were expressed using TSS as a surrogate. Regressions between TSS and turbidity were developed for each of the water quality stations. Target TSS concentrations for each subsegment were calculated using the regression equations and numeric criteria for turbidity in the Louisiana water quality standards.

All nine TMDLs (three turbidity, one TSS, two sediment/siltation, one chloride, one sulfate, and one TDS) were developed using the load duration curve methodology. This method illustrates allowable loading at a wide range of stream flow conditions. The steps for applying this methodology for the TMDLs in this report were:

1. Developing a flow duration curve;
2. Converting the flow duration curve to load duration curves;
3. Plotting observed loads with load duration curves;
4. Calculating the TMDL components; and
5. Calculating percent reductions.

For the turbidity, TSS, and sediment/siltation TMDLs, an implicit margin of safety (MOS) was incorporated through the use of conservative assumptions. The primary conservative assumption was to treat TSS as a conservative parameter that does not settle out of the water column. For the chloride, sulfate, and TDS TMDLs, an explicit MOS was established as 10% of the TMDL. All of the TMDLs had an explicit future growth (FG) that was set equal to 10% of the TMDL.

Because point sources were considered to have negligible effect on existing violations of water quality standards, all of the load reductions were assigned to nonpoint sources. The wasteload allocation (WLA) for point sources, the load allocation (LA) for nonpoint sources and the nonpoint source percent reduction needed for each TMDL are summarized in Tables ES.1 and ES.2. Percent reductions were calculated assuming that all observed data must be reduced below the applicable numeric criterion or target concentration. It should be noted that no reduction is needed for Wallace Lake, which is not surprising because all of the turbidity measurement for Wallace Lake were below the numeric criterion of 25 NTU.

Table ES.1. Summary of six TMDLs for turbidity, TSS, and sediment/siltation.

Subsegment Number	Primary Waterbody	Parameters Causing Impairment	Loads (tons/day of TSS)					Percent Reduction Needed
			WLA	LA	MOS	FG	TMDL	
100309	Cross Bayou	Turbidity, TSS	0	2.07	0	0.23	2.30	89%
100602	Boggy Bayou	Turbidity, Sediment/Siltation	0	4.35	0	0.48	4.83	97%
100603	Wallace Lake	Turbidity, Sediment/Siltation	0	31.33	0	3.48	34.81	0%

Table ES.2. Summary of three TMDLs for chloride, sulfate, and TDS.

Subsegment Number	Primary Waterbody	Parameters Causing Impairment	Loads (tons/day)					Percent Reduction Needed
			WLA	LA	MOS	FG	TMDL	
100309	Cross Bayou	Chloride	0	6.12	0.77	0.77	7.66	71%
100309	Cross Bayou	Sulfate	0	10.28	1.29	1.29	12.86	72%
100309	Cross Bayou	TDS	0	12.27	1.53	1.53	15.33	79%

Hurricane Katrina made landfall on Monday, August 29, 2005 as a category 4 hurricane. The storm brought heavy winds and rain to southeast Louisiana, breaching several levees and flooding up to 80% of New Orleans and large areas of coastal Louisiana. Much of the area that was flooded in Hurricane Katrina was re-flooded by storm surge from Hurricane Rita. Both Hurricanes Katrina and Rita have caused a significant amount of change in sedimentation and water quality in south Louisiana. Many wastewater treatment facilities were temporarily or permanently damaged. Some wastewater treatment facilities will rebuild while others will relocate. The hurricanes expedited the loss of coastal land and modified the hydrology of some of the coastal waterbodies. Several federal and state agencies including United States Environmental Protection Agency (US EPA) and LDEQ are engaged in collecting environmental data and assessing the recovery of the Gulf of Mexico waters. The proposed TMDLs were developed based on the pre-hurricane conditions. Therefore, the post-hurricane conditions and other factors may delay the implementation of the proposed TMDLs or render the proposed TMDLs obsolete or may require modifications of the TMDLs.

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1.0 INTRODUCTION

This report presents total maximum daily loads (TMDLs) for chloride, sulfate, total dissolved solids (TDS), total suspended solids (TSS), and turbidity for one subsegment (100309); and turbidity and sediment/siltation for two other subsegments (100602 and 100603) in the Red River basin in northwestern Louisiana. These subsegments were included on the Louisiana Department of Environmental Quality (LDEQ) final 2004 303(d) list as not supporting their designated uses of fish and wildlife propagation and drinking water supply (LDEQ 2005a). The suspected sources of contamination and causes of impairment from the LDEQ 303(d) list are shown in Table 1.1. The TMDLs in this report were developed in accordance with Section 303(d) of the Federal Clean Water Act and the United States Environmental Protection Agency (US EPA) regulations in 40 CFR 130.7.

The purpose of a TMDL is to determine the pollutant loading that a waterbody can assimilate without exceeding the water quality standard for that pollutant, and to establish the load reduction that is necessary to meet the water quality standards in a waterbody. The TMDL is the sum of the wasteload allocation (WLA), load allocation (LA), and a margin of safety (MOS). The WLA is the load allocated to point sources of the pollutant of concern, and the LA is the load allocated to nonpoint sources, including natural background. The MOS is a percentage of the TMDL that takes into account any lack of knowledge concerning the relationship between pollutant loadings and water quality and the FG is reserved for future growth in loads to the waterbody.

Table 1.1. Subsegments and parameters for impairments addressed in this report.

Subsegment Number	Subsegment Name	Source of Information[1]	Impaired Use[2]	Suspected Causes of Impairment							Suspected Sources of Impairment	TMDL Priority (1 = highest)
				Chloride	Sulfate	TDS	Sediment/Siltation	TSS	Turbidity	Fecal Coliforms		
100309	Cross Bayou	LDEQ 303(d)	FWP, DWS	X	X	X		X	X		Source unknown	1
100602	Boggy Bayou	LDEQ 303(d)	FWP				X		X		Source unknown	1
100603	Wallace Lake	LDEQ 303(d)	FWP				X		X		Source unknown	1

Notes:

1. Source of information is the final 2004 LDEQ 303(d) list.
2. FWP = Fish and Wildlife Propagation, DWS – Drinking Water Supply

2.0 BACKGROUND INFORMATION

2.1 General Information

The study area for this project consists of the watersheds of Cross Bayou (subsegment 100309) Boggy Bayou (subsegment 100602), and Wallace Lake (subsegment 100603) in the Red River basin in Caddo and DeSoto Parishes in northwestern Louisiana (Figure A.1 in Appendix A). Boggy Bayou and Wallace Lake headwaters originate south of Shreveport, Louisiana, close to the Louisiana-Texas state line. Cross Bayou headwaters originate in Texas, just over the Louisiana-Texas state line, west of Shreveport. These subsegments are bounded on the north by Paw Bayou and Cross Lake, on the east by Wallace Bayou and Bayou Pierre, on the south by Toledo Bend Reservoir, Lake Edwards and Smithport Lake; and on the west by the Texas state line. The drainage areas for these subsegments and the United States Geological Survey (USGS) Hydrologic Units within which they are located are shown in Table 2.1.

Table 2.1. Subsegments included in this TMDL study area.

Subsegment	Primary Water Body	Area (mi^2)	HUC
100309	Cross Bayou	38	11140304
100602	Boggy Bayou	79	11140206
100603	Wallace Lake	178	11140206

2.2 Topography

The study area lies in the Gulf Coastal Plains, where 50 to 80% of the area slopes gently toward the sea. Local relief is typically less than 100 ft (30 m) with gentle slopes (Bailey ecoregions on www.nationalatlas.gov).

2.3 Soils

Soil textures for the study area were compiled from the STATSGO database, which is maintained by the United States Department of Agriculture (USDA) Natural Resources

Conservation Service (NRCS). Table 2.2 summarizes soil textures for each of the subsegments in the study area. Soils in the study area are primarily sandy loams.

Table 2.2. Subsegment soil textures.

Soil Texture	100309	100603	100602
Fine sandy loam	55%	51%	54%
Loam	10%	11%	7%
Silt loam	11%	21%	12%
Very fine sandy loam	18%	12%	22%
Other textures	6%	5%	5%
Total	100%	100%	100%

2.4 Land Use

Land use characteristics for the study area were compiled from the USGS 1992 National Land Cover Dataset (USGS 2000). Although these data were based on satellite imagery from the early 1990's, more recent land use data for this area are not available at this time. The spatial distribution of these land uses is shown on Figure A.2 (located in Appendix A) and land use percentages are shown in Table 2.3. These data indicate that approximately 70% of the study area consists of forest.

Table 2.3. Land use percentages for subsegments 100309, 100602, and 100603.

Land Use	Percent Coverage		
	100309	100603	100602
Water	0.8%	2.0%	0.6%
Urban/Transportation	1.5%	11.9%	7.6%
Barren	1.0%	0.5%	0.9%
Forest	70.1%	57.9%	69.3%
Grasslands/Herbaceous	0.0%	0.0%	0.0%
Pasture/Hay	8.6%	12.6%	12.9%
Row Crops	2.6%	3.5%	3.0%
Small Grains	0.0%	0.0%	0.0%
Urban/Recreational Grasses	0.0%	0.9%	0.2%
Wetlands	15.4%	10.7%	5.5%
Total	100.0%	100.0%	100.0%

2.5 Description of Hydrology

Average precipitation for the Caddo Parish, in which most of the study area lies, is about 46 inches per year. The normal yearly precipitation recorded at the Shreveport recording station is 51.30 inches (www.srcc.lsu.edu/southernclimate/atlas/ladescription). Mean monthly total precipitation at Shreveport is shown in Figure 2.1 (www.climate-zone.com/climate/united-states/louisiana/shrevport); these values are highest during winter and spring and lowest during late summer (August-September).

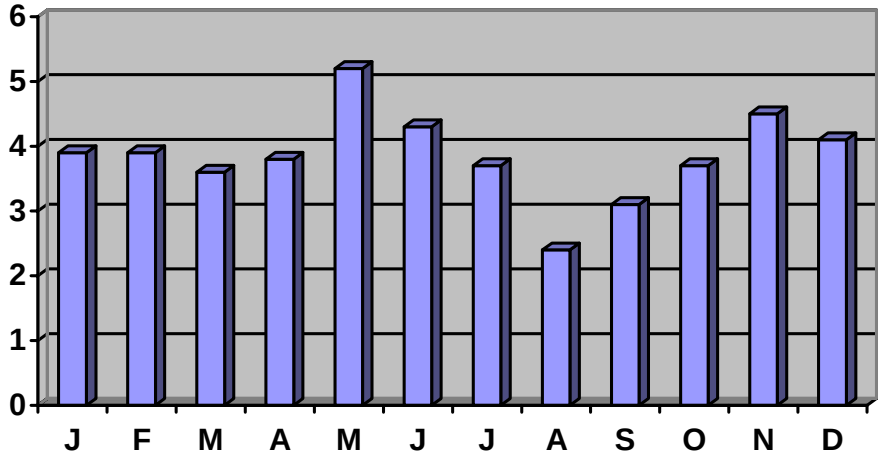

Figure 2.1. Average monthly total precipitation (inches) at Shreveport, Louisiana.

The only currently operating USGS flow gaging station in the study area is located on Cypress Bayou near Keithville (07351500), in subsegment 100603 (Wallace Lake). The location of this gaging station is shown on Figure A.1 (Appendix A). Flows for Cross Creek, Boggy Bayou, and Wallace Lake were estimated from Cypress Bayou flows per unit of watershed area.

2.6 Water Quality Standards

Water quality standards for Louisiana are included in the Title 33 Environmental Regulatory Code (LDEQ 2005b). Designated uses for the Cross Bayou, Boggy Bayou, and Wallace Lake subsegments are primary and secondary contact recreation, fish and wildlife propagation, and agriculture. In addition, Cross Bayou is also designated as a drinking water

supply. The numeric criteria for Cross Bayou for chloride, sulfate, and TDS are 75 mg/L chloride, 25 mg/L sulfate, and 150 mg/L TDS.

The Title 33 Environmental Regulatory Code assigns a turbidity criterion of 25 NTU for freshwater lakes (LDEQ 2005b). The Code does not include turbidity criterion for freshwater creeks and bayous that are not designated as scenic or outstanding natural resource waters. Cross Bayou is a tributary of Cross Lake, and Boggy Bayou is a tributary of Wallace Lake. As a result, both of these lakes are subject to the 25 NTU turbidity criterion. LDEQ assesses the turbidity of subsegments just upstream of lakes using the lake criterion, since a downstream receiving water body could not be expected to meet a lower criterion than the upstream water body that flows into it. Therefore, the value of 25 NTU was used as the turbidity criterion for all of the subsegments.

2.7 Nonpoint Sources

The 2000 Nonpoint Source Pollution Annual Report for Louisiana (LDEQ 2000) discusses the nonpoint source pollution concerns for the river basins in Louisiana. The nonpoint sources identified in this report as threatening Cross Bayou are silvicultural operations, surface runoff, home sewer systems, and petroleum activities (LDEQ 2000). Runoff from urban areas (Shreveport, Louisiana) is a potential nonpoint source of pollutants to Boggy Bayou and Wallace Lake. In addition, recent dredging in Boggy Bayou may contribute to impairment (personal communication T. Hardaway LDEQ Northwest Regional Office, July 2005). Wallace Lake operations (operated strictly as a flood control reservoir, personal communication T. Hardaway LDEQ Northwest Regional Office, July 2005) may also contribute to turbidity; rapid water level fluctuations can suspend sediments, and the fact that the lake is fairly shallow may allow for wind and wave action to keep sediments suspended.

2.8 Point Sources

A list of point source discharges in the study area was generated by LDEQ using the TEMPO and PTS databases. Based on this list, there are 60 permitted point source discharges in the study area. Only one of these facilities is located in subsegment 100309. The facility does not

have permit limits for chloride, sulfate, TDS, or TSS; therefore it was assumed not to have a source of these pollutants and was not included in the TMDLs for subsegment 100309. The remainder of the point source discharges are fairly evenly split between subsegments 100602 and 100603. Approximately 16 of these discharges have permit limits for TSS. Information for the discharges in the study area was obtained by FTN Associates, Ltd. (FTN) from LDEQ's Electronic Document Management System (EDMS), and is included in Appendix B.

2.9 Previous Water Quality Studies

One previous water quality study was found for subsegment 100602; a water quality sampling survey of Brush Bayou in the fall of 1981. However, no report was prepared on the results of this water quality survey. There are no known previous water quality studies of subsegments 100309 or 100603.

3.0 EXISTING WATER QUALITY FOR TURBIDITY AND TSS

3.1 General Description of Data

Turbidity and TSS data have been collected by LDEQ at water quality monitoring stations located in the three subsegments that are impaired for either TSS, turbidity, and/or sediment/siltation within the study area. Locations of these sampling sites are shown on Figure A.1 (located in Appendix A). Tables 3.1 and 3.2 show summaries of these data, including percentages of values above the turbidity criterion of 25 NTU. TSS data are included in this summary because TSS is needed as a surrogate parameter for expressing the sediment/siltation and turbidity TMDLs. Time series plots of data for the entire period of record at each station are show on Figures C.1 through C.4 for turbidity, and Figures C.5 through C.8 for TSS (located in Appendix C). These data were obtained from LDEQ.

Table 3.1. Summary of available turbidity data.

Station	1193	1207	1184	279
Station Description	Cross Bayou at S. Lakeshore Dr., west of Shreveport, Louisiana	Boggy Bayou southwest of Shreveport, Louisiana	Wallace Lake southeast of Shreveport, Louisiana	Brushy Bayou near Shreveport, Louisiana
Subsegment	10039	100602	100603	100603
Period of Record	1/15/02 – 12/10/02, 12/7/04, 10/10/5-9/19/05	1/7/02 – 12/3/02, 1/13/04-11/16/04, 3/22/05-8/23/05	1/7/02 – 12/3/02, 1/13/04-11/16/04	1/8/90-3/12/98
No. of Values	24	35	24	51
Minimum (NTU)	7.5	7.1	2.2	7.6
Maximum (NTU)	112	160	24	416
Median (NTU)	19.5	37	7.6	19
No. Values >25 NTU	8	21	0	20
% Values > 25 NTU	33%	60%	0%	39%

Table 3.2. Summary of available TSS data.

Station	1193	1207	1184	279
Station Description	Cross Bayou at S. Lakeshore Dr., west of Shreveport, LA	Boggy Bayou southwest of Shreveport, LA	Wallace Lake southeast of Shreveport, LA	Brushy Bayou near Shreveport, LA
Subsegment	100309	100602	100603	100603
Period of Record	1/15/02-12/10/02, 12/7/04, 10/10/05-9/19/05	1/7/02 – 12/3/02, 1/13/04-11/16/04, 3/22/05-8/23/05	1/7/02 – 12/3/02, 1/13/04 – 11/16/04	1/8/90 – 5/12/98
No. of Values	24	34	24	51
Minimum (mg/L)	1	9	1	4
Maximum (mg/L)	143	526	47	1,065
Median (mg/L)	12.5	27.3	4.8	25

Note: For values below the detection limit, the value was set equal to 1 mg/L (half the detection limit of 2 mg/L).

3.2 Seasonal Patterns

The data for these four stations appear to follow no seasonal patterns for either turbidity or TSS (Figures C.1 through C.8, Appendix C).

3.3 Relationships for Turbidity and TSS vs. Flow

Plots of turbidity and TSS versus estimated stream flow were also developed to examine any correlation between these water quality parameters and stream flow rates (Figures C.9 through C.16; located in Appendix C). Generally these plots show little or no correlation between turbidity or TSS and stream flow.

3.4 Relationships Between TSS and Turbidity

Plots of TSS versus turbidity for each station (Figures C.17 through C.20) show a noticeable correlation, with higher turbidity levels tending to correspond with higher TSS concentrations. Linear regression was preformed on the natural logarithms of turbidity and TSS; the results of these regressions are summarized in Table 3.3. The regressions were performed using the natural logarithms of the data (rather than the raw data values) because turbidity and TSS usually fit a lognormal distribution better than a normal distribution.

Table 3.3. Results of regressions between TSS and turbidity for each station.

Sampling Station	Regression Equation	Number of Data	R^2	Significance Level (P value)
1193	Turbidity = $4.5417*TSS^{0.5853}$	24	0.61	5.87×10^{-6}
1207	Turbidity = $3.397*TSS^{0.6842}$	34	0.50	2.76×10^{-6}
279	Turbidity = $2.2435*TSS^{0.7035}$	51	0.74	9.37×10^{-16}
1184	Turbidity = $4.3856*TSS^{0.4277}$	24	0.48	1.72×10^{-4}

The strength of the linear relationship is measured by the coefficient of determination (R^2) calculated during the regression analysis (Zar 1996). The R^2 value is the percentage of the total variation in turbidity that is explained or accounted for by the fitted regression (TSS). For example, for station 1193, 61% of the variation in turbidity is accounted for by turbidity and the remaining 39% of variation in turbidity is unexplained. The unexplained portion is attributed to factors other than TSS. The correlations between TSS and turbidity were variable, with R^2 values ranging from 0.48 to 0.74.

The statistical significance for each regression was evaluated by computing the "P value" for the slope for each regression. The P value is essentially the probability that the slope of the regression line is really zero. Thus, a low P value indicates that a non-zero slope calculated from the regression analysis is statistically significant. For these regressions, the P values are all less than 0.01 (Table 3.3), and are considered acceptable.

4.0 EXISTING WATER QUALITY FOR CHLORIDE, TDS, AND SULFATE

4.1 General Description of Data

Within the study area, only one subsegment (100309) was impaired for chloride, TDS, and sulfate. Data for these parameters have been collected by LDEQ at one site in subsegment 100309 (station 1193). The location of this sampling site is shown on Figure A.1 (Appendix A). Table 4.1 shows summaries of these data. Time series plots of data for the entire period are shown on Figure D.1 for chloride, Figure D.2 for TDS, and Figure D.3 for sulfate (located in Appendix D). These data were obtained from LDEQ.

Table 4.1. Summary of chloride, sulfate, and TDS data for station 1193.

Parameter	Chloride	Sulfate	TDS
Period of Record	1/7/02 – 12/3/02, 1/13/04 – 4/7/04	1/7/02 – 12/3/02, 1/13/04 – 4/7/04	1/7/02 – 12/3/02, 1/13/04 – 4/7/04
No. of Values	12	12	12
Minimum (mg/L)	11.8	8.6	111
Maximum (mg/L)	202	70	550
Median (mg/L)	57	33	238
Criterion from standards (mg/L)	75	25	150
No. Values > criterion	5	6	11
% Values > criterion	42%	50%	92%

4.2 Seasonal Patterns

No seasonal patterns are apparent in the chloride, sulfate, or TDS data for Cross Bayou (Figures D.1 through D.3, located in Appendix D).

4.3 Relationships Between Concentration and Flow

Plots of chloride, TDS, and sulfate versus estimated stream flow were also developed to examine any correlation between concentration and flow (Figure D.4 through D.6; located in Appendix D). In all of these plots, a low concentration occurred at the highest flow, so there may be an inverse relationship between flow and concentration. Additional data would be needed to confirm this relationship.

5.0 TMDL DEVELOPMENT

5.1 Seasonality and Critical Conditions

EPA's regulations at 40 CFR 130.7 require the determination of TMDLs to take into account critical conditions for stream flow, loading, and water quality parameters. Also, both Section 303(d) of the Clean Water Act and regulations at 40 CFR 130.7 require TMDLs to consider seasonal variations for meeting water quality standards. Therefore, the historical data and analyses discussed in Sections 3.0 and 4.0 were used to evaluate whether there were certain flow conditions or certain periods of the year that could be used to characterize critical conditions.

For the turbidity and TSS, no significant relationships were found between turbidity nor TSS and estimated stream flow. Seasonal patterns were also not apparent in turbidity or TSS measurements. For chloride, sulfate, and TDS, the lowest concentrations occurred during the one high flow event, with a range of generally higher concentrations at low flows. However, there were not enough data to confirm a relationship with flow. Based on these analyses, the TMDLs in this report were not developed on a seasonal basis. The methodology used to develop these TMDLs (load duration curve) addresses a wide range of flow conditions.

5.2 Water Quality Targets

Turbidity is an expression of the optical properties in a water sample that cause light to be scattered or absorbed and is caused by suspended matter, such as clay, silt, finely divided organic and inorganic matter, soluble colored organic compounds, and plankton and other microscopic organisms (Standard Methods 1999). Turbidity and sediment/siltation cannot be expressed as a load as preferred for TMDLs. To achieve a load based value, turbidity and sediment/siltation are often correlated with a surrogate parameter such as TSS that can be expressed as a load. For the turbidity and sediment/siltation TMDLs, the relationships between turbidity and TSS presented in Section 3.4 were used to develop target TSS concentrations (i.e., numeric endpoints for the TMDLs). The target TSS concentrations calculated from the turbidity criterion of 25 NTU are shown in Table 5.1. Note that the target subsegment 100603 is calculated based on the

relationship for the Wallace Lake water quality station (1184), since Wallace Lake is the primary waterbody in subsegement 100603.

Table 5.1. Target TSS concentrations for subsegments 100309, 100602, and 100603.

Subsegment	Regression Equation	Turbidity Criterion	TSS Target
100309	Turbidity = $4.5417*TSS^{0.5853}$	25 NTU	18 mg/L
100602	Turbidity = $3.397*TSS^{0.6842}$	25 NTU	18 mg/L
100603	Turbidity = $4.3856*TSS^{0.4277}$	25 NTU	58 mg/L*

*This target is calculated based on the relationship for the Wallace Lake Station (1184)

The water quality targets for chloride, sulfate, and TDS were simply the criteria from the standards (Section 2.6). These parameters can easily be expressed as mass, so there was no need to use surrogate parameters.

5.3 Methodology for TMDL Calculations

The methodology used for all of the TMDLs in the report is the load duration curve. Because loading capacity varies as a function of the flow present in the stream, these TMDLs represent a continuum of desired loads over all flow conditions, rather than fixed at a single value. The basic elements of this procedure are documented on the Kansas Department of Health and Environment web site (KDHE 2005). This method was used to illustrate allowable loading at a wide range of flows. The steps for how this methodology was applied for the TMDLs in this report can be summarized as follows:

1. Develop a flow duration curve (Section 5.4).
2. Convert the flow duration curve to load duration curves (Section 5.5).
3. Plot observed loads with load duration curves (Section 5.6).
4. Calculate TMDL, MOS, WLA, and LA (Sections 5.7-5.9).
5. Calculate percent reductions required to meet assessment criteria (Section 5.10).

5.4 Flow Duration Curve

A single flow per unit area duration curve was developed for all of the subsegments. Daily streamflow measurements from Cypress Bayou near Keithville (USGS gage number 07351500) were sorted in increasing order and the percentile ranking of each flow was calculated. The data from the Cypress Bayou gage were used because the load duration methodology requires that the same flow data be used for developing the flow duration as for calculating observed loads from sampling data. The Cypress Bayou gage was the only flow gage in the study area with data during the years that water quality sampling occurred.

5.5 Load Duration Curves

For each TMDL parameter (TSS, chloride, TDS, and sulfates), the flows per unit area from the flow duration curve were multiplied by the appropriate target concentration (from Section 5.2) to calculate an allowable load per unit area duration curve. Each load duration curve is a plot of tons per day per mi^2 of drainage area versus the percent exceedances from the flow duration curve. The load duration curves are presented in the following appendices:

APPENDIX E:	load duration curve for subsegment 100309 for TSS
APPENDIX F:	load duration curve for subsegment 100602 for TSS
APPENDIX G:	load duration curve for subsegment 100603 for TSS
APPENDIX H:	load duration curve for subsegment 100309 for chloride
APPENDIX I:	load duration curve for subsegment 100309 for sulfate
APPENDIX J:	load duration curve for subsegment 100309 for TDS

The calculations for these load duration curves are shown in Tables E.1, F.1, G.1, H.1, I.1, and J.1.

The load duration curve is beneficial when analyzing monitoring data with its corresponding flow information plotted as a load. This allows the monitoring data to be plotted in relation to its place in the flow continuum. Assumptions of the probable source or sources of the impairment can then be made from the plotted data.

The load duration curve shows the calculation of the TMDL at any flow rather than at a single critical flow. The official TMDL number is reported as a single number, but the curve is provided to demonstrate the value of the acceptable load at any flow. This will allow analysis of load cases in the future for different flow regimes.

5.6 Observed Loads

For each sampling station, observed loads were calculated by multiplying each observed concentration of the parameters of interest by the flow per unit area on the sampling day. These observed loads were then plotted versus the percent exceedances of the flow per unit area on the sampling day and placed on the same plot as the load duration curve. These plots are shown in the appendices of this report as follows:

Figure E.1:	plot of loads for TSS for subsegment 100309
Figure F.1:	plot of loads for TSS for subsegment 100602
Figure G.1:	plot of loads for TSS for subsegment 100603
Figure H.1:	plot of loads for chloride for subsegment 100309
Figure I.1:	plot of loads for sulfate for subsegment 100309
Figure J.1:	plot of loads for TDS for subsegment 100309

These plots provide visual comparisons between observed and allowable loads under different flow conditions. Observed loads that are plotted above the load duration curve (identified as “TMDL - FG” curve in the legend for the TSS load duration curves and "TMDL - FG - MOS" curve in the legend for the other load duration curves) represent conditions where observed water quality concentrations exceed the target concentrations. Observed loads below the load duration curve represent conditions where observed water quality concentrations were less than target concentrations (i.e., not violating water quality standards).

5.7 TMDL, MOS, and FG

Each TMDL was calculated as the area under the load duration curve. Because the load duration curves were expressed in mass per unit drainage area, the area under the curve ($lb/day/mi^2$) was multiplied by the subsegment drainage area.

Both Section 303(d) of the Clean Water Act and regulations at 40 CFR 130.7 require TMDLs to include a MOS to account for uncertainty in available data or in the actual effect that controls will have on the loading reductions and receiving water quality. The MOS may be expressed explicitly as unallocated assimilative capacity or implicitly through conservative assumptions used in establishing the TMDL. For the turbidity, TSS, and sediment/siltation TMDLs, an implicit MOS was incorporated through the use of conservative assumptions. The primary conservative assumption was calculating the turbidity, TSS, and sediment/siltation TMDLs assuming that TSS is a conservative parameter and does not settle out of the water column. For the chloride, sulfate, and TDS TMDLs, an explicit MOS was established as 10% of the TMDL .

