Bayou Toro (Subsegment 110402), Louisiana, Final TMDL for Dissolved Lead

Prepared for:

Louisiana Department of Environmental Quality, Water Quality Assessment Division,
Total Maximum Daily Load Program

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October 2010

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EXECUTIVE SUMMARY

Section 303(d) of the Clean Water Act and the U.S. Environmental Protection Agency's Water Quality Planning and Management Regulations (Title 40 of the *Code of Federal Regulations* Part 130) require states to identify waterbodies that are not meeting water quality standards and to develop total maximum daily loads (TMDLs) of pollutants for those waterbodies. A TMDL establishes the amount of a pollutant that a waterbody can assimilate without exceeding its water quality standard for that pollutant. TMDLs provide the scientific basis for a state to establish water quality-based controls to reduce pollution from both point and nonpoint sources in order to restore and maintain the quality of the state's water resources (USEPA 1991).

A TMDL for a given pollutant and waterbody is composed of the sum of individual wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include an implicit or explicit margin of safety (MOS) to account for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. The TMDL components are illustrated using the following equation:

$$TMDL = \sum WLAs + \sum LAs + MOS.$$

This dissolved lead TMDL has been developed for Bayou Toro, in the Sabine River Basin in western Louisiana. Bayou Toro flows for 12 miles from LA 473 to the Sabine River.

For the purpose of TMDL development, the dissolved lead numerical criteria were calculated using the freshwater chronic value for aquatic life protection using the average hardness values from 2006 at station 1161 (Bayou Toro at Louisiana Highway 392, Louisiana). The dissolved lead numerical criterion for Bayou Toro was determined to be 0.54 microgram per liter. For the purpose of this TMDL, dissolved lead was considered to be a conservative parameter. Using the 7Q10 flow at the end of subsegment 110402 and the calculated lead criterion, a TMDL of 0.00126 pound per day was calculated for lead contributions from the subsegment. The TMDL was then allocated to its WLA, MOS, and LA components.

1. Introduction

Section 303(d) of the Clean Water Act and the U.S. Environmental Protection Agency's (EPA's) Water Quality Planning and Management Regulations (Title 40 of the *Code of Federal Regulations* [CFR] Part 130) require states to develop total maximum daily loads (TMDLs) of pollutants for waterbodies that are not supporting their designated uses, even if pollutant sources have implemented technology-based controls. A TMDL establishes the maximum allowable load (mass per unit of time) of a pollutant that a waterbody is able to assimilate and still support its designated uses. The maximum allowable load is determined on the basis of the relationship between pollutant sources and in-stream water quality. A TMDL provides the scientific basis for a state to establish water quality-based controls to reduce pollution from both point and nonpoint sources to restore and maintain the quality of the state's water resources (USEPA 1991).

A TMDL for a given pollutant and waterbody is composed of the sum of individual wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include an implicit or explicit margin of safety (MOS) to account for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. The TMDL components are illustrated in the following equation:

$$TMDL = \sum WLAs + \sum LAs + MOS.$$

This dissolved lead TMDL has been developed for Bayou Toro, in the Sabine River Basin in western Louisiana. Bayou Toro flows for 12 miles from LA 473 to the Sabine River (Figure 1-1).

LDEQ placed Bayou Toro on the 2004 and 2006 editions of the state's *Louisiana Water Quality Inventory: Integrated Report* (*Integrated Report*) and was identified as not supporting its designated use of primary contact recreation because of total fecal coliform from managed pasture grazing (LDEQ 2005, 2007a). The state's draft 2008 *Integrated Report* includes an impairment to the fish and wildlife propagation designated use because of lead. The suspected source of impairment from lead is unknown (LDEQ 2008).