For all of the TMDLs, 10% of the TMDL was set aside as an explicit FG load (in addition to the MOS).

5.8 Point Source Loads

For the turbidity, TSS, and sediment/siltation TMDLs, the WLAs for the point sources were set to zero because the surrogate being used for turbidity and sediment/siltation (TSS) is considered to represent inorganic suspended solids (i.e., soil and sediment particles from erosion or sediment resuspension). The suspended solids discharged by point sources in subsegments 100602 and 100603 are assumed to consist primarily of organic solids rather than inorganic solids. Discharges of organic suspended solids from point sources are already addressed by LDEQ through their permitting of point sources to maintain water quality standards for DO. The WLAs to support these turbidity, TSS, and sediment/siltation TMDLs will not require any changes to the permits concerning suspended solids.

5.9 Nonpoint Source Loads

For each of the TMDLs in this report, the LA for nonpoint sources was set equal to the TMDL minus the MOS, FG, and the WLA. For the turbidity and sediment/siltation TMDLs, the LA was effectively the TMDL minus FG, because the WLA was zero and the MOS was implicit.

For the chloride, sulfate, and TDS TMDLs, the LA was effectively the TMDL minus the MOS and FG (because the WLA was zero).

Calculations for the TMDLs, MOSs, FGs, and LAs are shown in the appendices of this report as follows:

Table E.2:	calculations for TSS for subsegment 100309
Table F.2:	calculations for TSS for subsegment 100602
Table G.2:	calculation for TSS for subsegment 100603
Table H.2:	calculations for chloride for subsegment 100309
Table I.2:	calculations for sulfate for subsegment 100309
Table J.2:	calculations for TDS for subsegment 100309

5.10 Percent Reductions

In addition to calculating allowable loads, estimates were made for percent reductions of nonpoint source loads that would be needed for all of the observed loads to be on or below the load duration curve. The observed loads at each sampling station were reduced by certain percentages until there were no loads above the load duration curve. The results of the percent reduction calculations are shown in Tables 5.2 through 5.5. Wallace Lake has a zero percent reduction, which is expected since Wallace Lake had no turbidity violations (see Table 3.1). The detailed calculations are in Tables E.2, F.2, G.2, H.2, I.2, and J.2

Table 5.2. Summary of turbidity and sediment/siltation TMDLs.

Subsegment	Stream Name	Loads (tons/day of TSS)					Percent Reduction Needed
		WLA	LA	MOS	FG	TMDL	
100309	Cross Bayou	0	2.07	0	0.23	2.30	89%
100602	Boggy Bayou	0	4.35	0	0.48	4.83	97%
100603	Wallace Lake	0	31.33	0	3.48	34.81	0%

Table 5.3. Chloride TMDL for subsegment 100309.

Subsegment	Stream Name	Loads (tons/day of Chloride)					Percent Reduction Needed
		WLA	LA	MOS	FG	TMDL	
100309	Cross Bayou	0	6.12	0.77	0.77	7.66	71%

Table 5.4. Sulfate TMDL for subsegment 100309.

Subsegment	Stream Name	Loads (tons/day of Sulfate)					Percent Reduction Needed
		WLA	LA	MOS	FG	TMDL	
100309	Cross Bayou	0	10.28	1.29	1.29	12.86	72%

Table 5.5. TDS TMDL for subsegment 100309.

Subsegment	Stream Name	Loads (tons/day of TDS)					Percent Reduction Needed
		WLA	LA	MOS	FG	TMDL	
100309	Cross Bayou	0	12.27	1.53	1.53	15.33	79%

6.0 OTHER RELEVANT INFORMATION

This TMDL has been developed to be consistent with the State antidegradation policy (LAC 33:IX.1109.A).

LDEQ will work with other agencies such as local Soil Conservation Districts to implement nonpoint source best management practices in the watershed through the 319 programs. LDEQ will also continue to monitor the waters to determine whether standards are being attained.

In accordance with Section 106 of the federal Clean Water Act, and under the authority of the Louisiana Environmental Quality Act, the LDEQ has established a comprehensive program for monitoring the quality of the state's surface waters. The LDEQ Surveillance Section collects surface water samples at various locations, utilizing appropriate sampling methods and procedures for ensuring the quality of the data collected. The objectives of the surface water monitoring program are to determine the quality of the State's surface waters, to develop a long-term data base for water quality trend analysis, and to monitor the effectiveness of pollution controls. The data obtained through the surface water monitoring program is used to develop the state's biennial 305(b) report (Water Quality Inventory) and the 303(d) list of impaired waters. This information is also utilized in establishing priorities for the LDEQ nonpoint source program.

The LDEQ has implemented a watershed approach to surface water quality monitoring. Through this approach, the entire state is sampled over a 4-year cycle. Long-term trend monitoring sites at various locations on the larger rivers and Lake Pontchartrain are sampled throughout the 4-year cycle. Sampling is conducted on a monthly basis to yield approximately 12 samples per site each year the site is monitored. Sampling sites are located where they are considered to be representative of the waterbody. Under the current monitoring schedule, approximately one half of the State's waters are newly assessed for each 305(b) and 303(d) listing biennial cycle, with sampling occurring statewide each year. The 4-year cycle follows an initial 5-year rotation that covered all basins in the state according to the TMDL priorities. This will allow the LDEQ to determine whether there has been any improvement in water quality

following implementation of the TMDLs. As the monitoring results are evaluated at the end of each year, waterbodies may be added to or removed from the 303(d) list.

Hurricane Katrina made landfall on Monday, August 29, 2005 as a category 4 hurricane. The storm brought heavy winds and rain to southeast Louisiana, breaching several levees and flooding up to 80% of New Orleans and large areas of coastal Louisiana. Much of the area that was flooded in Hurricane Katrina was re-flooded by storm surge from Hurricane Rita. Both Hurricanes Katrina and Rita have caused a significant amount of change in sedimentation and water quality in south Louisiana. Many wastewater treatment facilities were temporarily or permanently damaged. Some wastewater treatment facilities will rebuild while others will relocate. The hurricanes expedited the loss of coastal land and modified the hydrology of some of the coastal waterbodies. Several federal and state agencies including US EPA and LDEQ are engaged in collecting environmental data and assessing the recovery of the Gulf of Mexico waters. The proposed TMDLs were developed based on the pre-hurricane conditions. Therefore, the post-hurricane conditions and other factors may delay the implementation of the proposed TMDLs or render the proposed TMDLs obsolete or may require modifications of the TMDLs.

7.0 PUBLIC PARTICIPATION

When US EPA establishes a TMDL, federal regulations require US EPA to publicly notice and seek comment concerning the TMDL. These TMDLs were prepared under contract to US EPA. After development of the TMDLs, US EPA will prepare a notice seeking comments, information, and data from the general public and affected public. Any comments, data, or information submitted during the public comment period will be addressed in the final TMDL, which will then be transmitted to LDEQ for implementation and for incorporation into LDEQ's current water quality management plan.

8.0 REFERENCES

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APPENDIX A

Maps

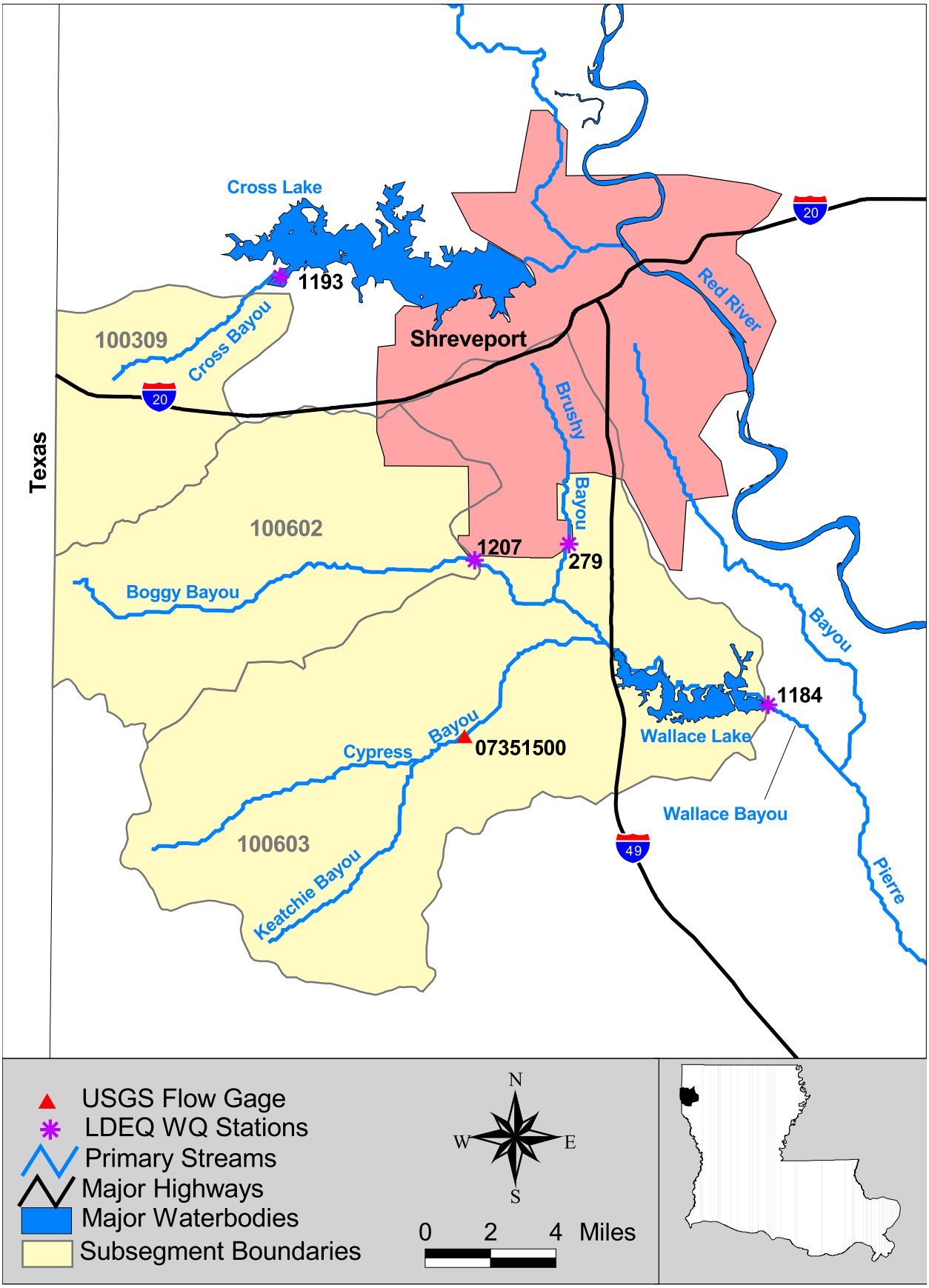


Figure A.1. Watershed map for subsegments 100309, 100602, and 100603.

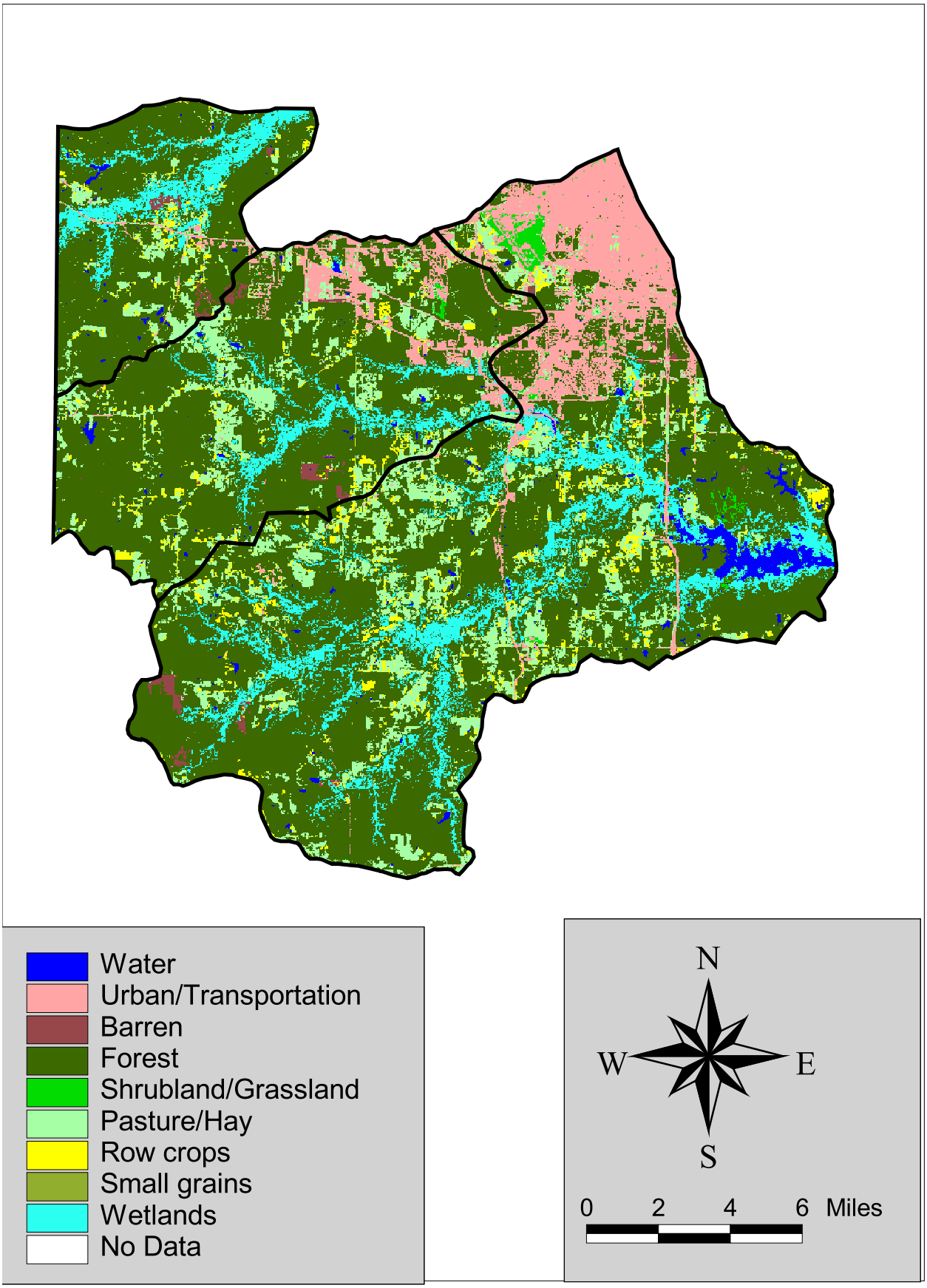


Figure A.2. Land use for subsegments 100309,100602, and 100603.

APPENDIX B

Point Sources Located in Study Area

APPENDIX B

Subsegment	Permit Number	Facility Name	Location	Outfall	Sampled/ Estimated/ Design Flows	Permitted Flows	Flow Units	Receiving Water	Chloride Permit Limits	Sulfate Permit Limits	TDS Permit Limits	TSS Permit Limits	Turbidity Permit Limits	Included in Chloride TMDL?	Included in Sulfate TMDL?	Included in TDS TMDL?	Included in TSS/Turbidity /Sediment TMDL?
100309	LAG480092	Flying J Travel Plaza	Greenwood, 9510 Greenwood Rd	001	2800		gpd	Local drainage to Cross Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LA0005657	Shreveport Battery Plant	Shreveport, 6901 Westport Ave.	001	Intermittent	Report	mgd	Boggy Bayou-Cypress Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LA0005657	Shreveport Battery Plant	Shreveport, 6901 Westport Ave.	002	Intermittent	Report	mgd	Boggy Bayou-Cypress Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LA0005657	Shreveport Battery Plant	Shreveport, 6901 Westport Ave.	004	Intermittent	Report	mgd	Boggy Bayou-Cypress Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LA0007021	Poulan/Weed Eater Division WCI	NA	NA	NA			Red River	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LA0047601	Lalaurie Lane Oxidation Pond	Keithville, Lalaurie Ln.	001	60,000	<100,000	gpd	Boggy Bayou-Cypress Bayou-Wallace Lake	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LA0053694	Shreveport Assembly Plant	Shreveport, 7600 General Motors Blvd.	001	Intermittent 1.200	Report	mgd	Bayou Gilmer	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LA0090565	Jack Cooper Transport Co Inc	Shreveport, 7248 Dinkins Dr.	001	2,600	<5,000	gpd	Gilmer Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LA0092967	Shreveport Regional Airport Fuel Farm	Shreveport Airport					Ditch-Hollywood Ditch	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LA0093611	Greenwood Stp	Greenwood, off E. Starwood Dr.	001 - Sanitary WW	Design flow 0.45	Report		Unnamed Stream-Boggy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LA0099881	Shreveport Facility	Shreveport, 1.1 mile east of Hwy 526 & US 80	001 - Treated equipment, wash WW		Report		Boggy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LA0099881	Shreveport Facility	Shreveport, 1.1 mile east of Hwy 526 & US 80	002 - Treated sanitary WW		5,000	gpd	Boggy Bayou	NA	NA	NA	TSS = 45 mg/L (daily max.)	NA	NA	NA	NA	NA
100602	LA0099881	Shreveport Facility	Shreveport, 1.1 mile east of Hwy 526 & US 80	003 - Stormwater outfall previously permitted in WP4946				Boggy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LA0099953	Shreveport Facility	Shreveport, 6851 Greenwood Rd.	001 - Exterior vehicle and equipment wash WW				Ditch-Boggy Bayou	NA	NA	NA	TSS = 45 mg/L (daily max.)	NA	NA	NA	NA	NA
100602	LA0099953	Shreveport Facility	Shreveport, 6851 Greenwood Rd.	002 -Treated sanitary WW		5,000	gpd	Ditch-Boggy Bayou	NA	NA	NA	TSS = 45 mg/L (weekly avg.)	NA	NA	NA	NA	NA
100602	LA0099953	Shreveport Facility	Shreveport, 6851 Greenwood Rd.	003 - Treated sanitary WW		25,000	gpd	Ditch-Boggy Bayou	NA	NA	NA	TSS = 30-45 mg/L (monthly - weekly avg.)	NA	NA	NA	NA	NA
100602	LA0099953	Shreveport Facility	Shreveport, 6851 Greenwood Rd.	004 - Commingled discharges of treated vehicle wash and sanitary WW		25,000	gpd	Ditch-Boggy Bayou	NA	NA	NA	TSS = 45 mg/L (daily max.)	NA	NA	NA	NA	NA
100602	LA0099953	Shreveport Facility	Shreveport, 6851 Greenwood Rd.	005 - Wastewaters from portable washing operations which are discharged at a centralized location				Ditch-Boggy Bayou	NA	NA	NA	TSS = 45 mg/L (daily max.)	NA	NA	NA	NA	N
100602	LA0103632	Dean Road Tree Trim Debris LFL	Shreveport, Dean Road	001 - Stormwater runoff				Gilmer Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LA0104205	BFI Waste Services LLC	Shreveport, 6896 Industrial Loop	001 - Intermittent discharge of uncontaminated stormwater runoff		Report		Ditch-Gilmer Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LA0104205	BFI Waste Services LLC	Shreveport, 6896 Industrial Loop	002 - Intermittent discharge of uncontaminated stormwater runoff		Report		Ditch-Gilmer Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA

Subsegment	Permit Number	Facility Name	Location	Outfall	Sampled/ Estimated/ Design Flows	Permitted Flows	Flow Units	Receiving Water	Chloride Permit Limits	Sulfate Permit Limits	TDS Permit Limits	TSS Permit Limits	Turbidity Permit Limits	Included in Chloride TMDL?	Included in Sulfate TMDL?	Included in TDS TMDL?	Included in TSS/Turbidity /Sediment TMDL?
100602	LA0104205	BFI Waste Services LLC	Shreveport, 6896 Industrial Loop	003 - Intermittent discharge of uncontaminated stormwater runoff		Report		Ditch-Gilmer Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LA0104205	BFI Waste Services LLC	Shreveport, 6896 Industrial Loop					Ditch-Gilmer Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LA0104205	BFI Waste Services LLC	Shreveport, 6896 Industrial Loop					Ditch-Gilmer Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LA0104205	BFI Waste Services LLC	Shreveport, 6896 Industrial Loop					Ditch-Gilmer Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LA0105694	Industrial Oils Unlimited, AR Inc.	Shreveport, 7268 W 70th St.	001 - Intermittent discharge of stormwater runoff		Report		Gilmer Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LAG110024	Brooks Road Plant (Permanent Plant)	Shreveport, 7007 Brooks Rd.	001 - Processed WW and process area stormwater		Report		Ditch-Drainage Ditch-Boggy Bayou	NA	NA	NA	TSS = 50 mg/L (daily max)	NA	NA	NA	NA	NA
100602	LAG480011	FKA La Clark lift Inc	Shreveport, 6847 Greenwood Rd.	001	1800, 2520	Report	gpd	Gilmer Bayou-Boggy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LAG480011	FKA La Clark lift Inc	Shreveport, 6847 Greenwood Rd.	002	12067	Report	gpd	Gilmer Bayou-Boggy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LAG480284	Jack Cooper Transport Co., Inc	Shreveport, 7248 Dinkins Dr.	001	1100, 2500	Report	gpd	Gilmer Bayou to Boggy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LAG530610	Word Of Life Center	Shreveport, 4425 Meriwether Rd.	001	2100	Report	gpd	Brush Bayou-Boggy Bayou-Wallace Lake	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LAG530693	Fud's III Bar And Lounge	Shreveport, 6148 Bert Kouns Loop	001	675	Report	gpd	Boggy Bayou-Brush Bayou-Wallace Lake-Red River	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LAG531200	Whitt's Barbeque WWTF	Bethany, State Line Rd; on Hwy 79 350 ft east of State Line Rd.	001	3000	Report	gpd	Socagee Creek	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LAG541012	Grawood Baptist Church	Keithville, 5841 Colquitt Rd.	001	6000	Report	gpd , weekly avg	Boggy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LAG560044	Deepwoods Subdivision	Shreveport, Deep Wood Dr. & Long Branch Ln.	001	44,000	<50,000	gpd	Boggy Bayou-Wallace Lake	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LAG560089	Wildwood Estates	Bethany, 9698 US 79	001	30,000	<50,000	gpd	Stream-Lakeland Farm Lake-Boggy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LAG560140	Turkey Creek Village Municipal Treatment Plant	13826 Veterans Memorial, Hwy S19 T2s RLE west of LA 13	001	35,000	<50,000	gpd	Boggy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LAG570220	Eagle Water Inc. Lalaurie Lane Oxidation Pond	Lalaurie Ln.	001	60,000	<100,000	gpd	Boggy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LAG750449	Deep South Equipment	Shreveport, 6851 Greenwood Rd.						NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LAG750459	Norwell Equipment Co.	1.1 mile east of Hwy 526 & US 80						NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LAR05N167	Industrial Oils Unlimited AR Inc.	7268 W 70th St	001 - Intermittent discharge of stormwater		Report		Gilmer Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100602	LAR05N401	General Electric Shreveport Operation	7000 W Bert Kouns Industrial Loop	001 - Treated sanitary WW		Report		Boggy Bayou	NA	NA	NA	TSS = 0.34 - 0.51 kg/day (daily avg. - daily max)	NA	NA	NA	NA	NA
100602	LAR05N401	General Electric Shreveport Operation	7000 W Bert Kouns Industrial Loop	002 - Process WW		Report		Boggy Bayou	NA	NA	NA	TSS = 10.4 - 12.4 kg/day (daily avg. - daily max)	NA	NA	NA	NA	NA
100602	WP1858	Cook'n Cajun Products	Shreveport, Stage Coach Rd.	001 - Smoker parts washer		Report		Roadside Ditch-Boggy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA

Subsegment	Permit Number	Facility Name	Location	Outfall	Sampled/ Estimated/ Design Flows	Permitted Flows	Flow Units	Receiving Water	Chloride Permit Limits	Sulfate Permit Limits	TDS Permit Limits	TSS Permit Limits	Turbidity Permit Limits	Included in Chloride TMDL?	Included in Sulfate TMDL?	Included in TDS TMDL?	Included in TSS/Turbidity /Sediment TMDL?
100602	WP1858	Cook'n Cajun Products	Shreveport, Stage Coach Rd.	002 - Treated sanitary WW	1,000	Report		Roadside Ditch-Boggy Bayou	NA	NA	NA	TSS = 45 mg/L (daily max)	NA	NA	NA	NA	NA
100603	LA0032417	Shreveport Refinery	Shreveport, 3333 Midway St.					Brushy Bayou-Wallace Lake	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LA0063631 LAR05M037	Shreveport Yard	Shreveport, 6215 Jewella Rd.	002	Intermittent		mgd	Brush Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LA0063631 LAR05M037	Shreveport Yard	Shreveport, 6215 Jewella Rd.	003	Intermittent	Report	mgd	Brush Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LA0104060	Forcht Wade Correctional Center	Keithville, 7990 Caddo Dr.	001 - Sanitary WW	Design flow = 0.255	Report	mgd	Ditch-Spring Bridge.-Cypress Bayou-Wallace Lake	NA	NA	NA	TSS = 15-23 mg/L (monthly - weekly avg.)	NA	NA	NA	NA	NA
100603	LAG110004	Li Ready Mix 24 Shreveport; Braswell Industries	Shreveport, 101 Braswell Rd.	001 - Processed WW and process area stormwater from cement and concrete facilities		Report		Brush Bayou	NA	NA	NA	TSS = 50 mg/L (daily max.)	NA	NA	NA	NA	NA
100603	LAG110004	Li Ready Mix 24 Shreveport; Braswell Industries	Shreveport, 101 Braswell Rd.	002 - Washrack and shop floor washdown WW discharges from cement, concrete, and asphalt facilities		Report		Brush Bayou	NA	NA	NA	TSS = 45 mg/L (daily max.)	NA	NA	NA	NA	NA
100603	LAG110004	Li Ready Mix 24 Shreveport; Braswell Industries	Shreveport, 101 Braswell Rd.	003 - Stormwater and aggregate spray from sand & gravel unloading areas and stockpiles of washed sand and gravel		Report		Brush Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG110018	Shreveport Facility	Shreveport, 580 E. Zion Rd.	001 - Processed WW and process area Stormwater		Report		Ditch-Brush Bayou	NA	NA	NA	TSS = 50 mg/L (daily max.)	NA	NA	NA	NA	NA
100603	LAG110018	Shreveport Facility	Shreveport, 580 E. Zion Rd.	002 - Nonprocess area stormwater		Report		Ditch-Brush Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG110021	Boxco	Shreveport, 8650 Box Rd.	001 - Processed WW and process area stormwater		Report		Ditch-Brushy Bayou-Wallace Lake	NA	NA	NA	TSS = 50 mg/L (daily max.)	NA	NA	NA	NA	NA
100603	LAG110022	St. Vincent Plant (Permanent)	Shreveport, St. Vincent Ave & Lynbrook; 8900 St. Vincent Ave.	001 - Process area stormwater runoff		Report		Ditch-Storm Drain-Brush Bayou	NA	NA	NA	TSS = 50 mg/L (daily max.)	NA	NA	NA	NA	NA
100603	LAG110022	St. Vincent Plant (Permanent)	Shreveport, St Vincent Ave & Lynbrook; 8900 St. Vincent Ave.	002 - Stormwater runoff from stockpiles of washed sand and gravel		Report		Ditch-Storm Drain-Brush Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG110111	Madden Contracting Co., Inc. Astec 400 TPH Double Barrel Asphaltic Concrete Plant SN 89-203	Shreveport, 3820 W 70th St.	001	Process WW and process area stormwater runoff rrom concrete operations (25,000 gpd) + 0.43 gpd Max (Old 107)	Report	gpd	Brush Bayou to Red River	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG110111	Madden Contracting Co., Inc. Astec 400 TPH Double Barrel Asphaltic Concrete Plant SN 89-203	Shreveport, 3820 W 70th St.	002	Process area stormwater from asphalt operations + 0.95 gpd max (Old 005) + 0.864 gpd max (Old 007)	Report	gpd	Brush Bayou to Red River	NA	NA	NA	NA	NA	NA	NA	NA	NA

Subsegment	Permit Number	Facility Name	Location	Outfall	Sampled/ Estimated/ Design Flows	Permitted Flows	Flow Units	Receiving Water	Chloride Permit Limits	Sulfate Permit Limits	TDS Permit Limits	TSS Permit Limits	Turbidity Permit Limits	Included in Chloride TMDL?	Included in Sulfate TMDL?	Included in TDS TMDL?	Included in TSS/Turbidity /Sediment TMDL?
100603	LAG110111	Madden Contracting Co., Inc. Astec 400 TPH Double Barrel Asphaltic Concrete Plant SN 89-203	Shreveport, 3820 W 70th St.	003	Stormwater and aggregate spray from unloading areas and stockpiles	Report	gpd	Brush Bayou to Red River	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG110111	Madden Contracting Co., Inc. Astec 400 TPH Double Barrel Asphaltic Concrete Plant SN 89-203	Shreveport, 3820 W 70th St.	004	Nonprocess area stormwater + 2.59 gpd max (Old 001)	Report	gpd	Brush Bayou to Red River	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG110111	Madden Contracting Co., Inc. Astec 400 TPH Double Barrel Asphaltic Concrete Plant SN 89-203	Shreveport, 3820 W 70th St.	005	Treated sanitary WW (5000 gpd permit limit)	Report	gpd	Brush Bayou to Red River	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG110111	Madden Contracting Co., Inc. Astec 400 TPH Double Barrel Asphaltic Concrete Plant SN 89-203	Shreveport, 3820 W 70th St.	006	Washrack and shop floor washdown + 5.18 gpd max (Old 006)	Report	gpd	Brush Bayou to Red River	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG110149	Builders Supply Co., Inc. W 70th Street Plant	Shreveport, 3980 W 70th St.	001	Process WW and process area stormwater runoff from concrete operations	Report	gpd	Brushy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG110149	Builders Supply Co., Inc. W 70th Street Plant	Shreveport, 3980 W 70th St.	002	Process area stormwater from asphalt operations	Report	gpd	Brushy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG110149	Builders Supply Co., Inc. W 70th Street Plant	Shreveport, 3980 W 70th St.	003	Stormwater and aggregate spray from unloading areas and stockpiles	Report	gpd	Brushy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG110149	Builders Supply Co., Inc. W 70th Street Plant	Shreveport, 3980 W 70th St.	004	Nonprocess area stormwater	Report	gpd	Brushy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG110149	Builders Supply Co., Inc. W 70th Street Plant	Shreveport, 3980 W 70th St.	005	Treated sanitary WW	Report	gpd	Brushy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG110149	Builders Supply Co., Inc. W 70th Street Plant	Shreveport, 3980 W 70th St.	006	Washrack and shop floor washdown	Report	gpd	Brushy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG470113	Southpoint Ford/Mercury	Stonewall, 250 Hwy 171	001	390	Report	gpd	Cypress Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG470113	Southpoint Ford/Mercury	Stonewall, 250 Hwy 171	002	390	Report	gpd	Cypress Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG470113	Southpoint Ford/Mercury	Stonewall, 250 Hwy 171	003	390	Report	gpd	Cypress Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG470113	Southpoint Ford/Mercury	Stonewall, 250 Hwy 171	004	390	Report	gpd	Cypress Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG470113	Southpoint Ford/Mercury	Stonewall, 250 Hwy 171	005	390	Report	gpd	Cypress Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG470113	Southpoint Ford/Mercury	Stonewall, 250 Hwy 171	006	390	Report	gpd	Cypress Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG480365	Central Oil & Supply Corp. Harde Mart #221	Shreveport, 404 Bert Kouns	001	500 gpd washwater, 1000 gpd wastewater	Report	gpd	Ditch to Brush Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG530088	Bobby Dyson Mobile Home Park, Oxidation Pond A	Stonewall, Stanley Rd, 1.25 miles east of Hwy 171	001	4500	Report	gpd, max	Cypress Bayou to Wallace Lake	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG530337	Ideaworks, LLC	Shreveport, 103 thru 115 Brewster St.	001	720	Report	gpd avg. (test)	Unnamed Tributary of Boggy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG530482	Huntington Industrial Park	Shreveport, 5905 Financial Plaza	001	150	Report	gpd avg. (test)	Brushy Bayou-Boggy Bayou-Wallace Lake	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG530577	NOAA Weather Forecast Office	Shreveport, on Buncombe Rd.	001	460	Report	gpd avg. estimated	Stream-Brushy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA

Subsegment	Permit Number	Facility Name	Location	Outfall	Sampled/ Estimated/ Design Flows	Permitted Flows	Flow Units	Receiving Water	Chloride Permit Limits	Sulfate Permit Limits	TDS Permit Limits	TSS Permit Limits	Turbidity Permit Limits	Included in Chloride TMDL?	Included in Sulfate TMDL?	Included in TDS TMDL?	Included in TSS/Turbidity /Sediment TMDL?
100603	LAG530864	Bailsco Blades And Castings	Shreveport, 9500 Paxton Rd.	001	800	Report	gpd avg. estimated	Brushy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG531687	Rustic Cowboy Inc	12780 Mansfield Rd.	001	4000	Report	gpd treatment plant	Local Drainage to Cypress Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG540022	C&H Mobile Home Park	Keithville, 12575 Mansfield Rd. (Hwy 171)	001	1800	Report	gpd avg. (test)	Cypress Bayou-Wallace Lake	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG540055	TRA DOR Mgt Inc/Spring Forest Apts.	Spring Ridge, 6759 Colquitt Rd.	001	2400, 11000	Report	gpd avg. (test), gpd max., estimated	Buchanan Bayou-Wallace Lake	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG540164	Autumn Acres Mobile Home Park	Keithville, 949 Barron Rd; 5925 LA Hwy 3112	001	25,000	Report	gpd permit limit	Cypress Bayou-Wallace Lake	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG540790	Wildoak Subdivision	Shreveport, Ellerbe Rd. S-Overton Brks Rd. Wildoak Dr.	001	16,000	Report	gpd avg. estimated	Creek-Wallace Lake	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG541102	Triple JJJ Travel Center	8311 Springridge Rd	001	8,100	Report	gpd	Johnson Branch	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG541234	Stonewall Retirement Apartments STP	899 Hwy 171 S	001	12,000	<25,000	gpd	Cypress Bayou-Wallace Lake	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG541274	Chimp Haven Inc	13600 Chimpanzee Plaza	001	7,500	<25,000	gpd	Spring Branch	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG560159	Bella Vista Mobile Home Park	Keithville, 2651 Barron Rd.	001	40,000	<25,000	gpd	Ditch-Boggy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG750137	Factory Carwash #222	Shreveport, 404 Bert Kouns	001	1,640	<50,000	gpd	Brush Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG750184	South Point Ford Mercury Mansfield Motors, Inc.	Stonewall, 265 Hwy 171	001	Variable	<5,000	gpd	Cypress Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG750184	South Point Ford Mercury Mansfield Motors, Inc.	Stonewall, 265 Hwy 171	002	1,400	Report	gpd	Cypress Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG750184	South Point Ford Mercury Mansfield Motors, Inc.	Stonewall, 265 Hwy 171	004	Variable	<5,000	gpd	Cypress Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG750522	Village At Westlake Apartment Homes Village At Westlake LLC - Construction	5610 Buncombe Rd	001 - Exterior vehicle and equipment wash WW		<25,000		Wallace Lake	NA	NA	NA	TSS = 45 mg/L (daily max.)	NA	NA	NA	NA	NA
100603	LAG830030	Interstate Station #79	6911 Linwood (at 70th St.)	001 - Groundwater recovery and treatment system	12	Report	gpm	Wallace Lake	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG830100	Triple JJJ Travel Center #5	Shreveport, 8965 Mansfield Rd.	001 - Groundwater recovery and treatment system	7,200	Report	gpd	Brushy Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA
100603	LAG830201	Nolen's Automotive	8801 Kingston Rd.	001 - Groundwater recovery and treatment system		Report		Brush Bayou	NA	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX C

Plots of Turbidity and TSS

Figure C.1 Turbidity for Cross Bayou at South Lakeshore Drive, west of Shreveport, LA (1193)

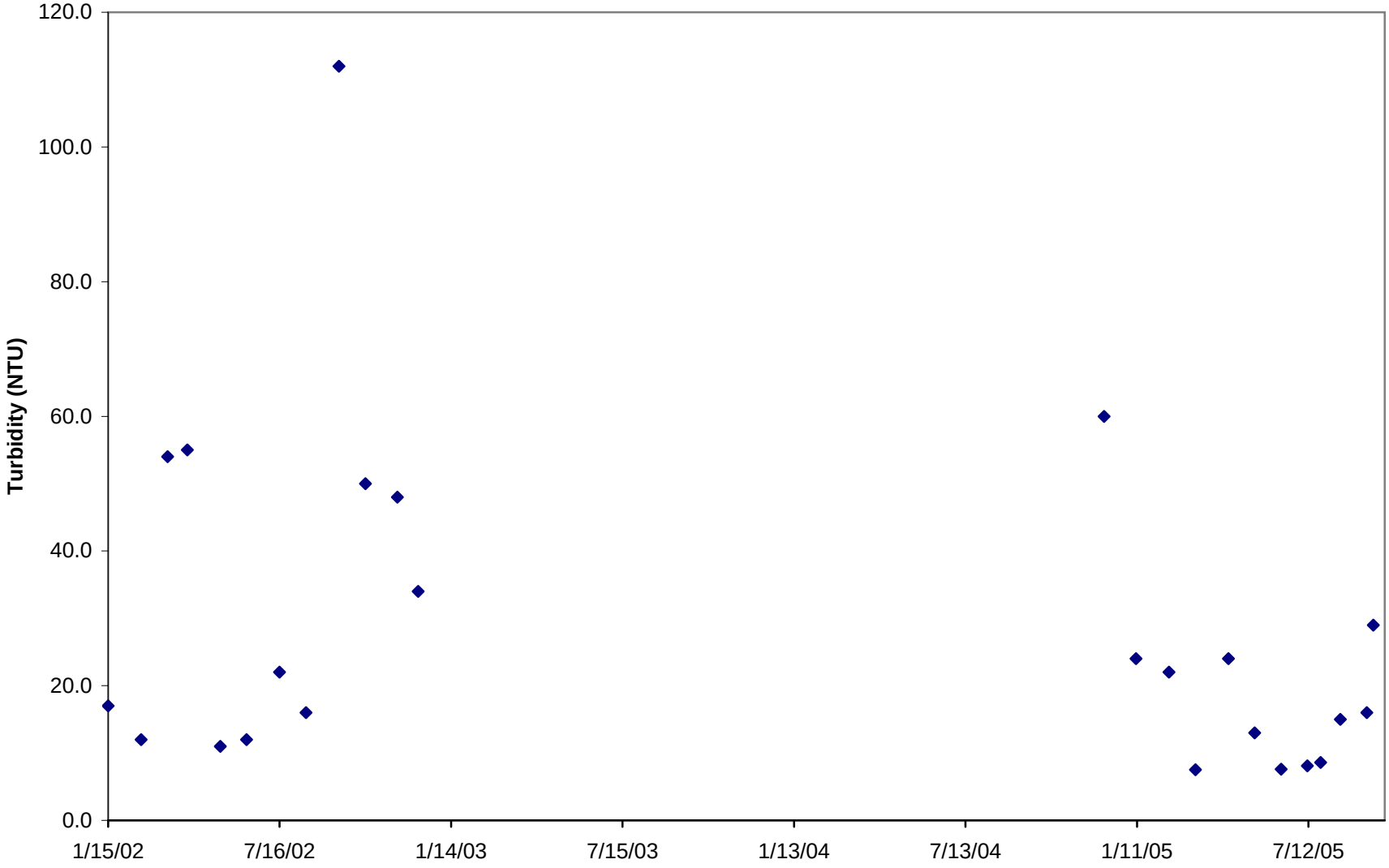


Figure C.2 Turbidity for Boggy Bayou southwest of Sherevport, LA (1207)

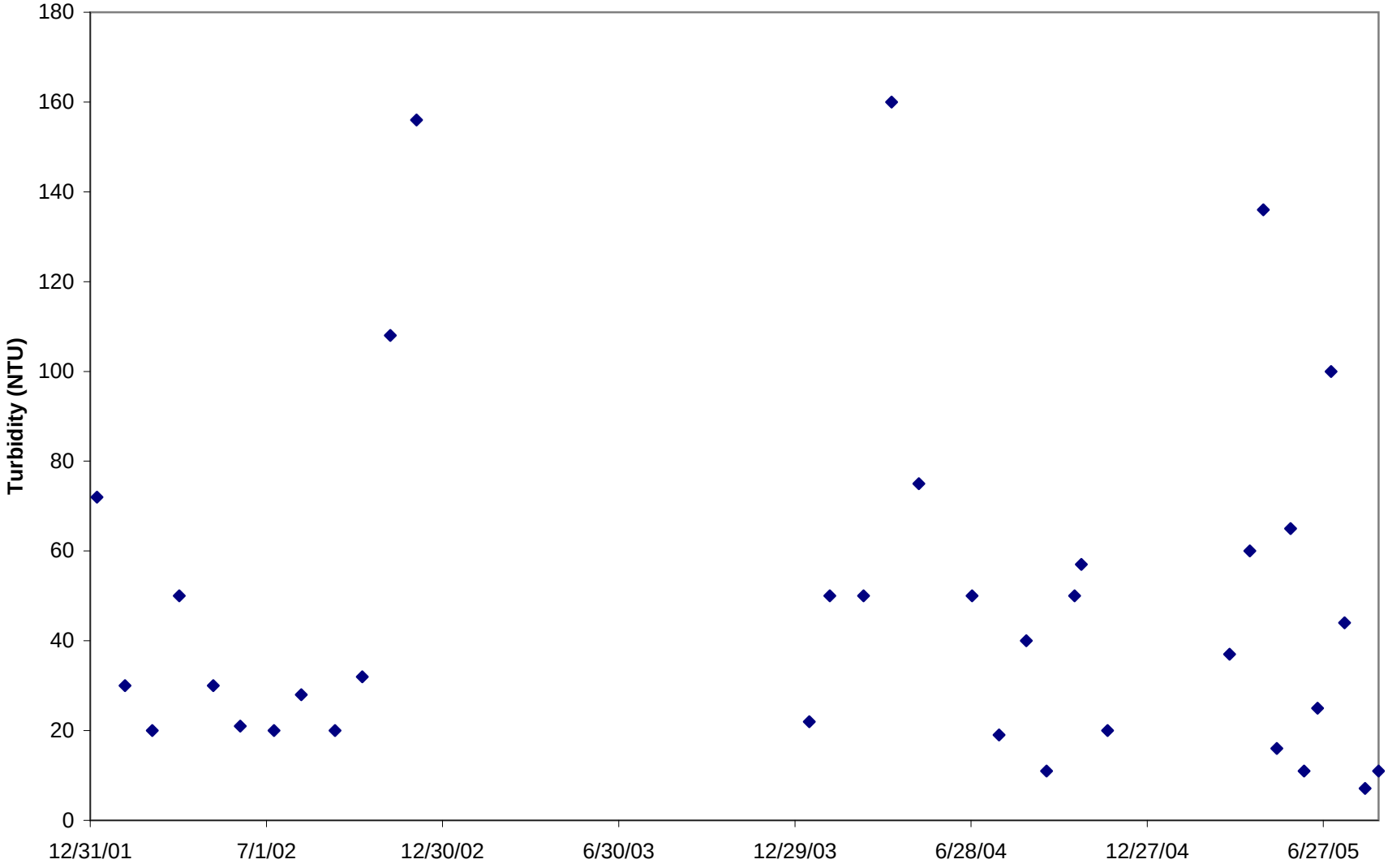


Figure C.3 Turbidity for Wallace Lake southeast of Shreveport, LA (1184)

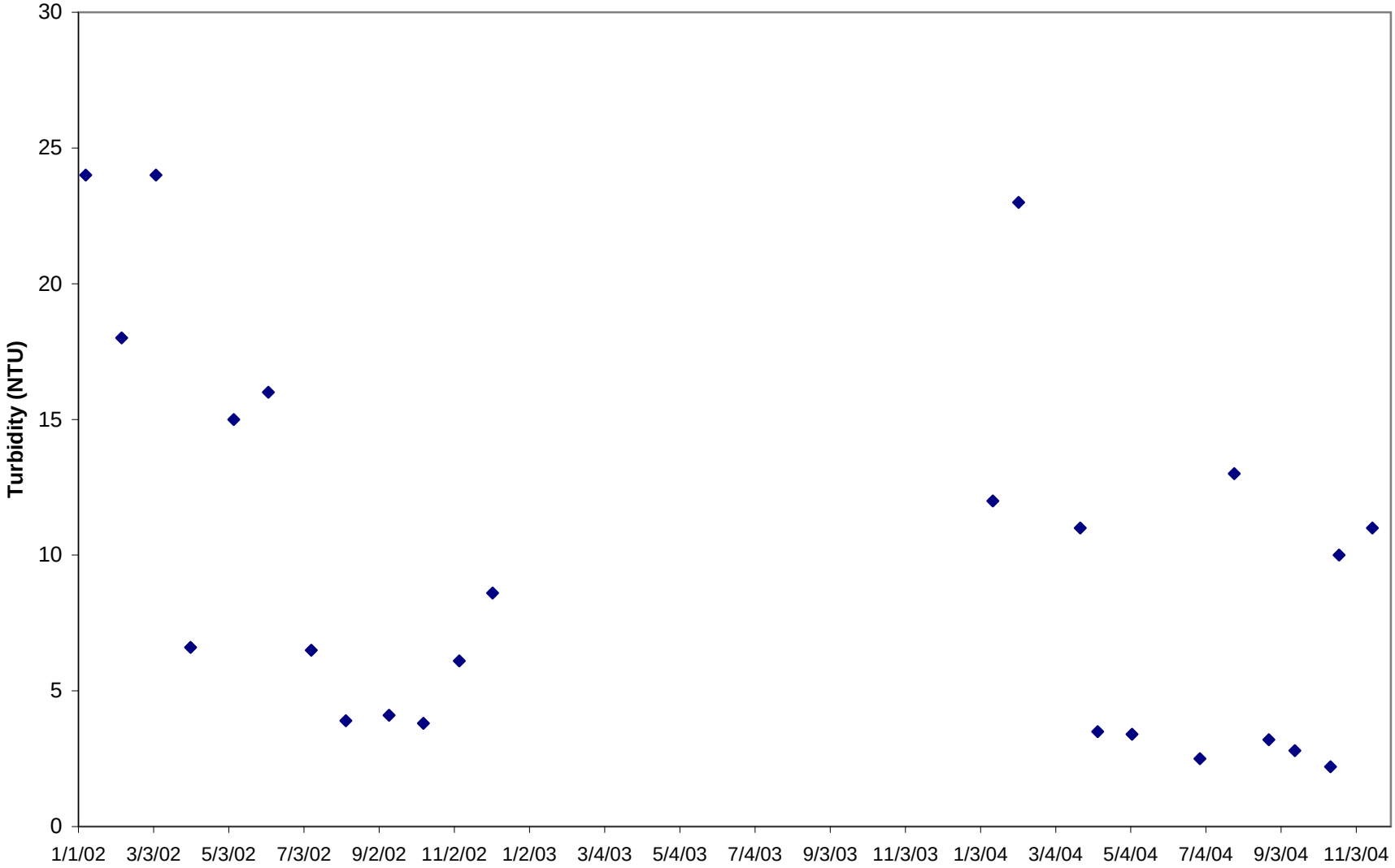


Figure C.4 Turbidity for Brushy Bayou near Shreveport, LA (0279)

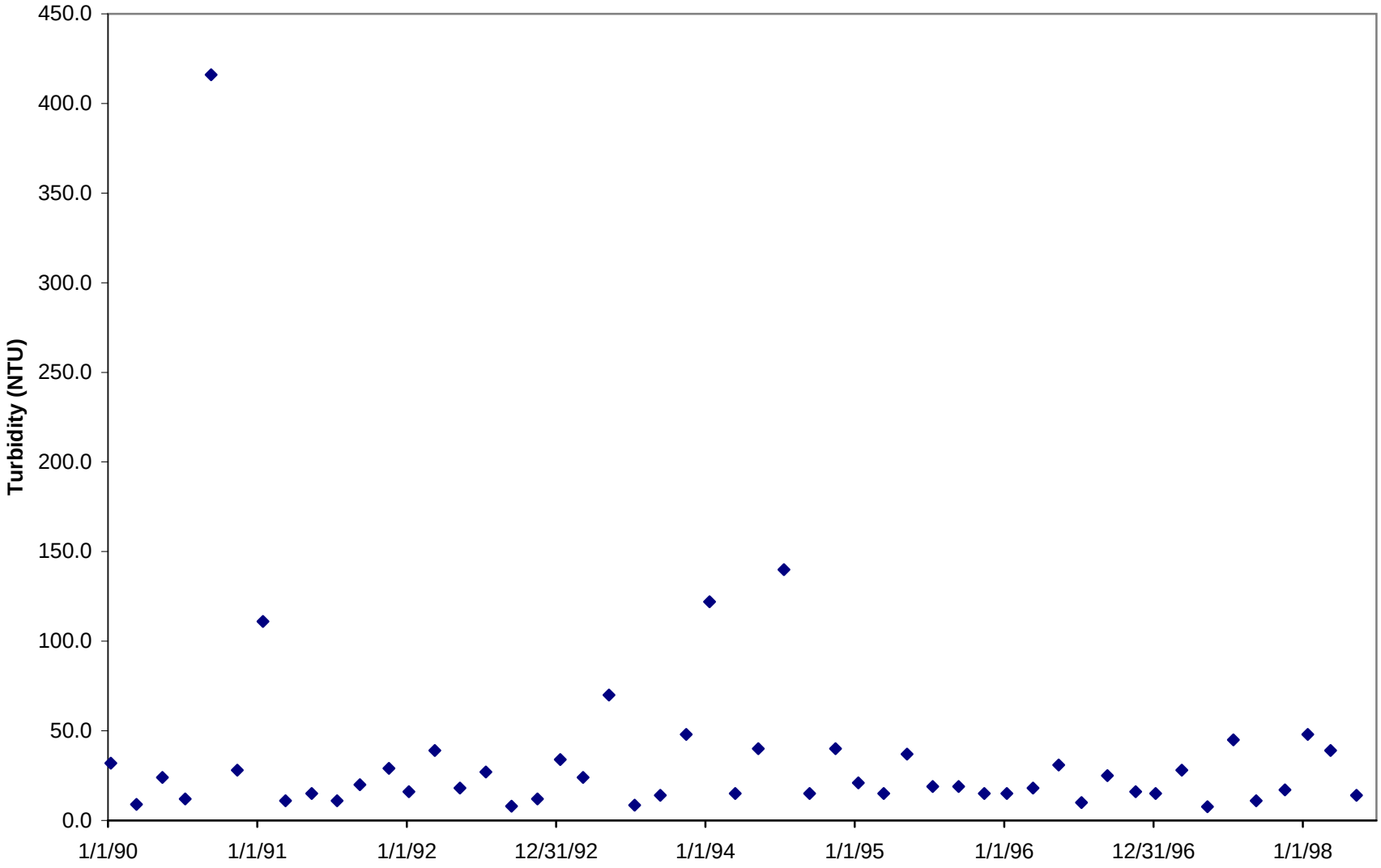


Figure C.5 TSS for Cross Bayou at South Lakeshore Drive, west of Shreveport, LA (1193)

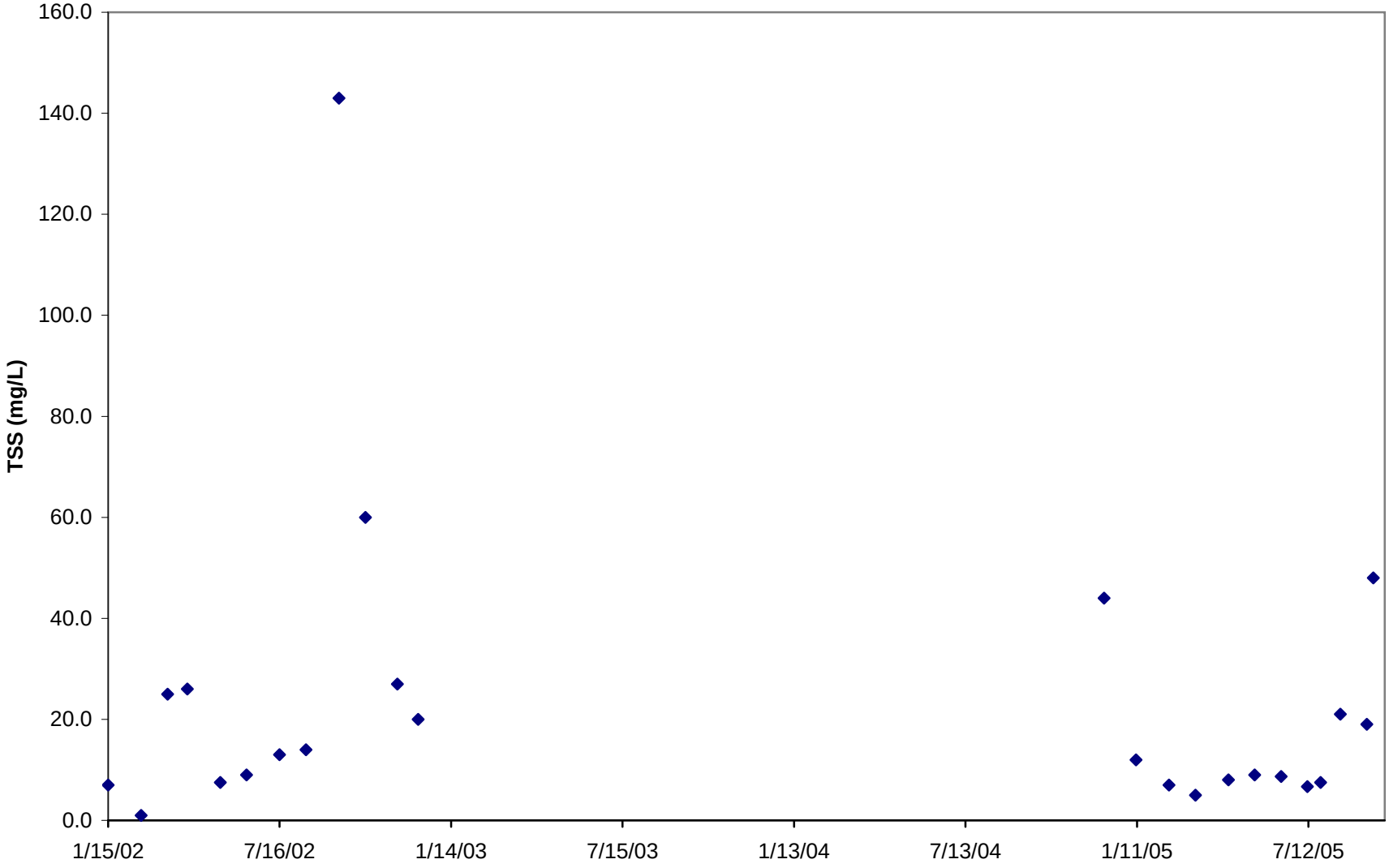


Figure C.6 TSS for Boggy Bayou southwest of Shreveport, LA (1207)

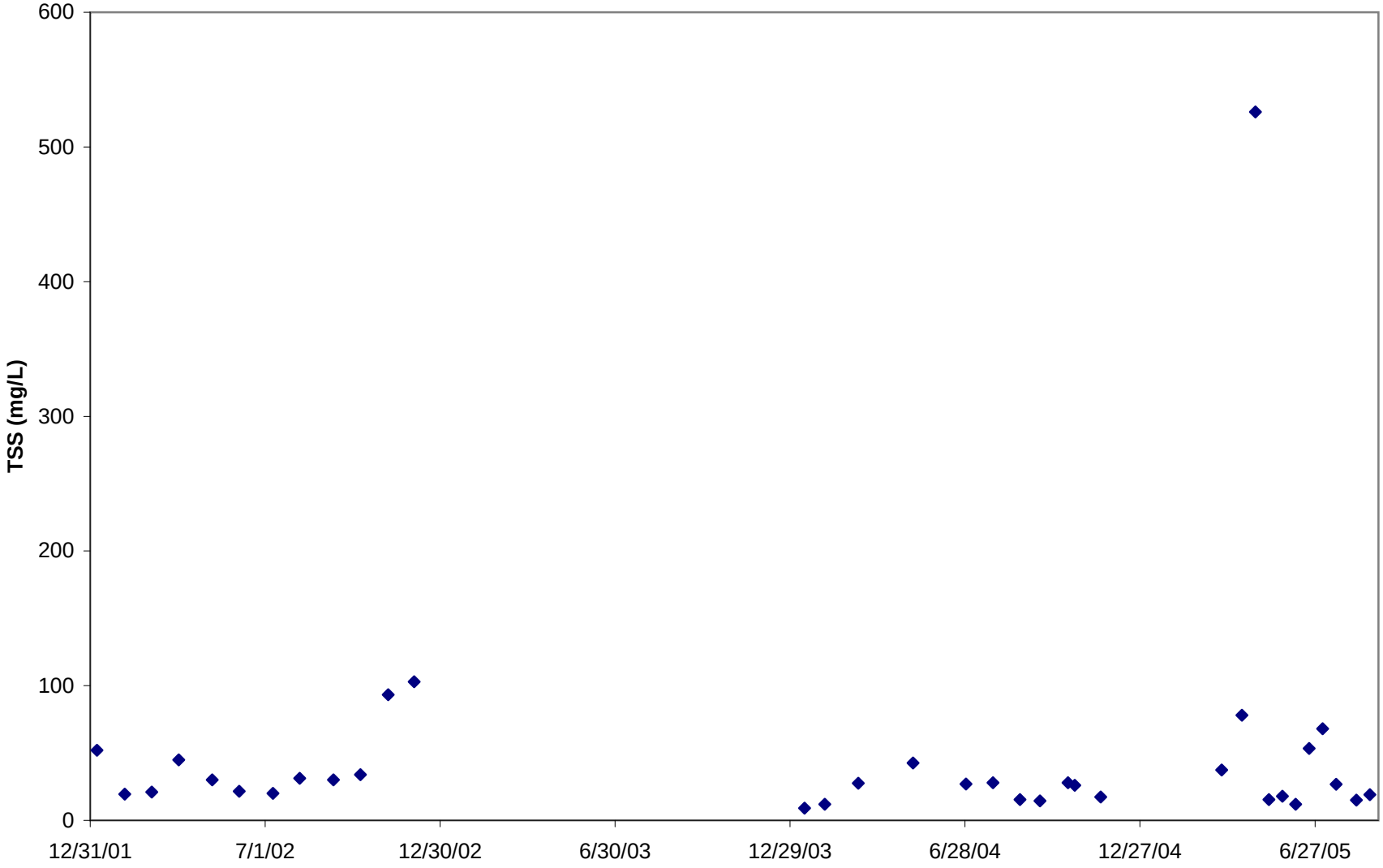


Figure C.7 TSS for Wallace Lake southeast of Shreveport, LA (1184)

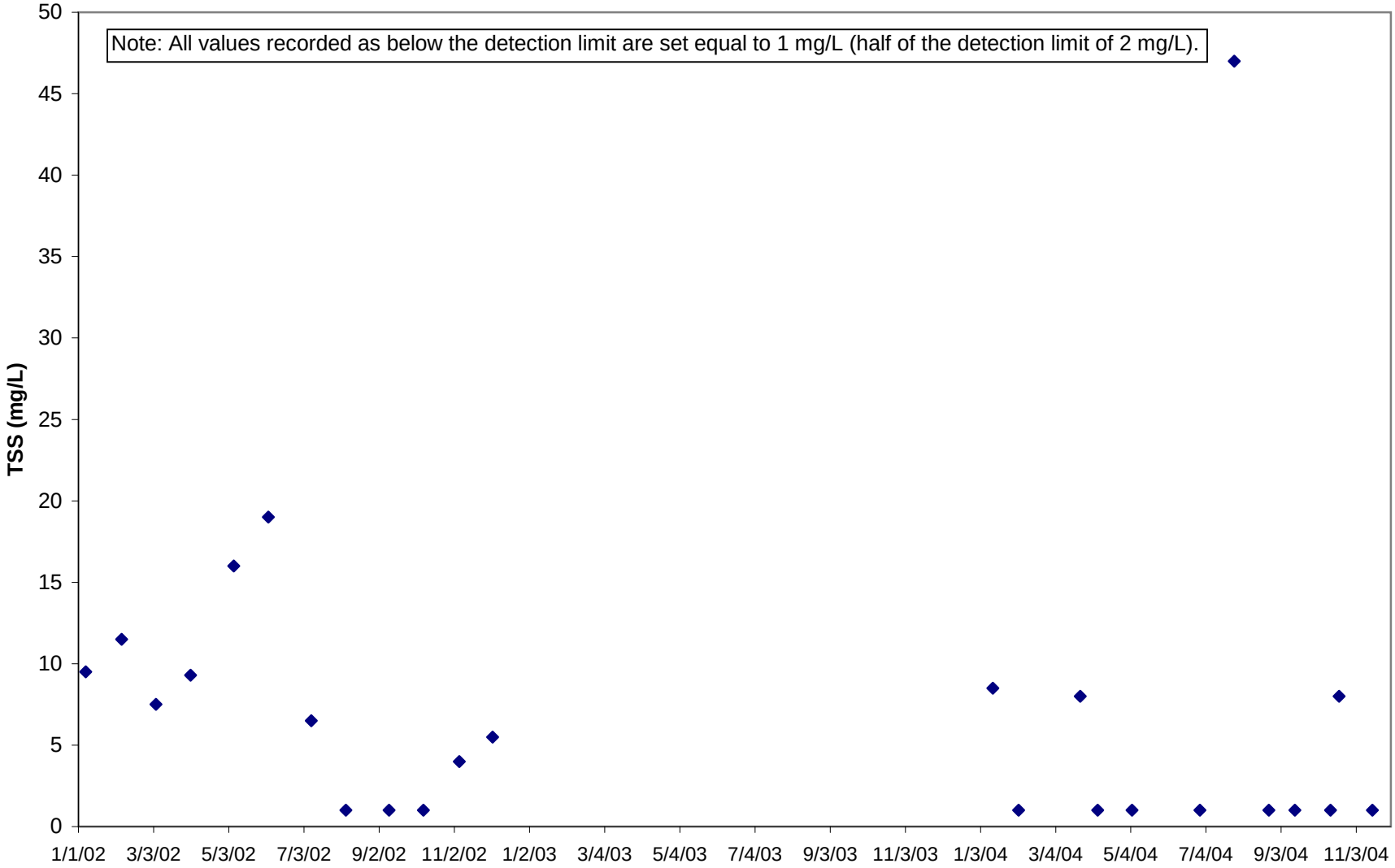


Figure C.8 TSS for Brushy Bayou near Shreveport, LA (0279)

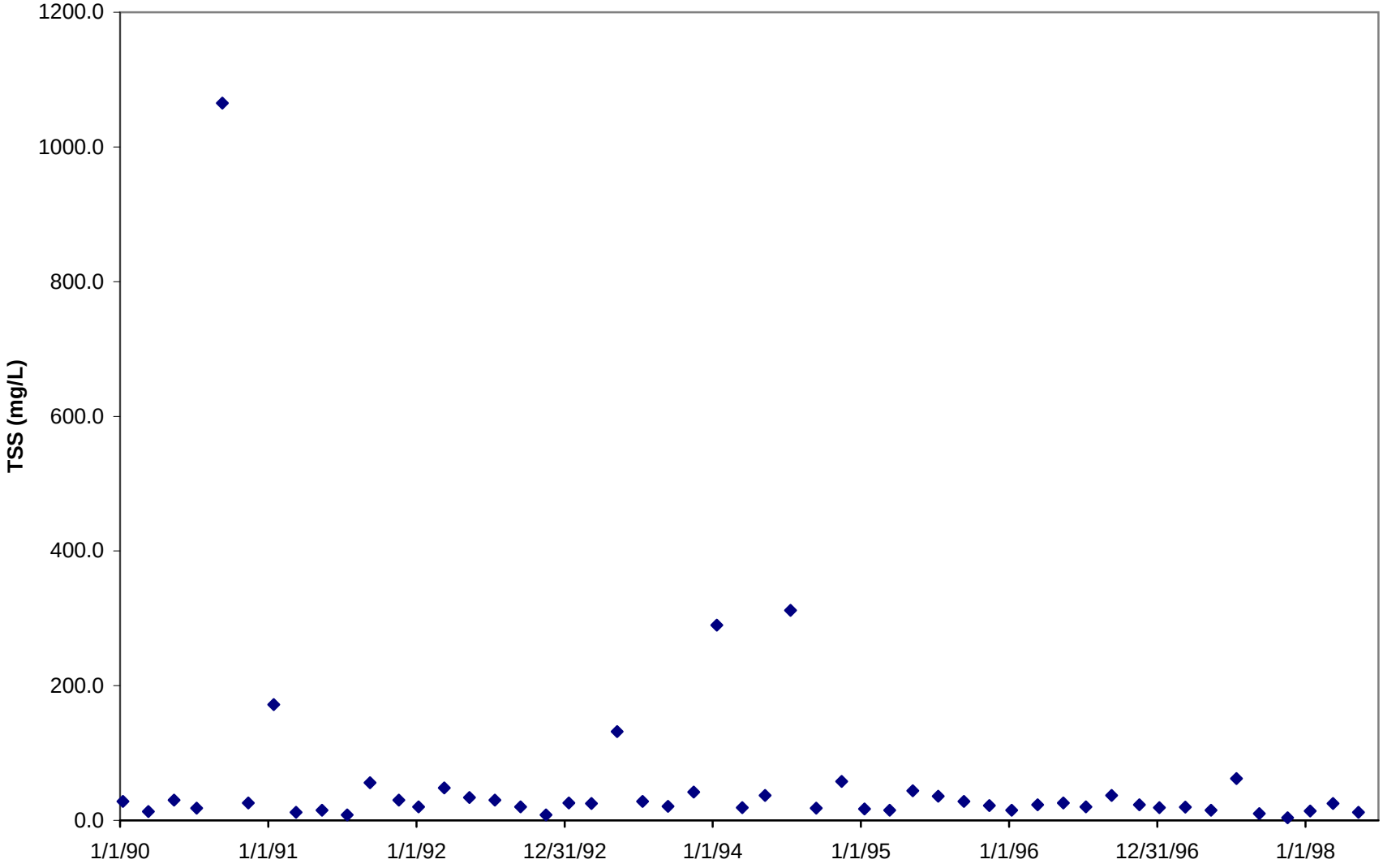


Figure C.9 Flow vs Turbidity for Cross Bayou at South Lakeshore Drive, west of Shreveport, LA (1193)

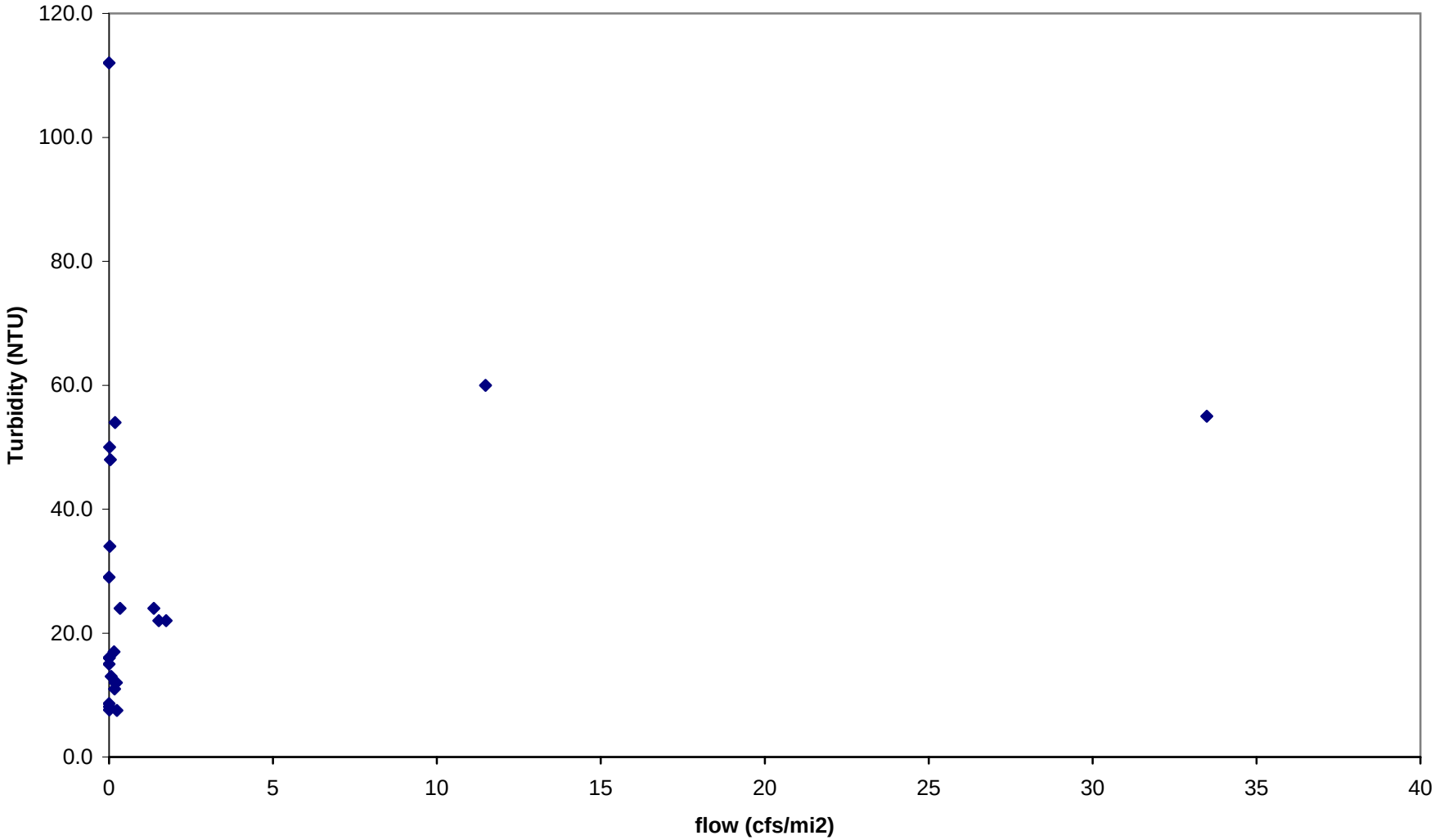


Figure C.10 Flow vs Turbidity for Boggy Bayou southwest of Shreveport, LA (1207)

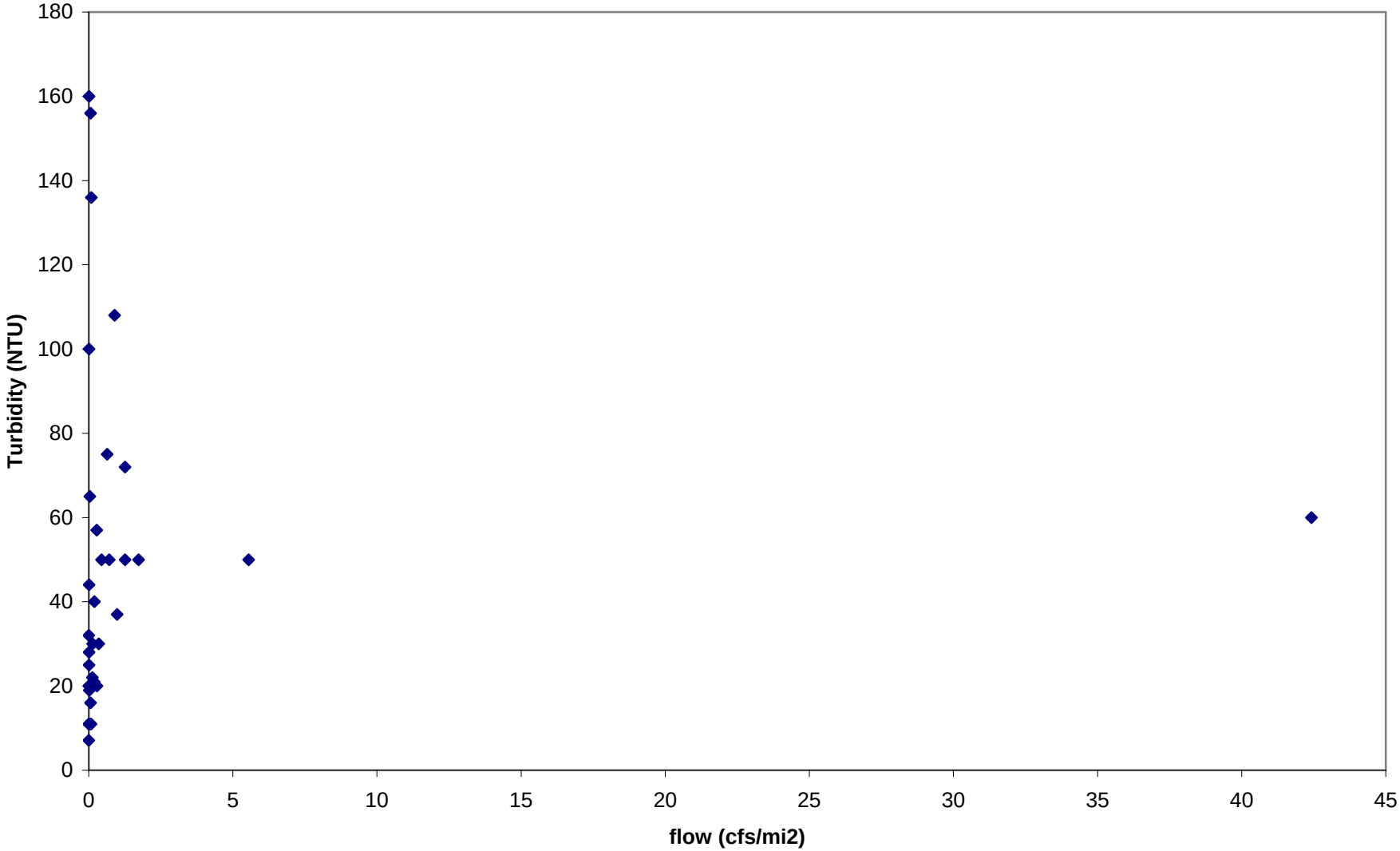


Figure C.11 Flow vs Turbidity for Wallace Lake southeast of Shreveport, LA (1184)

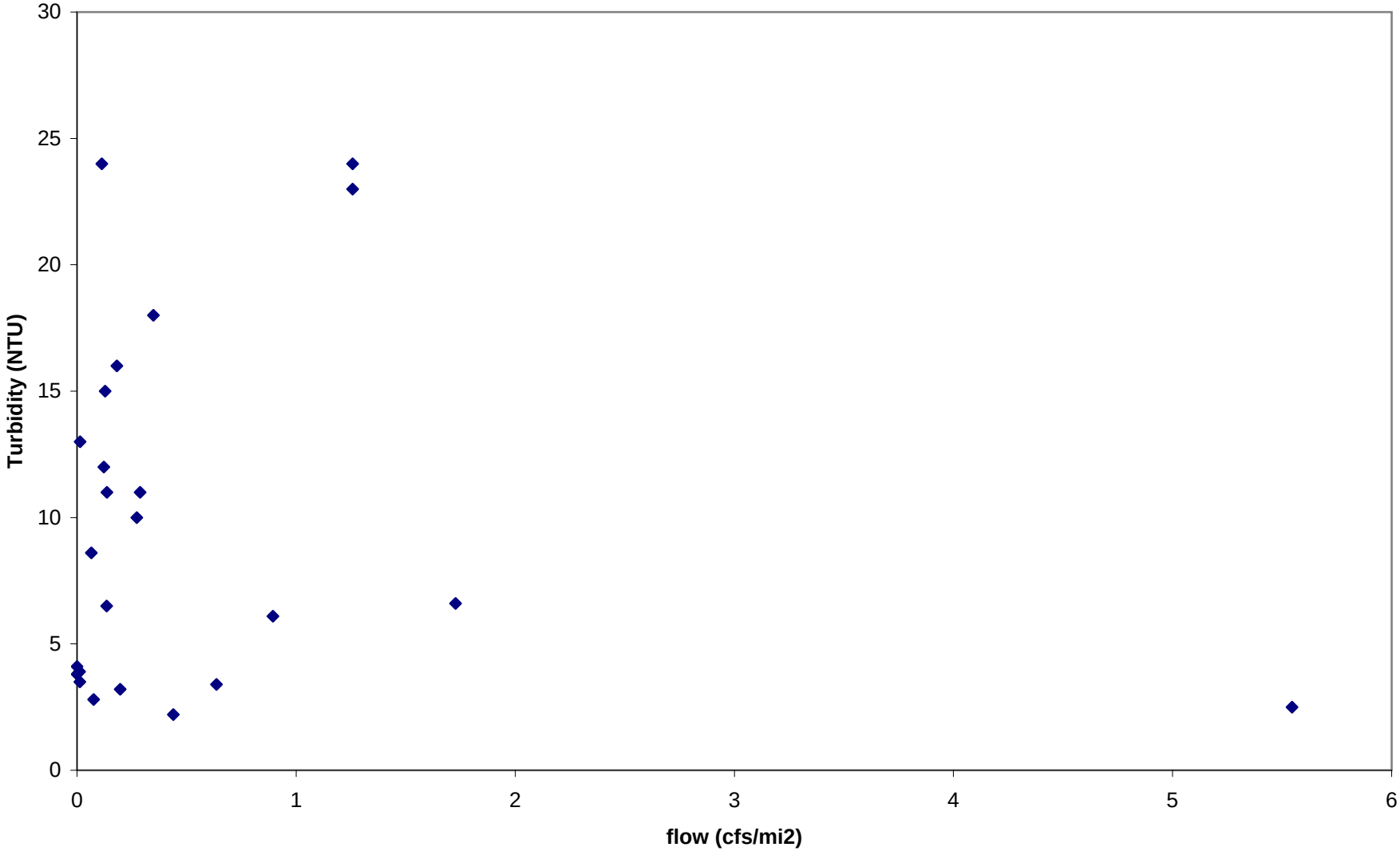


Figure C.12 Flow vs Turbidity for Brushy Bayou near Shreveport, LA (0279)

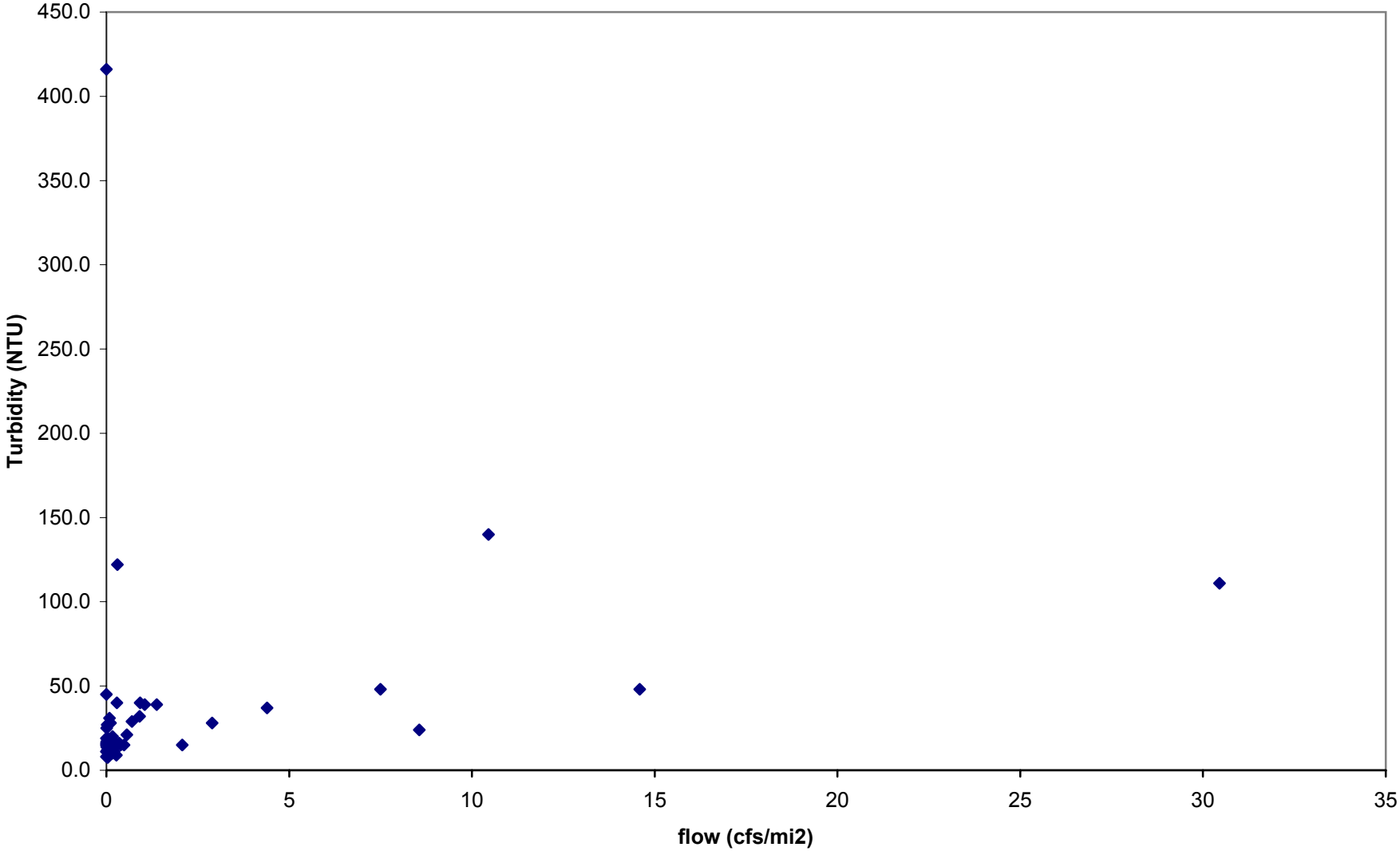


Figure C.13 Flow vs TSS for Cross Bayou at South Lakeshore Drive, west of Shreveport, LA (1193)

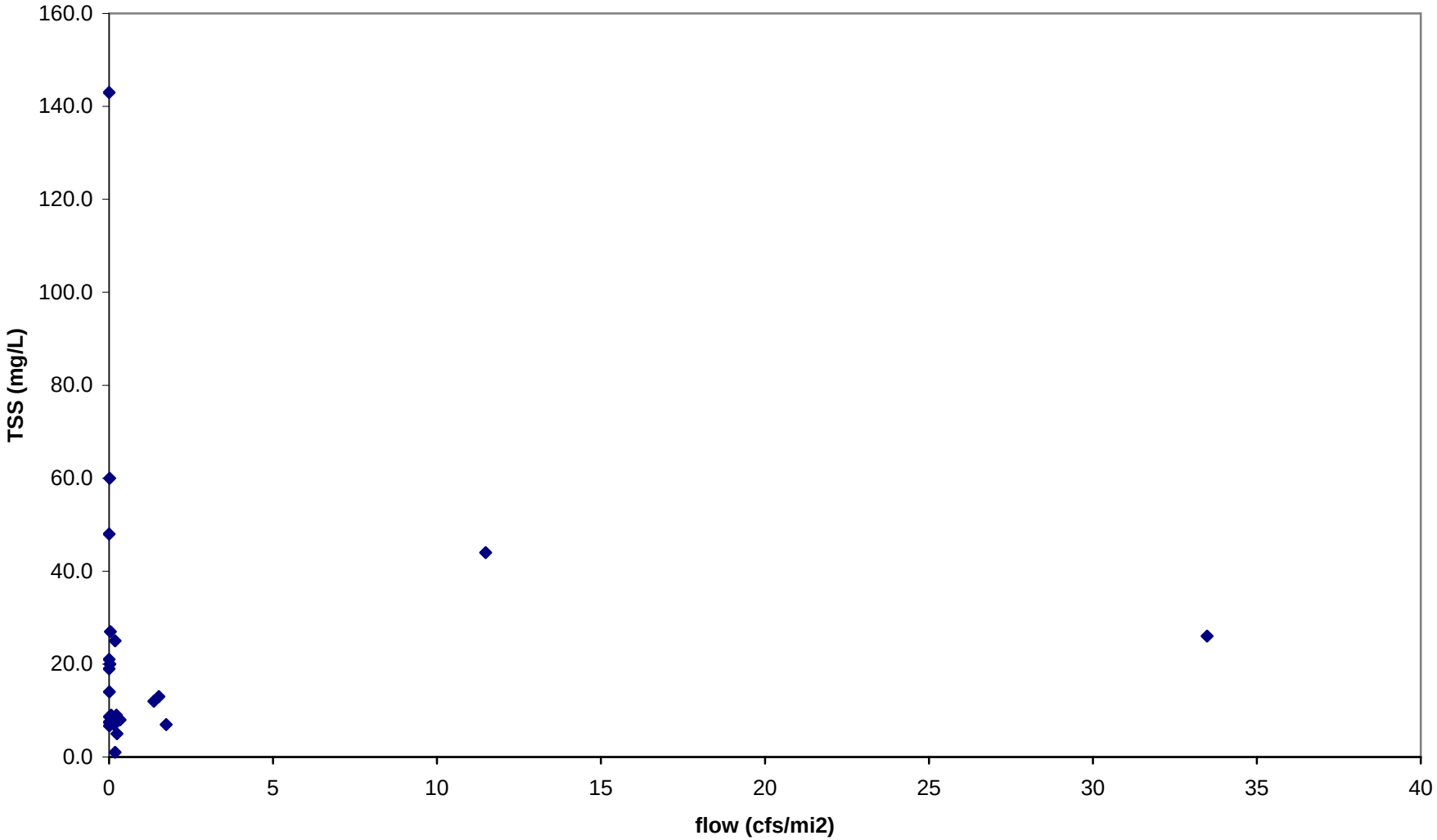


Figure C.14 Flow vs TSS for Boggy Bayou southwest of Shreveport, LA (1207)

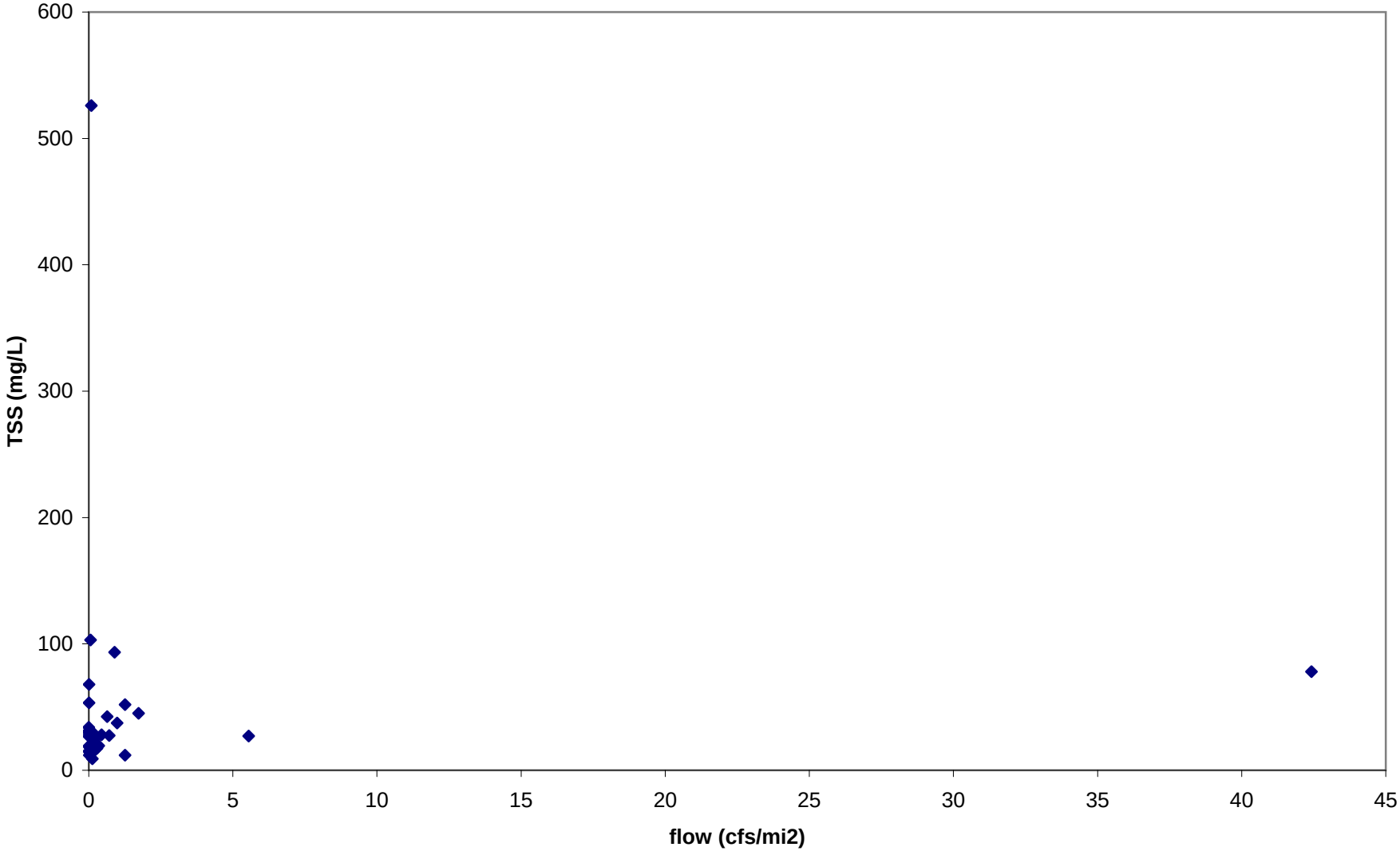


Figure C.15 Flow vs TSS for Wallace Lake southeast of Shreveport, LA (1184)

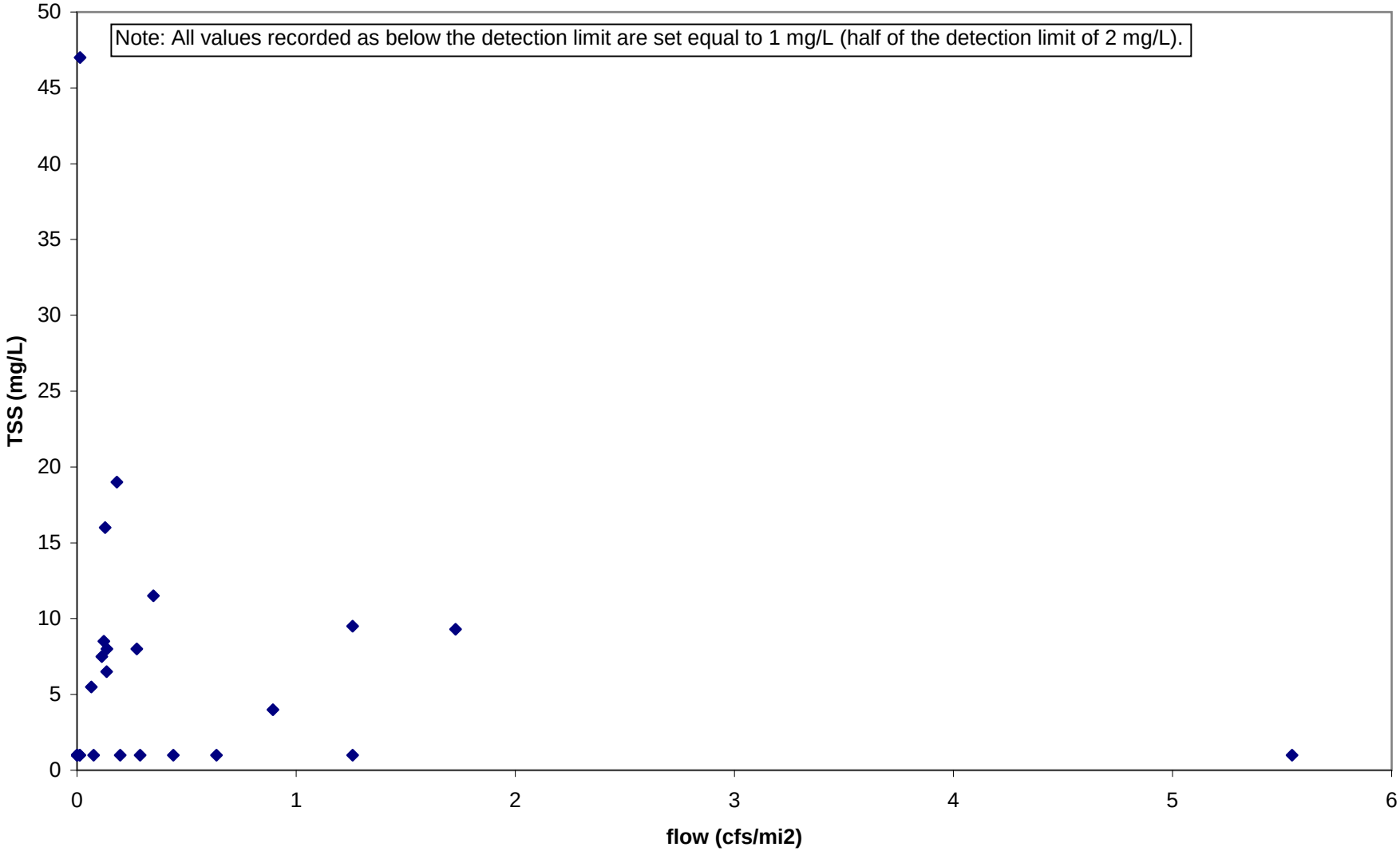


Figure C.16 Flow vs TSS for Brushy Bayou near Shreveport, LA (0279)

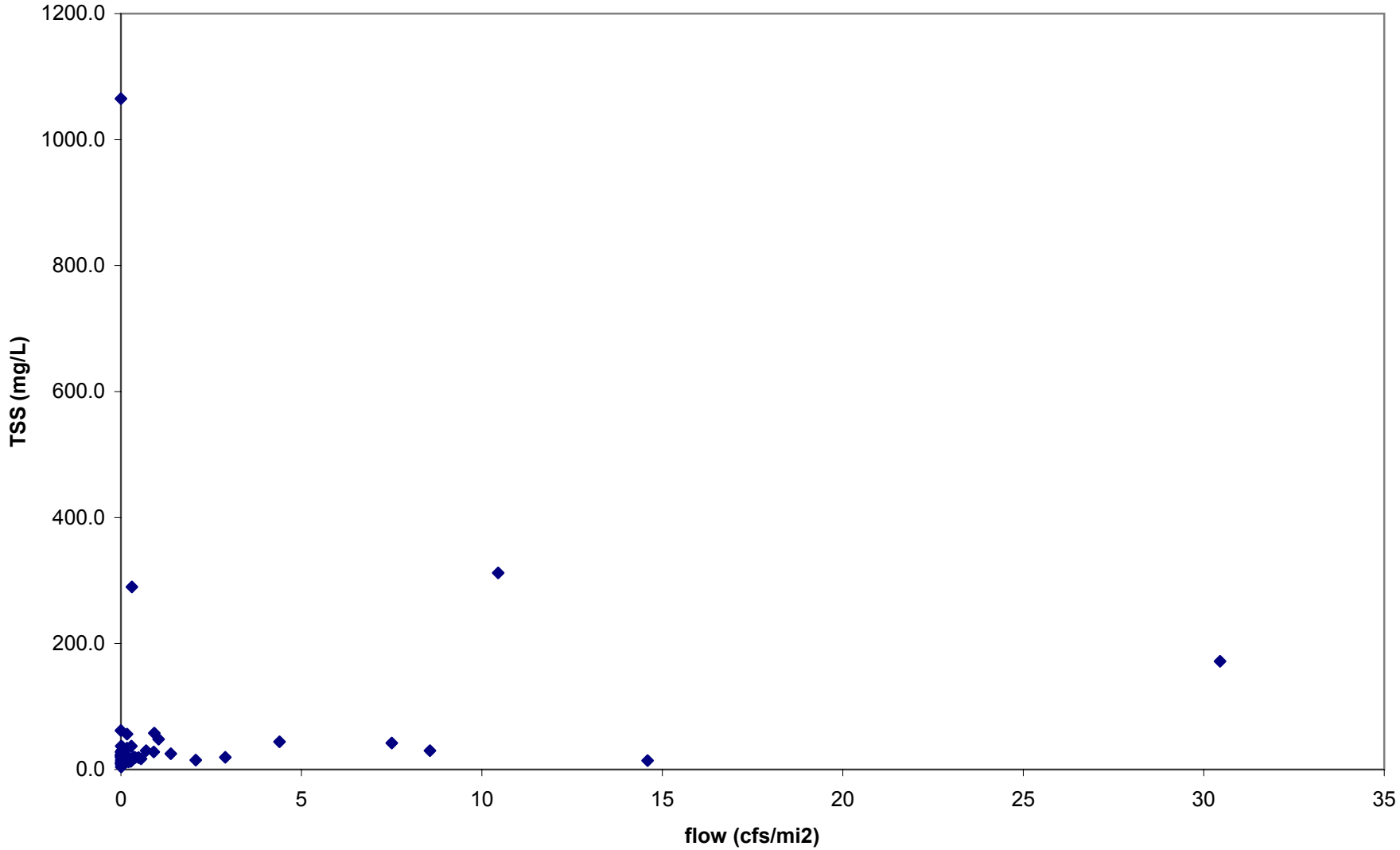


Figure C.17 Turbidity vs. TSS for Cross Bayou at South Lakeshore Drive, west of Shreveport, LA (1193)

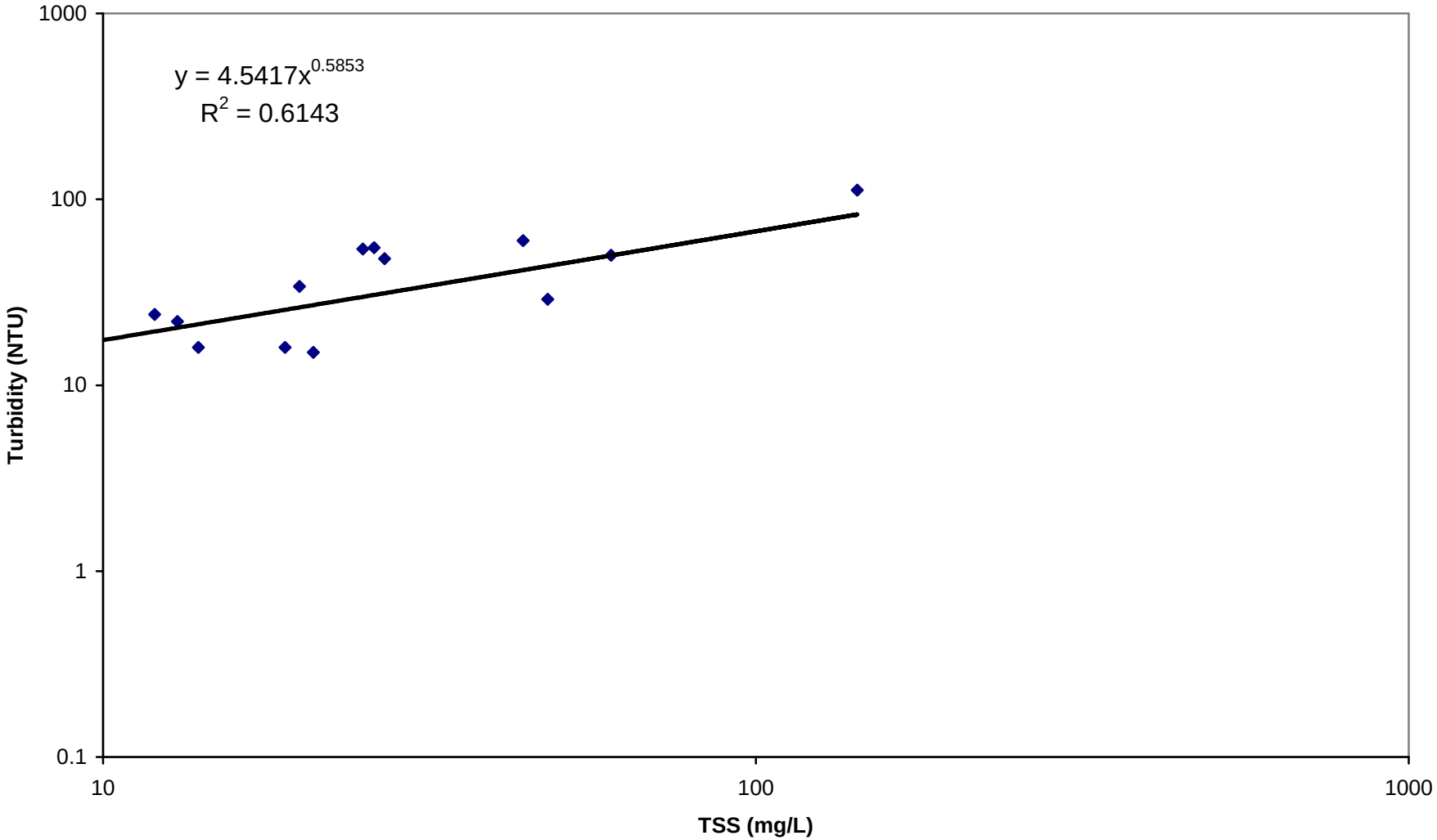


Figure C.18 Turbidity vs. TSS for Boggy Bayou southwest of Shreveport, LA (1207)

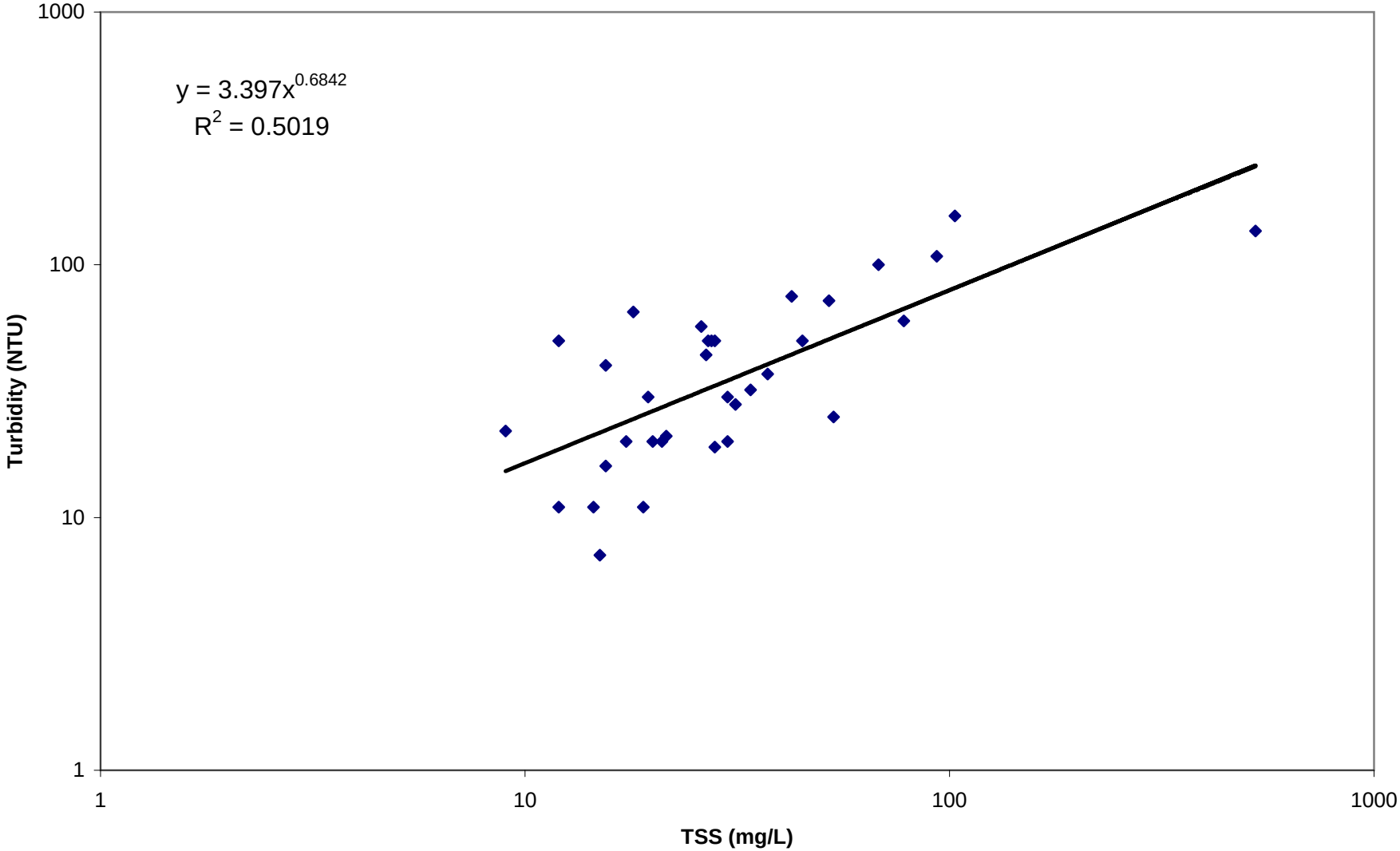


Figure C.19 Turbidity vs. TSS for Wallace Lake southeast of Shreveport, LA (1184)

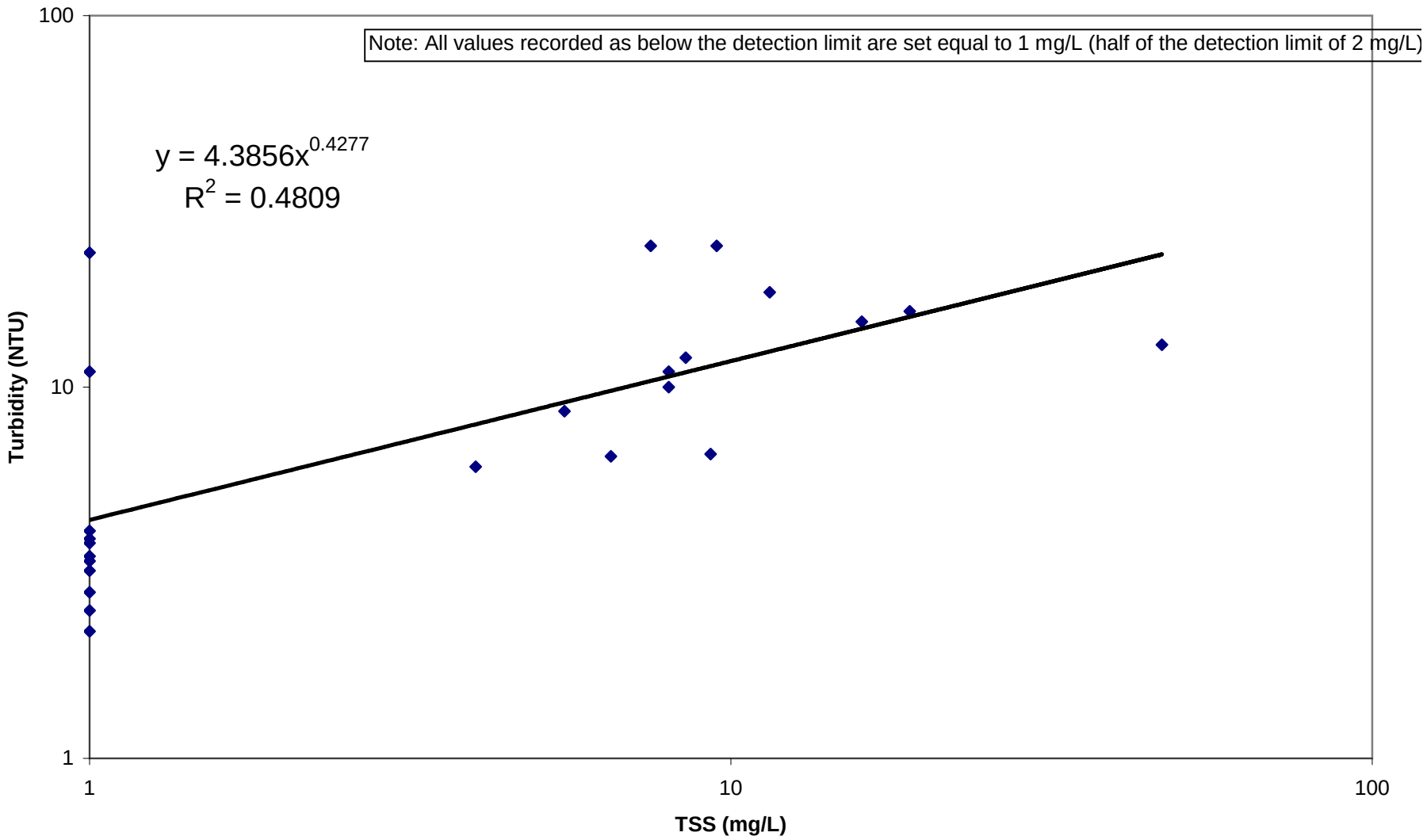
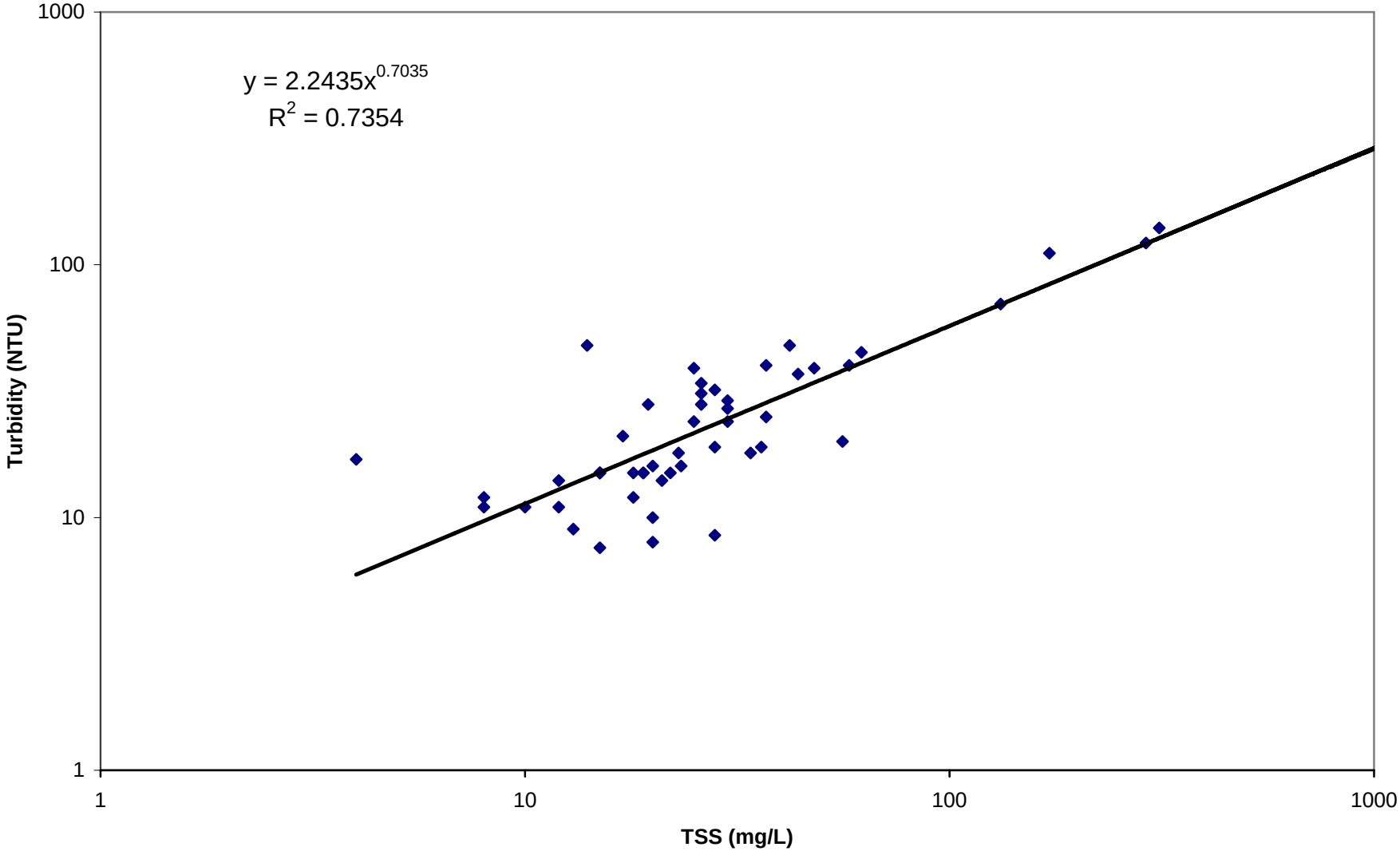


Figure C.20 Turbidity vs. TSS for Brushy Bayou near Shreveport, LA (0279)



APPENDIX D

Plots of Chloride, Sulfate, and TDS

Figure D.1 Chloride for Cross Bayou at South Lakeshore Drive, west of Shreveport, LA (1193)

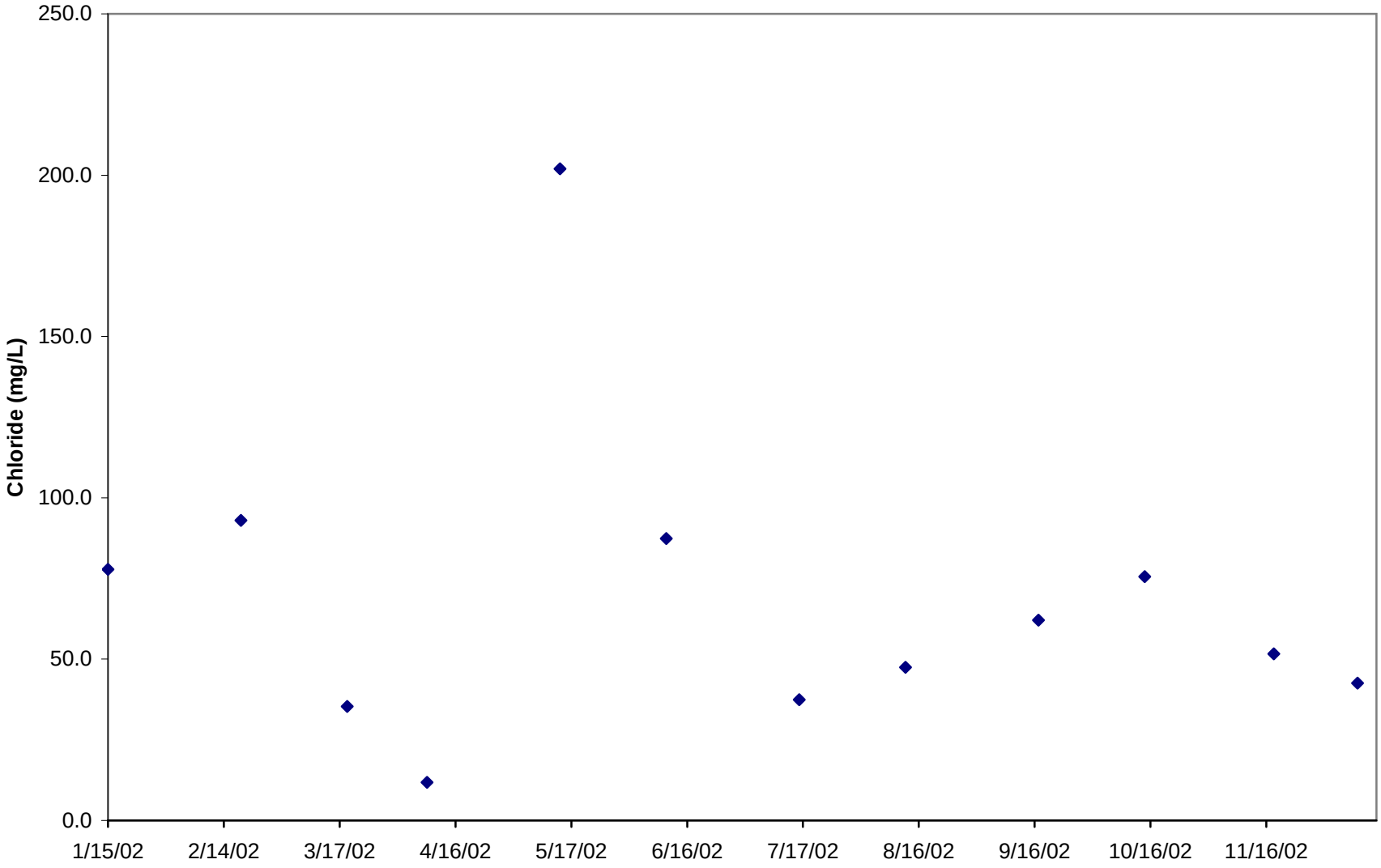


Figure D.2 TDS for Cross Bayou at South Lakeshore Drive, west of Shreveport, LA (1193)

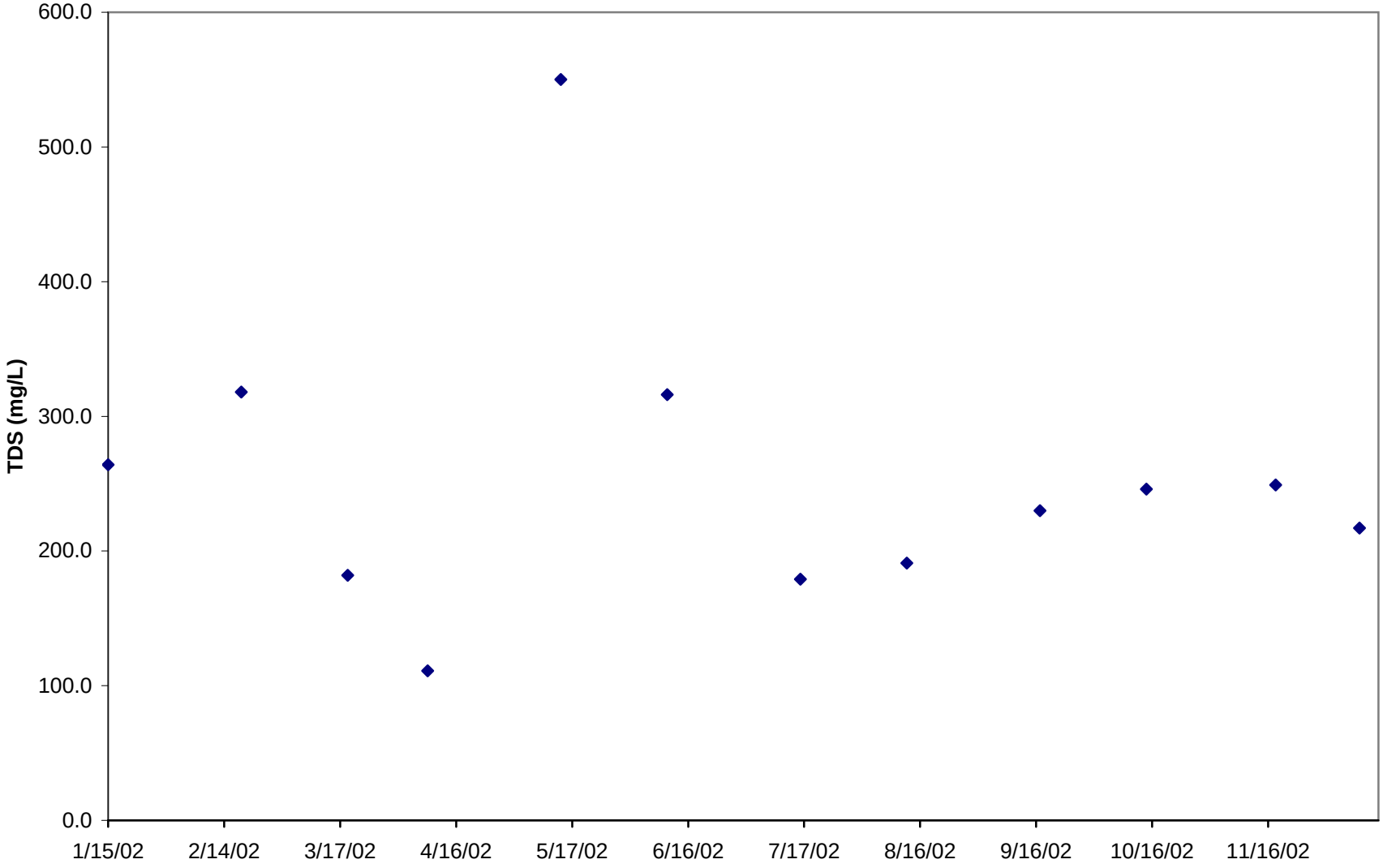


Figure D.3 Sulfate for Cross Bayou at South Lakeshore Drive, west of Shreveport, LA (1193)

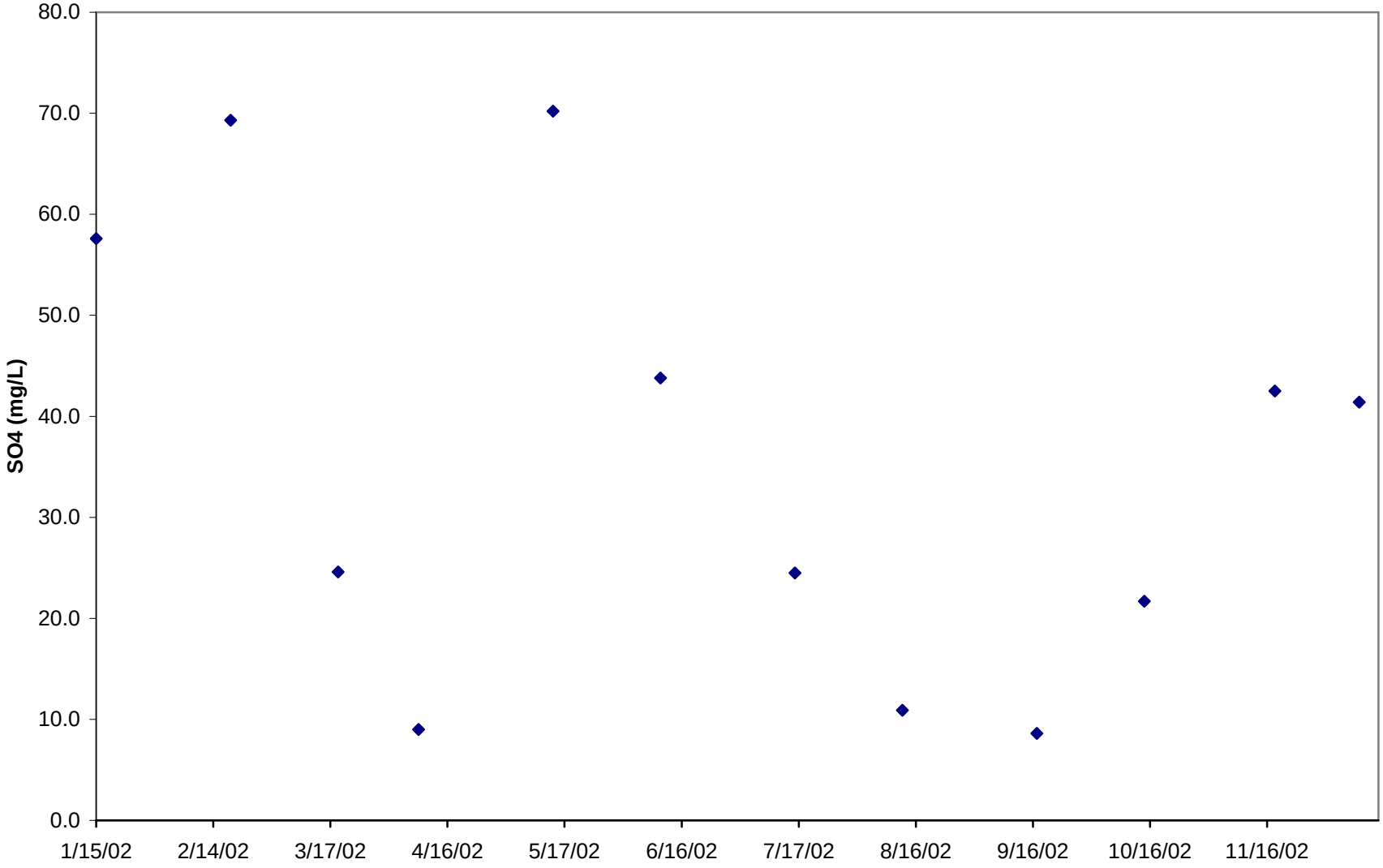


Figure D.4 Flow vs Chloride for Cross Bayou at South Lakeshore Drive, west of Shreveport, LA (1193)

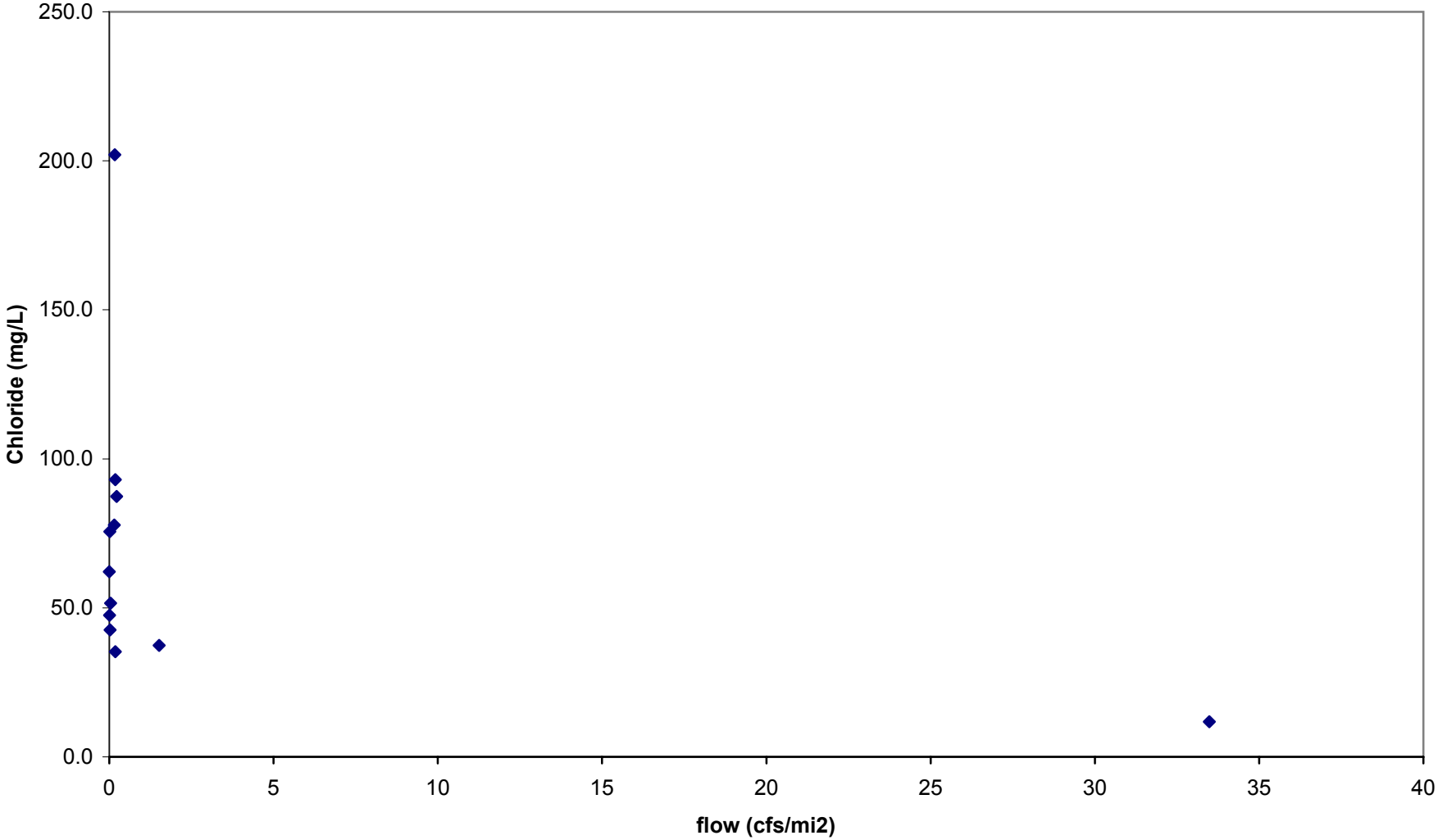


Figure D.5 Flow vs TDS for Cross Bayou at South Lakeshore Drive, west of Shreveport, LA (1193)

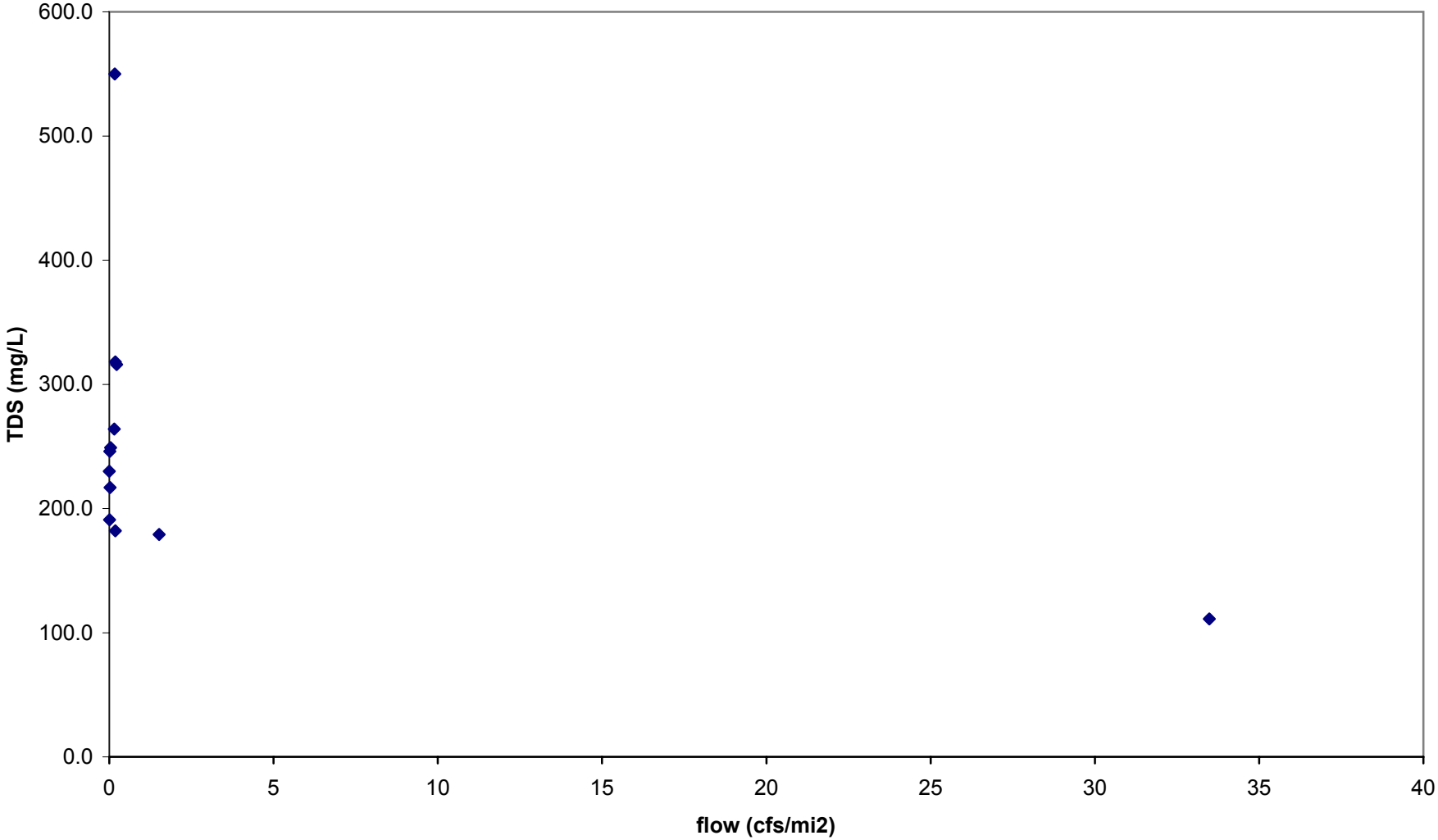
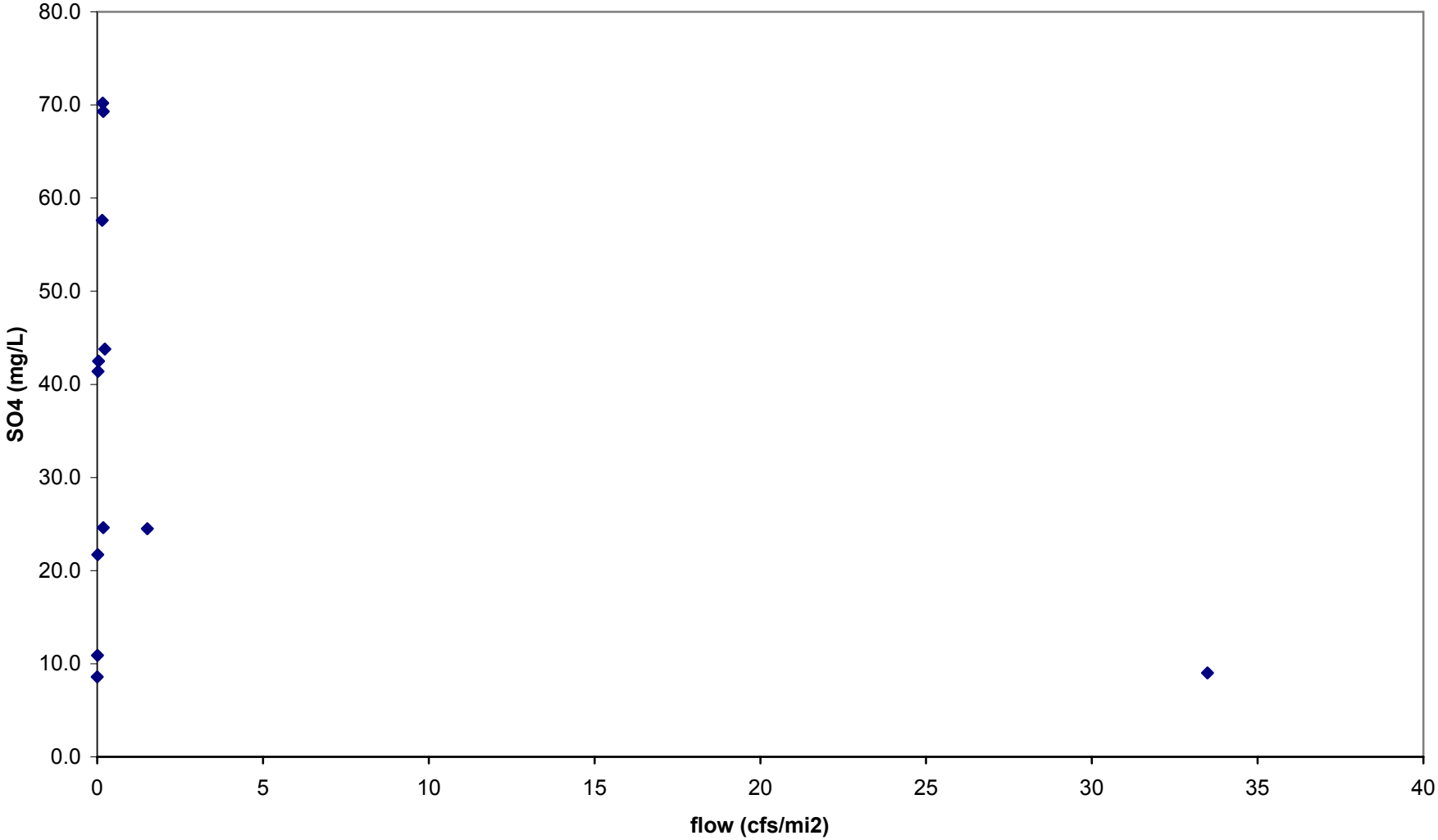


Figure D.6 Flow vs Sulfate for Cross Bayou at South Lakeshore Drive, west of Shreveport, LA (1193)



APPENDIX E

Calculations for subsegment 100309 TSS TMDL

Figure E.1 TSS Load Duration Curve for Cross Bayou (Subsegment 100309)

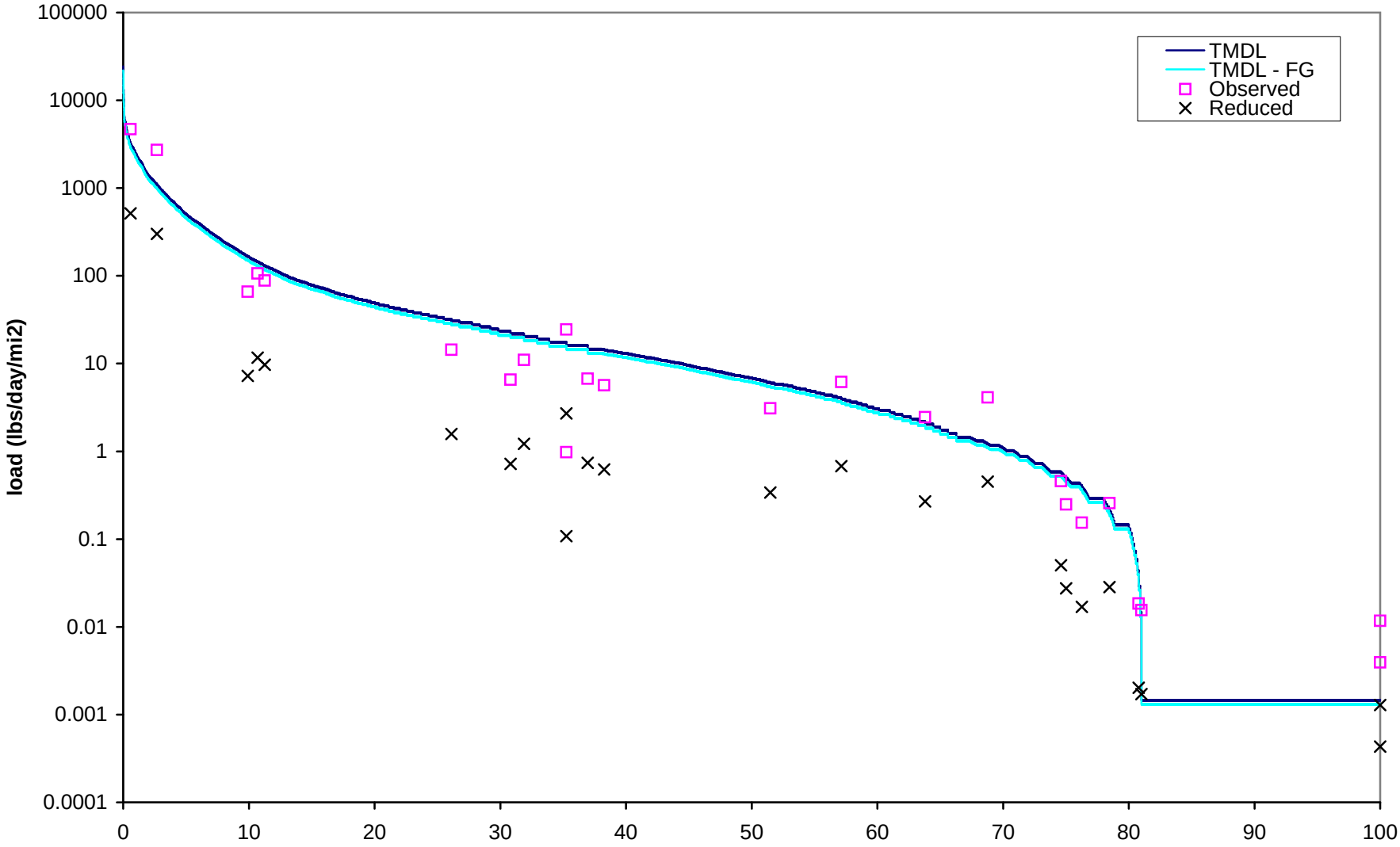


TABLE E.1 ALLOWABLE LOAD FOR TSS FOR CROSS BAYOU NEAR SHREVEPORT, LA (1193)

Drainage	66	mi2, of USGS Gage	70	mg/L = TURB standard
	37.82	mi2, of watershed 100309	18	mg/L = TSS Target

TSS target = 121.55 lbs/day/mi2

Date	Cypress Bayou flow (cfs)	Percent non exceed-ance	Percent exceed-ance	Flow per unit area (cfs/mi2)	Flow per unit area (cms/mi2)	Width on plot between data points (unitless)	TSS TMDL load (lbs/day/mi2)	TSS TMDL - FG load (lbs/day/mi2)	Area under TMDL curve (width times allowable load) (lbs/day/mi2)
6/15/1939	0.001	0.00	100.00	0.00	0.00	0.00711	1.471E-03	1.3237E-03	0.00
6/16/1939	0.001	0.01	99.99	0.00	0.00	0.00711	1.471E-03	1.3237E-03	0.00
6/17/1939	0.001	0.02	99.98	0.00	0.00	0.00711	1.471E-03	1.3237E-03	0.00
6/18/1939	0.001	0.02	99.98	0.00	0.00	0.00711	1.471E-03	1.3237E-03	0.00
6/19/1939	0.001	0.03	99.97	0.00	0.00	0.00711	1.471E-03	1.3237E-03	0.00
6/20/1939	0.001	0.04	99.96	0.00	0.00	0.00711	1.471E-03	1.3237E-03	0.00
6/21/1939	0.001	0.05	99.95	0.00	0.00	0.00711	1.471E-03	1.3237E-03	0.00
6/22/1939	0.001	0.05	99.95	0.00	0.00	0.00711	1.471E-03	1.3237E-03	0.00

For brevity, most of the rows in this spreadsheet have been hidden (between the 99.95% and the 0.05% exceedances).

1/30/1999	7,010	99.95	0.05	106.21	3.01	0.00711	10,310	9,279	0.73
4/5/1999	7,330	99.95	0.05	111.06	3.14	0.00711	10,781	9,703	0.77
1/5/1946	7,900	99.96	0.04	119.70	3.39	0.00711	11,619	10,457	0.83
4/14/1991	8,960	99.97	0.03	135.76	3.84	0.00711	13,178	11,861	0.94
4/23/1995	9,230	99.98	0.02	139.85	3.96	0.00711	13,576	12,218	0.97
8/3/1955	11,200	99.98	0.02	169.70	4.80	0.00711	16,473	14,826	1.17
4/5/1997	13,400	99.99	0.01	203.03	5.75	0.00711	19,709	17,738	1.40
1/29/1999	16,600	100.00	0.00	251.52	7.12	0.00711	24,415	21,974	1.74
								TOTAL =	121.55

FILE: R:\PROJECTS\2110-617\TECH\TMDL\FTN\RED\FINAL TMDL CROSS BAYOU WEST OF SHREVEPORT, LA 1193.XLS

TABLE E.2 EXISTING LOAD AND PERCENT REDUCTION FOR CROSS BAYOU NEAR SHREVEPORT, LA (1193)

TSS Target =	18 mg/L	Error check for reduction is / is not needed:	ok
Percent reduction needed =	89%	Error check for less or more reduction needed:	ok

Date	Observed TSS at stn 1193 (mg/L)	Flow per unit area on sampling day (cms/mi2)	Percent exceedance for flow on sampling day	Current TSS load (lbs/day)/mi2	Reduced TSS load (lbs/day)/mi2	Allowable TSS load (lbs/day)/mi2	Reduced load less than or equal to allow. load?
3/19/02	25.0	5.148E-03	35.26	24.514	2.696	15.885	Yes
2/19/02	ND	5.148E-03	35.26	0.981	0.108	15.885	Yes
11/18/02	27.0	1.201E-03	57.13	6.177	0.680	3.706	Yes
9/17/02	143.0	4.290E-07	100.00	0.012	0.001	0.001	Yes
7/16/02	13.0	4.290E-02	10.71	106.225	11.685	132.373	Yes
10/15/02	60.0	3.603E-04	68.78	4.118	0.453	1.112	Yes
1/15/02	7.0	4.247E-03	38.27	5.663	0.623	13.105	Yes
5/14/02	7.5	4.719E-03	36.95	6.741	0.742	14.561	Yes
8/13/02	14.0	1.716E-04	74.61	0.458	0.050	0.529	Yes
6/11/02	9.0	6.435E-03	31.88	11.031	1.213	19.856	Yes
12/10/02	20.0	6.435E-04	63.80	2.451	0.270	1.986	Yes
4/9/02	26.0	9.480E-01	0.58	4,695.167	516.468	2,925.450	Yes
9/19/05	48.0	4.290E-07	100.00	0.004	0.000	0.001	Yes
9/12/05	19.0	4.290E-06	81.01	0.016	0.002	0.013	Yes
8/15/05	21.0	6.435E-05	78.47	0.257	0.028	0.199	Yes
7/25/05	7.5	1.287E-05	80.80	0.018	0.002	0.040	Yes
7/11/05	6.7	1.201E-04	76.27	0.153	0.017	0.371	Yes
6/13/05	8.7	1.501E-04	75.01	0.249	0.027	0.463	Yes
5/16/05	9.0	1.802E-03	51.49	3.089	0.340	5.560	Yes
4/18/05	8.0	9.438E-03	26.11	14.381	1.582	29.122	Yes
3/14/05	5.0	6.864E-03	30.81	6.537	0.719	21.180	Yes
2/14/05	7.0	4.933E-02	9.90	65.778	7.236	152.229	Yes
1/10/05	12.0	3.861E-02	11.26	88.249	9.707	119.136	Yes
12/7/04	44.0	3.252E-01	2.68	2,725.256	299.778	1,003.390	Yes

Total number of values =		24
Allowable % of exceedances =		0%
Allowable no. of exceedances =		0
No. of exceedances before reductions =		10
No. of exceedances after reductions =		0

Total allowable loading per unit area to meet stds (from Table E.1) =	121.55	lbs/day/mi2
Total allowable loading for Subsegment 100309 = 121.55 * 38 mi2 =	2.30	tons/day
Explicit MOS for TSS for Subsegment 100309 (implicit)	0.00	tons/day
Future growth for TSS for Subsegment 100309 (10% of TMDL) =	0.23	tons/day
Sum of design flows for point sources of TSS for Subsegment 100309 =	0.000	cms
Assumed effluent TSS concentration for point sources =	0	mg/L
Existing point source TSS load for Subsegment 100309 =	0.00	tons/day
WLA for TSS for Subsegment 100309 (same as existing Point Source load) =	0.00	tons/day
LA for TSS for Subsegment 100309 = total - MOS - WLA - FG =	2.07	tons/day

Table E.2
Percent Reduction

APPENDIX F

Calculations for Subsegment 100602 TSS TMDL

Figure F.1. TSS Load Duration Curve for Boggy Bayou (100602)

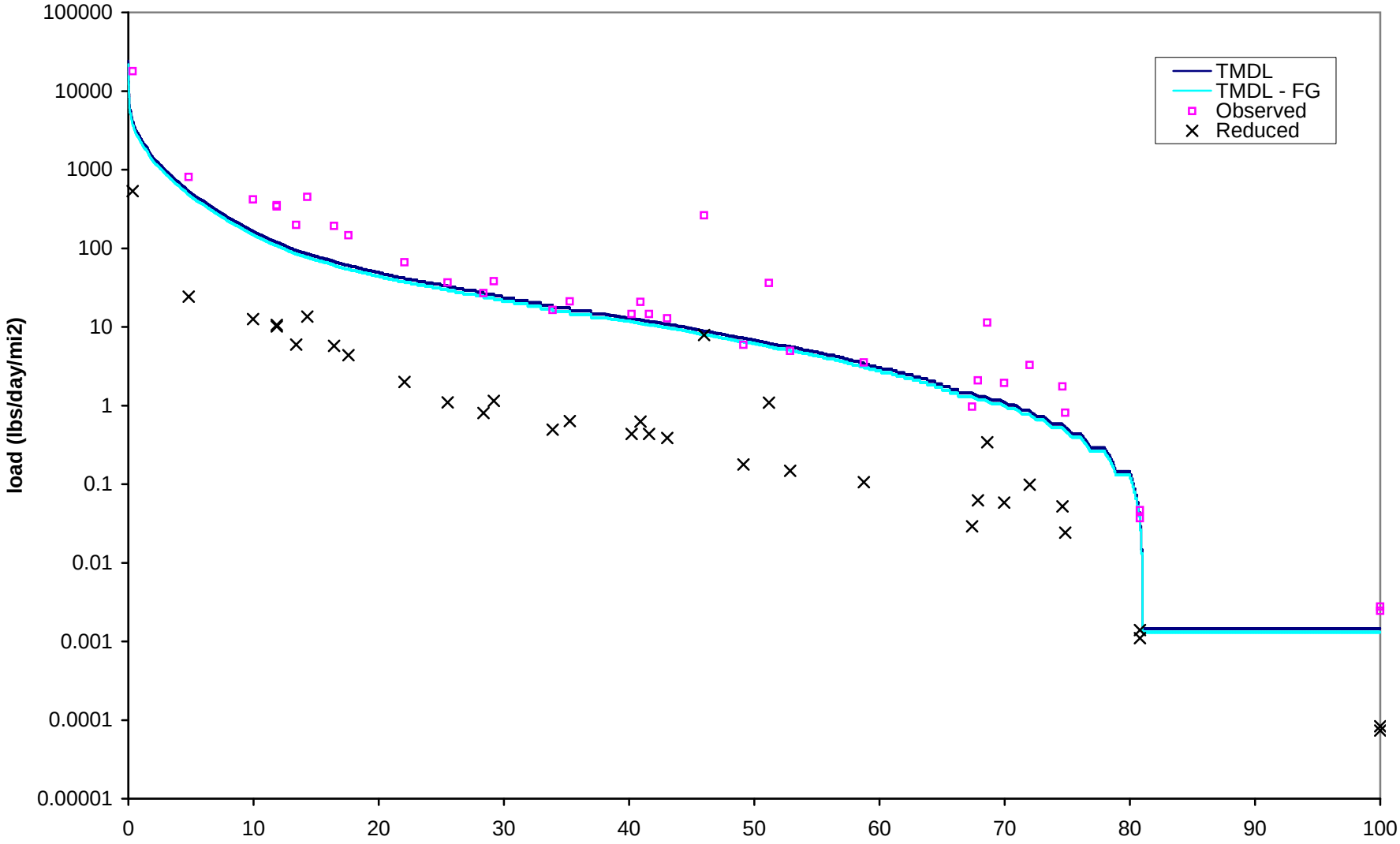


TABLE F.1 ALLOWABLE LOAD FOR TSS FOR BOGGY BAYOU SOUTHWEST OF SHREVEPORT, LA (1207)

Drainage 66 mi2, of gage
79.48 mi2, of watershed (100602)

25 mg/L = Turbidity standard
18 mg/L = TSS Target

TSS Target 121.54 lbs/day/mi2

Date	Cypress Bayou flow (cfs)	Percent non exceed-ance	Percent exceed-ance	Flow per unit area (cfs/mi2)	Flow per unit area (cms/mi2)	Width on plot between data points (unitless)	TSS TMDL load (lbs/day/mi2)	TSS TMDL - FG load (lbs/day/mi2)	Area under TMDL curve (width times allowable load) (lbs/day/mi2)
6/15/1939	0.001	0.00	100.00	1.5152E-05	0.000	0.00711	0.00	0.00	1.05E-07
6/16/1939	0.001	0.01	99.99	1.5152E-05	0.000	0.00711	0.00	0.00	1.05E-07
6/17/1939	0.001	0.02	99.98	1.5152E-05	0.000	0.00711	0.00	0.00	1.05E-07
6/18/1939	0.001	0.02	99.98	1.5152E-05	0.000	0.00711	0.00	0.00	1.05E-07
6/19/1939	0.001	0.03	99.97	1.5152E-05	0.000	0.00711	0.00	0.00	1.05E-07
6/20/1939	0.001	0.04	99.96	1.5152E-05	0.000	0.00711	0.00	0.00	1.05E-07
6/21/1939	0.001	0.05	99.95	1.5152E-05	0.000	0.00711	0.00	0.00	1.05E-07
6/22/1939	0.001	0.05	99.95	1.5152E-05	0.000	0.00711	0.00	0.00	1.05E-07

For brevity, most of the rows in this spreadsheet have been hidden (between the 99.95% and the 0.05% exceedances).

1/30/1999	7,010	99.95	0.05	106.21	3.007	0.00711	10,310.19	9,279.17	0.73
4/5/1999	7,330	99.95	0.05	111.06	3.144	0.00711	10,780.84	9,702.75	0.77
1/5/1946	7,900	99.96	0.04	119.70	3.389	0.00711	11,619.18	10,457.27	0.83
4/14/1991	8,960	99.97	0.03	135.76	3.844	0.00711	13,178.21	11,860.39	0.94
4/23/1995	9,230	99.98	0.02	139.85	3.959	0.00711	13,575.33	12,217.79	0.97
8/3/1955	11,200	99.98	0.02	169.70	4.805	0.00711	16,472.77	14,825.49	1.17
4/5/1997	13,400	99.99	0.01	203.03	5.748	0.00711	19,708.49	17,737.64	1.40
1/29/1999	16,600	100.00	0.00	251.52	7.121	0.00711	24,415.00	21,973.50	1.74
								TOTAL =	121.54

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TABLE F.2 EXISITNG LOAD AND PERCENT REDUCTION FOR BOGGY BAYOU SOUTHWEST OF SHREVEPORT, LA (1207)

TSS Target = 18 mg/L Error check for reduction is / is not needed: ok
Percent reduction = 97% Error check for less or more reduction needed: ok

Date	Observed TSS at Stn 1207 (mg/L)	Flow per unit area on sampling day (cms/mi2)	Percent exceedance for flow on sampling day	Current TSS load (tons/day)/mi2	Reduced TSS load (tons/day)/mi2	Allowable TDS load with MOS and FG incorporated (lbs/day)/mi2	Reduced load less than or equal to allow. load?
9/10/02	30.0	0.000	100.00	0.002	0.000	0.001	Yes
10/8/02	34.0	0.000	100.00	0.003	0.000	0.001	Yes
8/6/02	31.3	0.000	69.96	1.944	0.058	1.006	Yes
12/3/02	103.0	0.002	51.17	36.190	1.086	5.692	Yes
3/5/02	21.0	0.003	43.05	12.869	0.386	9.928	Yes
5/7/02	30.0	0.004	40.90	20.836	0.625	11.252	Yes
7/9/02	20.0	0.004	40.21	14.544	0.436	11.781	Yes
6/4/02	21.5	0.005	35.26	21.081	0.632	15.885	Yes
2/5/02	19.5	0.010	25.50	36.647	1.099	30.445	Yes
11/6/02	93.3	0.025	14.29	449.792	13.494	78.099	Yes
1/7/02	52.0	0.036	11.85	352.663	10.580	109.868	Yes
4/2/02	45.0	0.049	9.96	419.175	12.575	150.903	Yes
1/13/04	22.0	0.003	41.59	14.561	0.437	10.722	Yes
2/3/04	50.0	0.036	11.85	339.099	10.173	109.868	Yes
3/9/04	50.0	0.020	16.43	192.020	5.761	62.214	Yes
4/7/04	160.0	0.000	68.60	11.374	0.341	1.152	Yes
5/5/04	42.5	0.018	17.58	145.853	4.376	55.596	Yes
6/29/04	27.0	0.157	4.81	807.464	24.224	484.478	Yes
7/27/04	28.0	0.000	67.86	2.082	0.062	1.205	Yes
8/24/04	15.5	0.006	33.89	16.465	0.494	17.208	Yes
9/14/04	14.5	0.002	49.13	5.924	0.178	6.619	Yes
10/13/04	28.0	0.012	22.05	66.349	1.990	38.388	Yes
10/20/04	26.0	0.008	29.20	38.241	1.147	23.827	Yes
11/16/04	17.3	0.008	28.36	26.858	0.806	25.151	Yes
3/22/05	37.3	0.028	13.41	198.107	5.943	86.041	Yes
4/12/05	78.0	1.201	0.35	17845.581	535.367	3706.390	Yes
4/26/05	526.0	0.003	46.00	262.176	7.865	8.075	Yes

5/10/05	15.5	0.002	52.86	4.939	0.148	5.162	Yes
5/24/05	18.0	0.001	58.75	3.530	0.106	3.177	Yes
6/7/05	12.0	0.000	67.39	0.971	0.029	1.310	Yes
6/21/05	53.3	0.000	74.61	1.742	0.052	0.529	Yes
7/5/05	68.0	0.000	72.00	3.278	0.098	0.781	Yes
7/19/05	26.7	0.000	74.83	0.807	0.024	0.490	Yes
8/9/05	15.0	0.000	80.80	0.037	0.001	0.040	Yes
8/23/05	19.0	0.000	80.80	0.047	0.001	0.040	Yes

Total number of values =	35
Allowable % of exceedances =	0%
Allowable no. of exceedances =	0
No. of exceedances before reductions =	28
No. of exceedances after reductions =	0

Total allowable loading per unit area to meet TSS target (from Table F.1) =	121.54	lbs/day/mi2
Total allowable loading for Subsegment 100704 = 121.54 * 79 mi2 =	4.83	tons/day
Explicit MOS for TSS for Subsegment 100602 (implicit)	0.00	tons/day
Future growth for TSS for Subsegment 100602 (10% of TMDL) =	4.347	tons/day
Sum of design flows for point sources of TSS for Subsegment 100602 =	0.000	cms
Assumed effluent TSS concentration for point sources =	0	mg/L
Existing point source TSS load for Subsegment 100602 =	0.00	tons/day
WLA for TSS for Subsegment 100602 (same as existing Point Source load) =	0.00	tons/day
LA for TSS for Subsegment 100602 = total - MOS - WLA =	0.48	tons/day

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APPENDIX G

Calculations for Subsegment 100603 TSS TMDL

Figure G.1. TSS Load Duration Curve for Wallace Lake (Subsegment 100603)

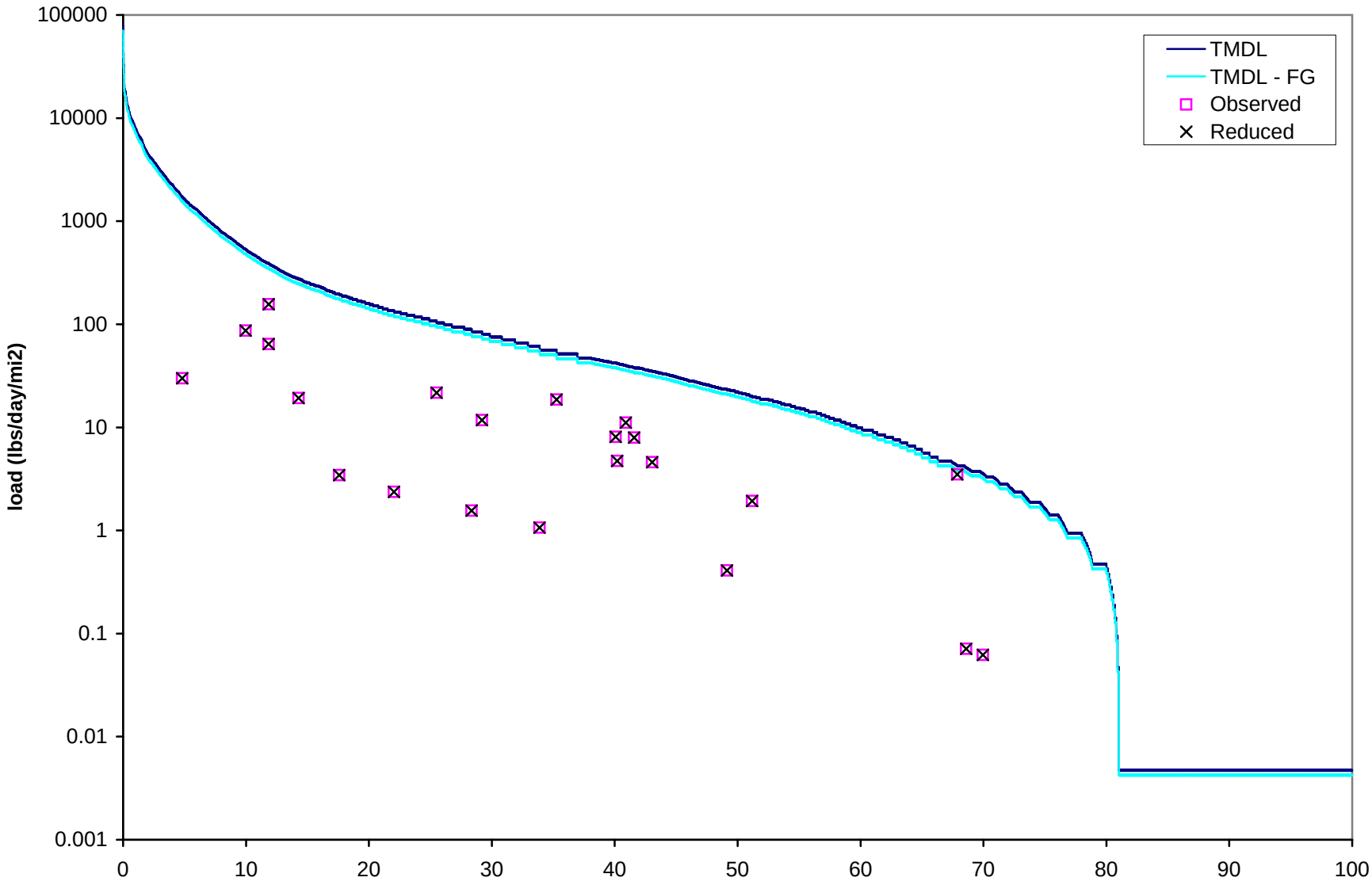

TABLE G.1 ALLOWABLE LOAD FOR TSS FOR WALLACE LAKE SOUTHEAST OF SHREVEPORT, LA (1184)

Drainage	66	mi2, of gage	Turbidity Criterion=	25	NTU
	178.38	mi2, of watershed (100603)	TSS target =	58	mg/L

TSS target = 390.25 lbs/day/mi2

Date	Brushy Bayou flow (cfs)	Percent non exceed-ance	Percent exceed-ance	Flow per unit area (cfs/mi2)	Flow per unit area (cms/mi2)	Width on plot between data points (unitless)	TSS TMDL load (lbs/day/mi2)	TSS TMDL - FG load (lbs/day/mi2)	Area under TMDL curve (width times allowable load) (lbs/day/mi2)
6/15/1939	0.001	0.00	100.00	1.52E-05	0.00	0.00711	0.00	0.00	3.37E-07
6/16/1939	0.001	0.01	99.99	1.52E-05	0.00	0.00711	0.00	0.00	3.37E-07
6/17/1939	0.001	0.02	99.98	1.52E-05	0.00	0.00711	0.00	0.00	3.37E-07
6/18/1939	0.001	0.02	99.98	1.52E-05	0.00	0.00711	0.00	0.00	3.37E-07
6/19/1939	0.001	0.03	99.97	1.52E-05	0.00	0.00711	0.00	0.00	3.37E-07
6/20/1939	0.001	0.04	99.96	1.52E-05	0.00	0.00711	0.00	0.00	3.37E-07
6/21/1939	0.001	0.05	99.95	1.52E-05	0.00	0.00711	0.00	0.00	3.37E-07
6/22/1939	0.001	0.05	99.95	1.52E-05	0.00	0.00711	0.00	0.00	3.37E-07

For brevity, most of the rows in this spreadsheet have been hidden (between the 99.97% and the 0.03% exceedances).

1/30/1999	7010	99.95	0.05	106.2121	3.01	0.00711	33,221.72	29,899.55	2.36E+00
4/5/1999	7330	99.95	0.05	111.0606	3.14	0.00711	34,738.26	31,264.43	2.47E+00
1/5/1946	7900	99.96	0.04	119.697	3.39	0.00711	37,439.60	33,695.64	2.66E+00
4/14/1991	8960	99.97	0.03	135.7576	3.84	0.00711	42,463.14	38,216.82	3.02E+00
4/23/1995	9230	99.98	0.02	139.8485	3.96	0.00711	43,742.72	39,368.45	3.11E+00
8/3/1955	11200	99.98	0.02	169.697	4.80	0.00711	53,078.92	47,771.03	3.77E+00
4/5/1997	13400	99.99	0.01	203.0303	5.75	0.00711	63,505.14	57,154.62	4.52E+00
1/29/1999	16600	100.00	0.00	251.5152	7.12	0.00533	78,670.54	70,803.49	4.20E+00
						TOTAL =			390.25

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TABLE G.2. EXISTING LOAD AND PERCENT REDUCTIONS FOR WALLACE LAKE SOUTHEAST OF SHREVEPORT, LA (1184)

TSS target = 58 mg/L
Percent reduction = 0%
Error check for reduction is / is not needed: ok
Error check for less or more reduction needed ok

Date	Observed TSS at station 1184 (mg/L)	Flow per unit area on sampling day (cms/mi2)	Percent exceedance for flow on sampling day	Current TSS load (lbs/day/mi2)	Reduced TSS load (lbs/day)/mi2	TSS TMDL - FG load (lbs/day)/mi2	Reduced load less than or equal to allow. load?
1/7/02	9.5	0.036	11.85	64.43	64.43	354.02	Yes
2/5/02	11.5	0.010	25.50	21.61	21.61	98.10	Yes
3/5/02	7.5	0.003	43.05	4.60	4.60	31.99	Yes
4/2/02	9.3	0.049	9.96	86.63	86.63	486.24	Yes
5/7/02	16.0	0.004	40.90	11.11	11.11	36.25	Yes
6/4/02	19.0	0.005	35.26	18.63	18.63	51.18	Yes
7/9/02	6.5	0.004	40.21	4.73	4.73	37.96	Yes
8/6/02	ND	0.000	69.96	0.06	0.06	3.24	Yes
9/10/02	ND	0.000	100.00	0.00	0.00	0.00	Yes
10/8/02	ND	0.000	100.00	0.00	0.00	0.00	Yes
11/6/02	4.0	0.025	14.29	19.28	19.28	251.65	Yes
12/3/02	5.5	0.002	51.17	1.93	1.93	18.34	Yes
1/13/04	12.0	0.003	41.59	7.94	7.94	34.55	Yes
2/3/04	23.0	0.036	11.85	155.99	155.99	354.02	Yes
3/24/04	11.0	0.004	40.07	8.09	8.09	38.39	Yes
4/7/04	ND	0.000	68.60	0.07	0.07	3.71	Yes
5/5/04	ND	0.018	17.58	3.43	3.43	179.14	Yes
6/29/04	ND	0.157	4.81	29.91	29.91	1561.10	Yes
7/27/04	47.0	0.000	67.86	3.49	3.49	3.88	Yes
8/24/04	ND	0.006	33.89	1.06	1.06	55.45	Yes
9/14/04	ND	0.002	49.13	0.41	0.41	21.33	Yes
10/13/04	1.0	0.012	22.05	2.37	2.37	123.69	Yes
10/20/04	8.0	0.008	29.20	11.77	11.77	76.78	Yes
11/16/04	ND	0.008	28.36	1.55	1.55	81.04	Yes

Total number of values =	24
Allowable % of exceedances =	0%
Allowable no. of exceedances =	0
No. of exceedances before reductions =	0
No. of exceedances after reductions =	0

Total allowable loading per unit area to meet TSS (from Table G.1) =	390.25	lbs/day/mi2
Total allowable loading for Subsegment 100603 = 390.25 * 178 mi2 =	34.81	tons/day
Explicit MOS for TSS for Subsegment 100603 (implicit)	0.00	tons/day
Future growth for TSS for Subsegment 100603 (10% of TMDL) =	3.48	tons/day
Sum of design flows for point sources of TSS for Subsegment 100603 =	0.000	cms
Assumed effluent TSS concentration for point sources =	0	mg/L
Existing point source TSS load for Subsegment 100603 =	0.00	tons/day
WLA for TSS for Subsegment 100603 (same as existing Point Source load) =	0.00	tons/day
LA for TSS for Subsegment 100603 = total - MOS - WLA - FG =	31.33	tons/day

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Table G.2
Percent Reduction

APPENDIX H

Calculations for subsegment 100309 Chloride TMDL

Figure H.1. Chloride Load Duration Curve for Cross Bayou (Subsegment 100309)

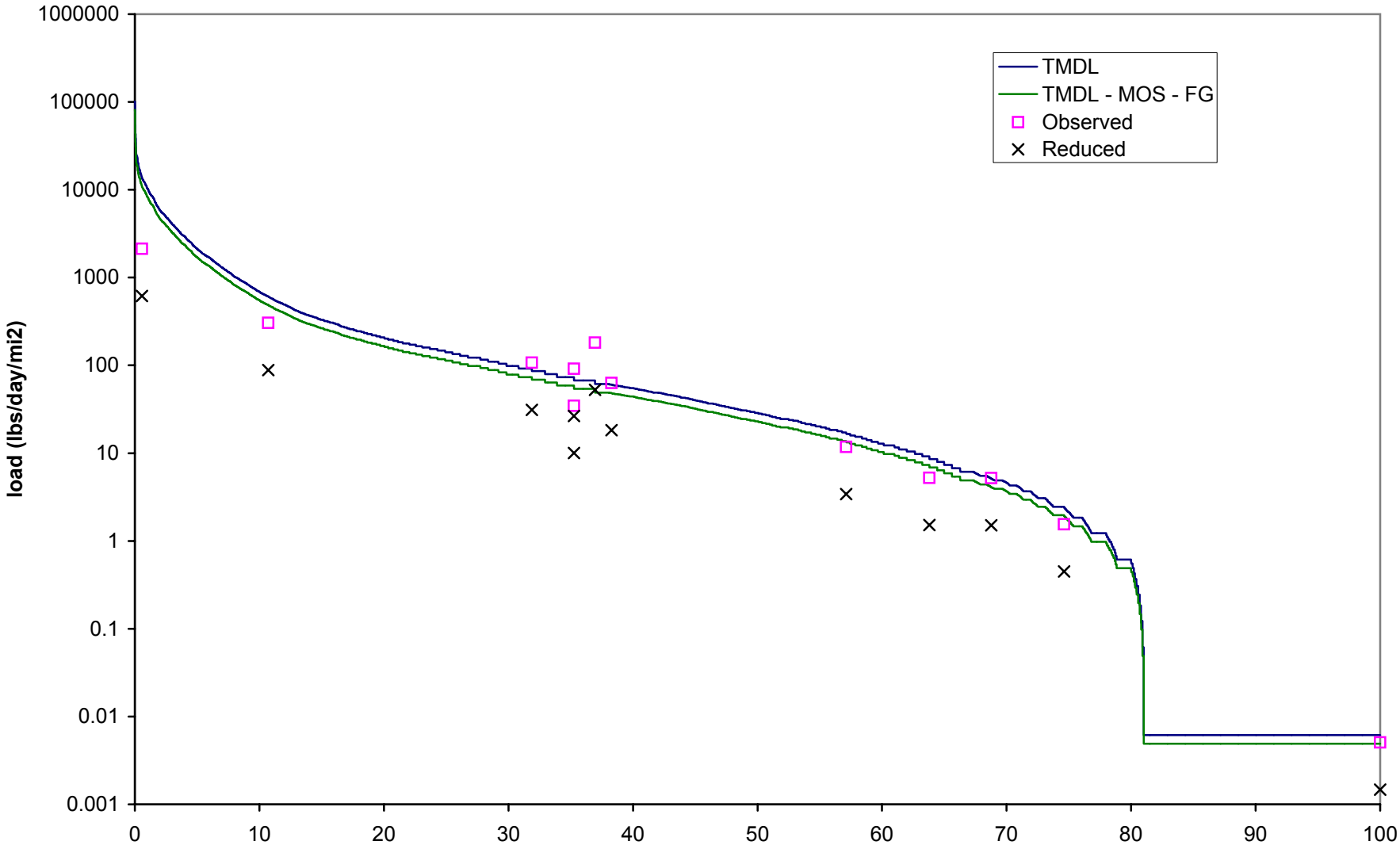

TABLE H.1 ALLOWABLE CHLORIDE LOAD FOR CROSS BAYOU NEAR SHREVEPORT, LA (1193)

Drainage 66 mi2, of USGS Gage
37.82 mi2, of watershed 100309

75 mg/L = Cl standard

Chloride Target 405.16 lbs/day/mi2

Date	Cypress Bayou flow (cfs)	Percent non exceed-ance	Percent exceed-ance	Flow per unit area (cfs/mi2)	Flow per unit area (cms/mi2)	Width on plot between data points (unitless)	Cl TMDL load (lbs/day/mi2)	TMDL - FG - MOS Cl load (lbs/day/mi2)	Area under TMDL curve (width times allowable load) (lbs/day/mi2)
6/15/1939	0.001	0.00	100.00	0.00	0.00	0.00711	6.1284E-03	4.9027E-03	3.49E-07
6/16/1939	0.001	0.01	99.99	0.00	0.00	0.00711	6.1284E-03	4.9027E-03	3.49E-07
6/17/1939	0.001	0.02	99.98	0.00	0.00	0.00711	6.1284E-03	4.9027E-03	3.49E-07
6/18/1939	0.001	0.02	99.98	0.00	0.00	0.00711	6.1284E-03	4.9027E-03	3.49E-07
6/19/1939	0.001	0.03	99.97	0.00	0.00	0.00711	6.1284E-03	4.9027E-03	3.49E-07
6/20/1939	0.001	0.04	99.96	0.00	0.00	0.00711	6.1284E-03	4.9027E-03	3.49E-07
6/21/1939	0.001	0.05	99.95	0.00	0.00	0.00711	6.1284E-03	4.9027E-03	3.49E-07
6/22/1939	0.001	0.05	99.95	0.00	0.00	0.00711	6.1284E-03	4.9027E-03	3.49E-07

For brevity, most of the rows in this spreadsheet have been hidden (between the 99.95% and the 0.05% exceedances).

1/30/1999	7,010	99.95	0.05	106.21	3.01	0.00711	42,960	34,368	2.444
4/5/1999	7,330	99.95	0.05	111.06	3.14	0.00711	44,921	35,937	2.555
1/5/1946	7,900	99.96	0.04	119.70	3.39	0.00711	48,414	38,731	2.754
4/14/1991	8,960	99.97	0.03	135.76	3.84	0.00711	54,910	43,928	3.124
4/23/1995	9,230	99.98	0.02	139.85	3.96	0.00711	56,565	45,252	3.218
8/3/1955	11,200	99.98	0.02	169.70	4.80	0.00711	68,638	54,910	3.905
4/5/1997	13,400	99.99	0.01	203.03	5.75	0.00711	82,120	65,696	4.672
1/29/1999	16,600	100.00	0.00	251.52	7.12	0.00711	101,731	81,385	5.787
								TOTAL =	405.16

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TABLE H.2 EXISTING LOAD AND PERCENT REDUCTION FOR CROSS BAYOU NEAR SHREVEPORT, LA (1193)

WQ standard for chloride =	75 mg/L	Error check for reduction is / is not needed:	ok
Percent reduction needed =	71%	Error check for less or more reduction needed:	ok

Date	Observed chloride at 1193 (mg/L)	Flow per unit area on sampling day (cms/mi2)	Percent exceedance for flow on sampling day	Current chloride load (lbs/day)/mi2	Reduced chloride load (lbs/day)/mi2	Allowable chloride load with MOS and FG incorporated (lbs/day)/mi2	Reduced load less than or equal to allow. load?
17-SEP-2002	62.1	0.00	100.00	0.01	0.00	0.00	Yes
13-AUG-2002	47.5	0.00	74.61	1.55	0.45	1.96	Yes
15-OCT-2002	75.6	0.00	68.78	5.19	1.50	4.12	Yes
10-DEC-2002	42.6	0.00	63.80	5.22	1.51	7.35	Yes
18-NOV-2002	51.6	0.00	57.13	11.81	3.42	13.73	Yes
15-JAN-2002	77.8	0.00	38.27	62.94	18.25	48.54	Yes
14-MAY-2002	202.0	0.00	36.95	181.56	52.65	53.93	Yes
19-FEB-2002	93.0	0.01	35.26	91.19	26.45	58.83	Yes
19-MAR-2002	35.3	0.01	35.26	34.61	10.04	58.83	Yes
11-JUN-2002	87.4	0.01	31.88	107.12	31.07	73.54	Yes
16-JUL-2002	37.4	0.04	10.71	305.60	88.62	490.27	Yes
09-APR-2002	11.8	0.95	0.58	2,130.88	617.96	10,835.00	Yes

Total number of values =	12
Allowable % of exceedances =	0%
Allowable no. of exceedances =	0
No. of exceedances before reductions =	5
No. of exceedances after reductions =	0

Total allowable loading per unit area to meet chloride standard (from Table H.1) =	405.16	lbs/day/mi2
Total allowable loading for Subsegment 100309 = 405.16 * 38 mi2 =	7.66	tons/day
Explicit MOS for chloride for Subsegment 100309 (10% * 7.66) =	0.77	tons/day
Future Growth for chloride for Subsegment 100309 (10% * 7.66) =	0.77	tons/day
Sum of design flows for point sources of chloride for Subsegment 100309 =	0.000	cms

Assumed effluent chloride concentration for point sources =	58	mg/L
Existing point source chloride load for Subsegment 100309 =	0.00	tons/day
WLA for chloride for Subsegment 100309 (same as existing Point Source load) =	0.00	tons/day
LA for chloride for Subsegment 100309 = total - MOS - WLA - FG =	6.12	tons/day

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APPENDIX I

Calculations for Subsegment 100309 Sulfate TMDL

Figure I.1. Sulfate Load Duration Curve for Cross Bayou (Subsegment 100309)

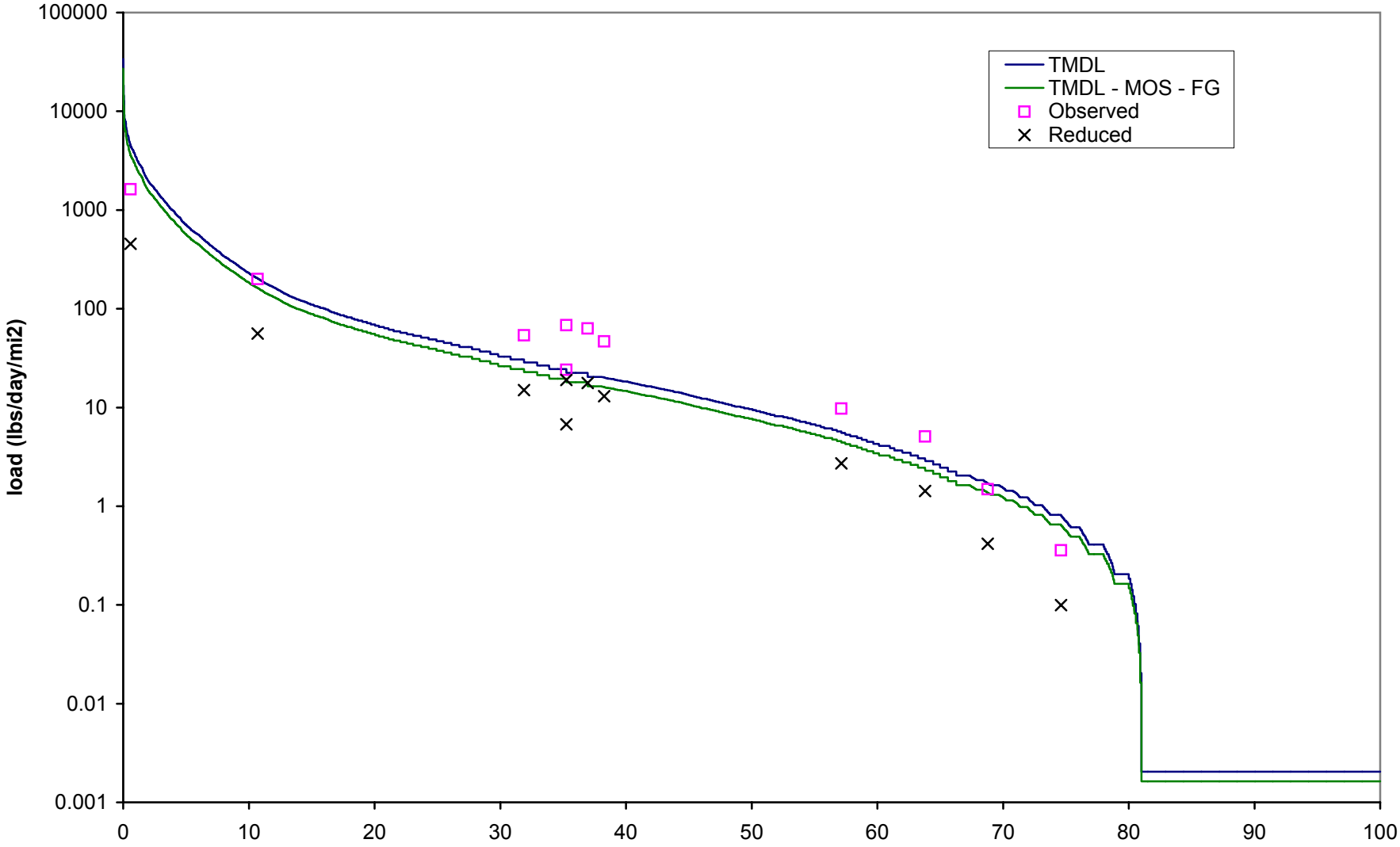

TABLE I.1 ALLOWABLE LOAD FOR SULFATE FOR CROSS BAYOU NEAR SHREVEPORT, LA (1193)

Drainage 66 mi2, of USGS Gage
37.82 mi2, of watershed 100309

25 mg/L = SO4 standard

Sulfate Target 135.05 lbs/day/mi2

Date	Cypress Bayou flow (cfs)	Percent non exceed- ance	Percent exceed- ance	Flow per unit area (cfs/mi2)	Flow per unit area (cms/mi2)	Width on plot between data points (unitless)	SO4 TMDL load (lbs/day/mi2)	TMDL - MOS - FG SO4 load (lbs/day/mi2)	Area under TMDL curve (width times allowable load)
6/15/1939	0.001	0.00	100.00	0.00	0.00	0.00711	2.0428E-03	1.6342E-03	1.16E-07
6/16/1939	0.001	0.01	99.99	0.00	0.00	0.00711	2.0428E-03	1.6342E-03	1.16E-07
6/17/1939	0.001	0.02	99.98	0.00	0.00	0.00711	2.0428E-03	1.6342E-03	1.16E-07
6/18/1939	0.001	0.02	99.98	0.00	0.00	0.00711	2.0428E-03	1.6342E-03	1.16E-07
6/19/1939	0.001	0.03	99.97	0.00	0.00	0.00711	2.0428E-03	1.6342E-03	1.16E-07
6/20/1939	0.001	0.04	99.96	0.00	0.00	0.00711	2.0428E-03	1.6342E-03	1.16E-07
6/21/1939	0.001	0.05	99.95	0.00	0.00	0.00711	2.0428E-03	1.6342E-03	1.16E-07
6/22/1939	0.001	0.05	99.95	0.00	0.00	0.00711	2.0428E-03	1.6342E-03	1.16E-07

For brevity, most of the rows in this spreadsheet have been hidden (between the 99.95% and the 0.05% exceedances).

1/30/1999	7,010	99.95	0.05	106.21	3.01	0.00711	14,320	11,456	0.815
4/5/1999	7,330	99.95	0.05	111.06	3.14	0.00711	14,974	11,979	0.852
1/5/1946	7,900	99.96	0.04	119.70	3.39	0.00711	16,138	12,910	0.918
4/14/1991	8,960	99.97	0.03	135.76	3.84	0.00711	18,303	14,643	1.041
4/23/1995	9,230	99.98	0.02	139.85	3.96	0.00711	18,855	15,084	1.073
8/3/1955	11,200	99.98	0.02	169.70	4.80	0.00711	22,879	18,303	1.302
4/5/1997	13,400	99.99	0.01	203.03	5.75	0.00711	27,373	21,899	1.557
1/29/1999	16,600	100.00	0.00	251.52	7.12	0.00711	33,910	27,128	1.929
								TOTAL =	135.05

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TABLE I.2 EXISTING LOAD AND PERCENT REDUCTION FOR CROSS BAYOU NEAR SHREVEPORT, LA (1193)

WQ standard for SO4 = 25 mg/L
Percent reduction needed = 72%

Error check for reduction is / is not needed: ok
Error check for less or more reduction needed: ok

Date	Observed SO4 at stn 1193 (mg/L)	Flow per unit area on sampling day (cms/mi2)	Percent exceedance for flow on sampling day	Current SO4 load (lbs/day)/mi2	Reduced SO4 load (lbs/day)/mi2	Allowable SO4 load with MOS and FG incorporated (lbs/day)/mi2	Reduced load less than or equal to allow. load?
17-SEP-2002	8.6	0.00	100.00	0.00	0.00	0.00	Yes
13-AUG-2002	10.9	0.00	74.61	0.36	0.10	0.65	Yes
15-OCT-2002	21.7	0.00	68.78	1.49	0.42	1.37	Yes
10-DEC-2002	41.4	0.00	63.80	5.07	1.42	2.45	Yes
18-NOV-2002	42.5	0.00	57.13	9.72	2.72	4.58	Yes
15-JAN-2002	57.6	0.00	38.27	46.60	13.05	16.18	Yes
14-MAY-2002	70.2	0.00	36.95	63.10	17.67	17.98	Yes
19-FEB-2002	69.3	0.01	35.26	67.95	19.03	19.61	Yes
19-MAR-2002	24.6	0.01	35.26	24.12	6.75	19.61	Yes
11-JUN-2002	43.8	0.01	31.88	53.68	15.03	24.51	Yes
16-JUL-2002	24.5	0.04	10.71	200.19	56.05	163.42	Yes
09-APR-2002	9.0	0.95	0.58	1,625.25	455.07	3,611.67	Yes

Total number of values =	12
Allowable % of exceedances =	0%
Allowable no. of exceedances =	0
No. of exceedances before reductions =	8
No. of exceedances after reductions =	0

Total allowable loading per unit area to meet SO4 standard (from Table I.1) =	135.05	lbs/day/mi2
Total allowable loading for Subsegment 100309 = 135.05 * 190 mi2 =	12.86	tons/day
Explicit MOS for SO4 for Subsegment 100309 (10% * 12.86) =	1.29	tons/day
Future Growth for SO4 for Subsegment 100309 (10% * 12.86) =	1.29	tons/day
Sum of design flows for point sources of SO4 for Subsegment 100309 =	0.000	cms

Assumed effluent SO4 concentration for point sources =	30	mg/L
Existing point source SO4 load for Subsegment 100309 =	0.00	tons/day
WLA for SO4 for Subsegment 100309 (same as existing Point Source load) =	0.00	tons/day
LA for SO4 for Subsegment 100309 = total - MOS - WLA - FG =	10.28	tons/day

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APPENDIX J

Calculations for Subsegment 100309 TDS TMDL

Figure J.1 TDS Load Duration Curve for Cross Bayou (subsegment 100309)

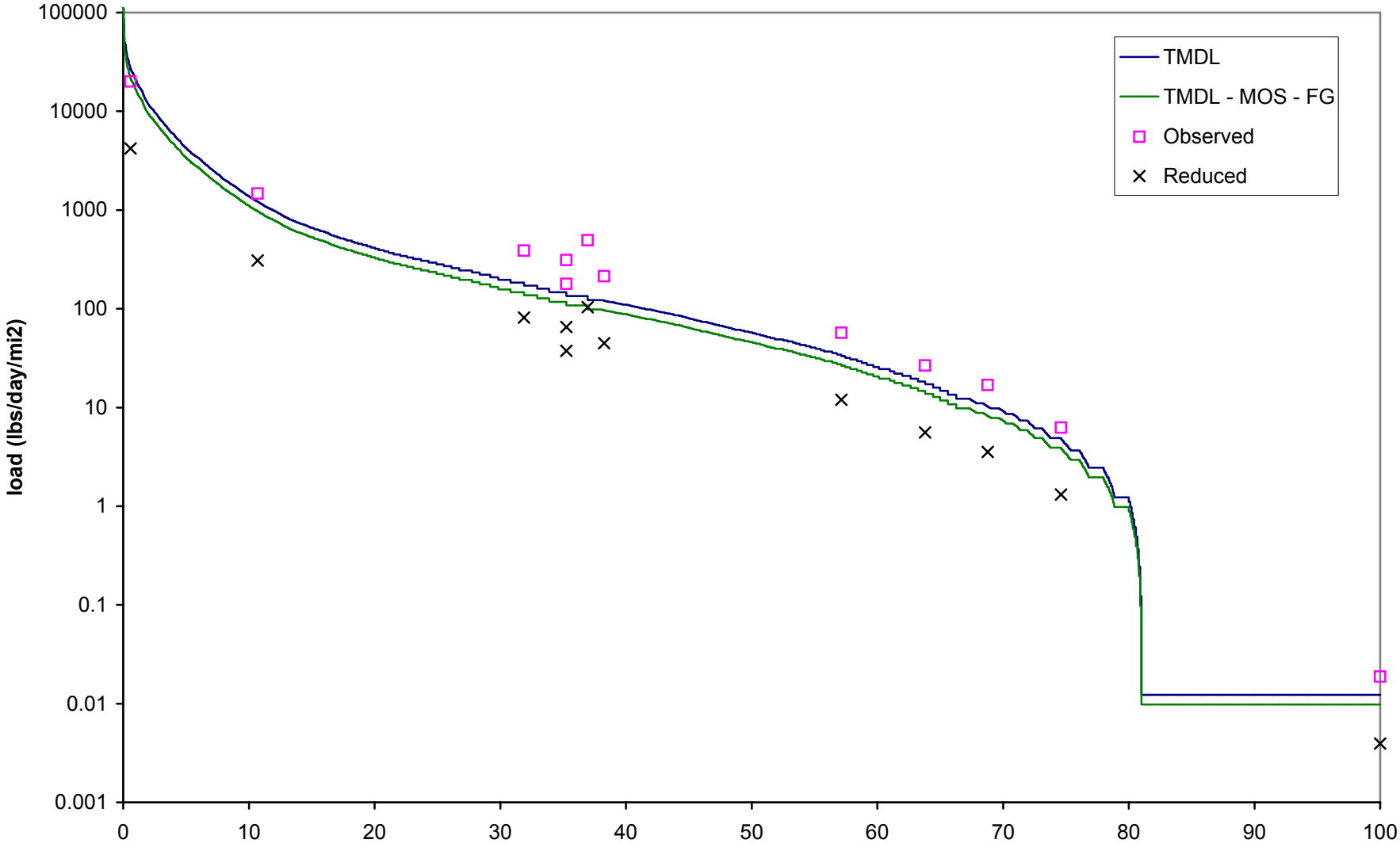

TABLE J.1 ALLOWABLE TDS LOAD FOR CROSS BAYOU NEAR SHREVEPORT, LA (1193)

Drainage 66 mi2, of USGS Gage
37.82 mi2, of watershed 100309 150 mg/L = TDS standard

TDS Target 810.31 lbs/day/mi2

Date	Cypress Bayou flow (cfs)	Percent non exceed-ance	Percent exceed-ance	Flow per unit area (cfs/mi2)	Flow per unit area (cms/mi2)	Width on plot between data points (unitless)	TDS TMDL load (lbs/day/mi2)	TMDL - MOS - FG TDS load (lbs/day/mi2)	Area under TMDL curve (width times allowable load) (lbs/day/mi2)
6/15/1939	0.001	0.00	100.00	0.00	0.00	0.00711	1.2257E-02	9.8054E-03	6.97E-07
6/16/1939	0.001	0.01	99.99	0.00	0.00	0.00711	1.2257E-02	9.8054E-03	6.97E-07
6/17/1939	0.001	0.02	99.98	0.00	0.00	0.00711	1.2257E-02	9.8054E-03	6.97E-07
6/18/1939	0.001	0.02	99.98	0.00	0.00	0.00711	1.2257E-02	9.8054E-03	6.97E-07
6/19/1939	0.001	0.03	99.97	0.00	0.00	0.00711	1.2257E-02	9.8054E-03	6.97E-07
6/20/1939	0.001	0.04	99.96	0.00	0.00	0.00711	1.2257E-02	9.8054E-03	6.97E-07
6/21/1939	0.001	0.05	99.95	0.00	0.00	0.00711	1.2257E-02	9.8054E-03	6.97E-07
6/22/1939	0.001	0.05	99.95	0.00	0.00	0.00711	1.2257E-02	9.8054E-03	6.97E-07

For brevity, most of the rows in this spreadsheet have been hidden (between the 99.95% and the 0.05% exceedances).

1/30/1999	7,010	99.95	0.05	106.21	3.01	0.00711	85,920	68,736	4.888
4/5/1999	7,330	99.95	0.05	111.06	3.14	0.00711	89,842	71,873	5.111
1/5/1946	7,900	99.96	0.04	119.70	3.39	0.00711	96,828	77,463	5.508
4/14/1991	8,960	99.97	0.03	135.76	3.84	0.00711	109,820	87,856	6.247
4/23/1995	9,230	99.98	0.02	139.85	3.96	0.00711	113,130	90,504	6.436
8/3/1955	11,200	99.98	0.02	169.70	4.80	0.00711	137,275	109,820	7.809
4/5/1997	13,400	99.99	0.01	203.03	5.75	0.00711	164,240	131,392	9.343
1/29/1999	16,600	100.00	0.00	251.52	7.12	0.00711	203,462	162,769	11.574
								TOTAL =	810.31

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TABLE J.2 EXISTING LOAD AND PERCENT REDUCTION FOR CROSS BAYOU NEAR SHREVEPORT, LA (1193)

WQ standard for TDS = 150 mg/L
Percent reduction needed = 79%

Error check for reduction is / is not needed: ok
Error check for less or more reduction needed: ok

Date	Observed TDS at stn 1193 (mg/L)	Flow per unit area on sampling day (cms/mi2)	Percent exceedance for flow on sampling day	Current TDS load (lbs/day)/mi2	Reduced TDS load (lbs/day)/mi2	Allowable TDS load with MOS and FG incorporated (lbs/day)/mi2	Reduced load less than or equal to allow. load?
17-SEP-2002	230.0	0.00	100.00	0.02	0.00	0.01	Yes
13-AUG-2002	191.0	0.00	74.61	6.24	1.31	3.92	Yes
15-OCT-2002	246.0	0.00	68.78	16.88	3.55	8.24	Yes
10-DEC-2002	217.0	0.00	63.80	26.60	5.59	14.71	Yes
18-NOV-2002	249.0	0.00	57.13	56.97	11.96	27.46	Yes
15-JAN-2002	264.0	0.00	38.27	213.56	44.85	97.07	Yes
14-MAY-2002	550.0	0.00	36.95	494.36	103.81	107.86	Yes
19-FEB-2002	318.0	0.01	35.26	311.81	65.48	117.67	Yes
19-MAR-2002	182.0	0.01	35.26	178.46	37.48	117.67	Yes
11-JUN-2002	316.0	0.01	31.88	387.31	81.34	147.08	Yes
16-JUL-2002	179.0	0.04	10.71	1462.64	307.16	980.54	Yes
09-APR-2002	111.0	0.95	0.58	20044.75	4209.40	21670.00	Yes

Total number of values =	12
Allowable % of exceedances =	0%
Allowable no. of exceedances =	0
No. of exceedances before reductions =	11
No. of exceedances after reductions =	0

Total allowable loading per unit area to meet stds (from Table J.1) = 810.31 lbs/day/mi2
Total allowable loading for Subsegment 100309 = 810.31 * 38 mi2 = 15.33 tons/day

Explicit MOS for TDS for Subsegment 100309 (10% * 15.33) = 1.53 tons/day

Future Growth for TDS for Subsegment 100309 (10% * 15.33) =	1.53	tons/day
Sum of design flows for point sources of TDS for Subsegment 100309 =	0.000	cms
Assumed effluent TDS concentration for point sources =	425	mg/L
Existing point source TDS load for Subsegment 100309 =	0.00	tons/day
WLA for TDS for Subsegment 100309 (same as existing Point Source load) =	0.00	tons/day
LA for TDS for Subsegment 100309 = total - MOS - WLA - FG=	12.27	tons/day

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