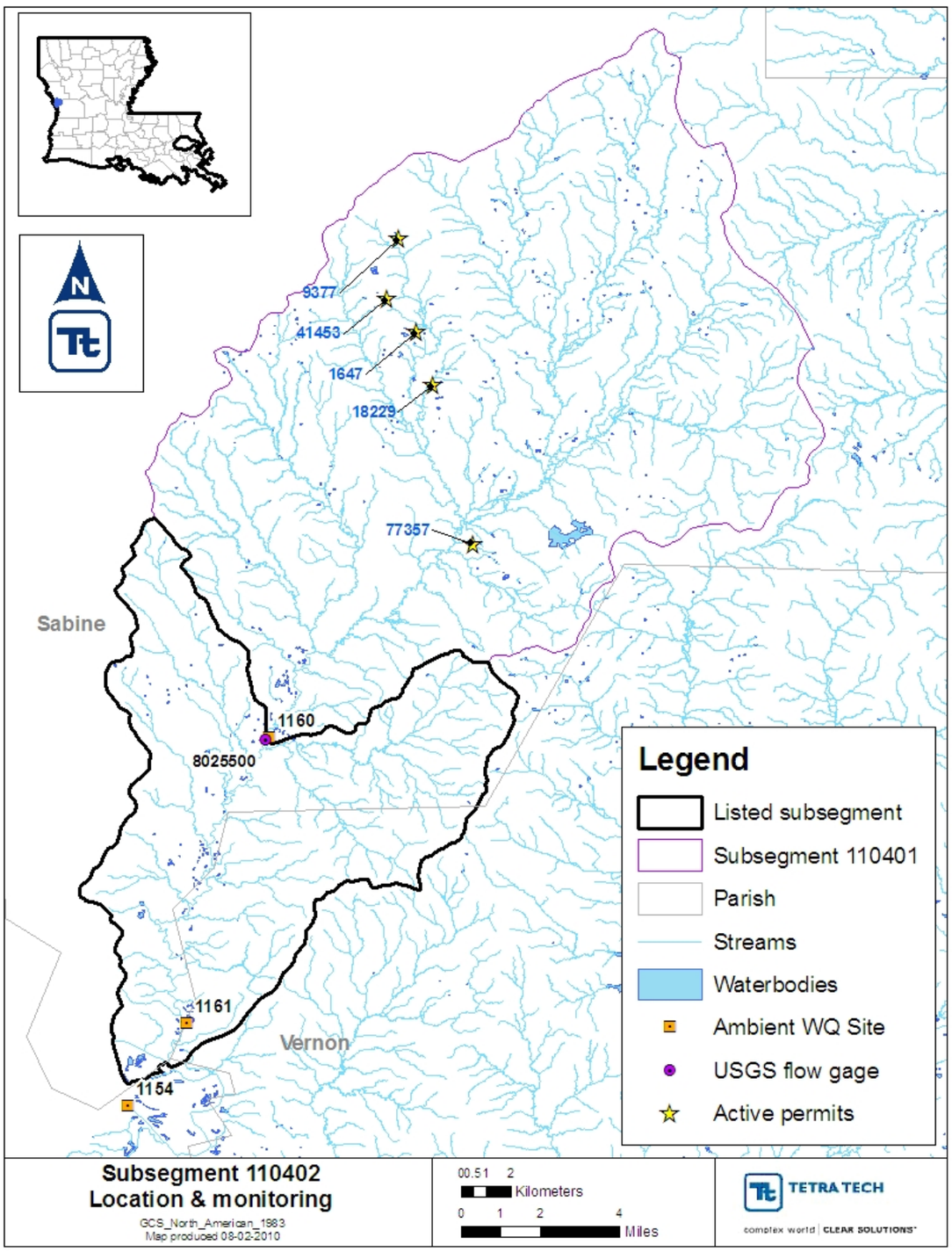

Figure 1-1. Subsegment 110402 (Bayou Toro) location and monitoring.

2. Study Area Description

2.1 Sabine River Basin—Bayou Toro

This dissolved lead TMDL has been developed for Bayou Toro, in the Sabine River Basin in western Louisiana. Bayou Toro flows for 12 miles from LA 473 to the Sabine River (Figure 1-1).

The Sabine River Basin lies along the Texas/Louisiana border, encompassing more than 2,900 square miles of drainage area in Louisiana. The basin stretches from the Texas state line near Shreveport to the Gulf of Mexico. It is bounded on the east by the Red River Basin and the Calcasieu River Basin. Characteristic vegetation ranges from mixed forests in the upper basin to hardwoods in the mid-section and brackish and saline marshes in the lower end. The land-use in the Sabine Basin ranges from forests and pastures in the northern section to marshes, both brackish and saline, to the south (LDEQ 1998).

Land use data from the 2001 National Land Cover Database (NLCD) were used in Table 2-1 and Figure 2-1. NLCD 2001 is a land-cover database composed of land cover, impervious surface, and canopy density data. NLCD 2001 uses improved classification algorithms, which result in data with more precise rendering of spatial boundaries between the 16 classes than those obtained using NLCD 1992 (USEPA 2007).

Table 2-1. Subsegment 110402 land use (NLCD 2001)

Land use	Percent
Open water	0.43%
Developed	3.51%
Barren land	0.05%
Forest	55.48%
Grass/shrub	18.98%
Pasture/hay	0.32%
Cultivated crops	0%
Woody wetlands	21.10%
Emergent herbaceous wetlands	0.13%

Source: USEPA 2007

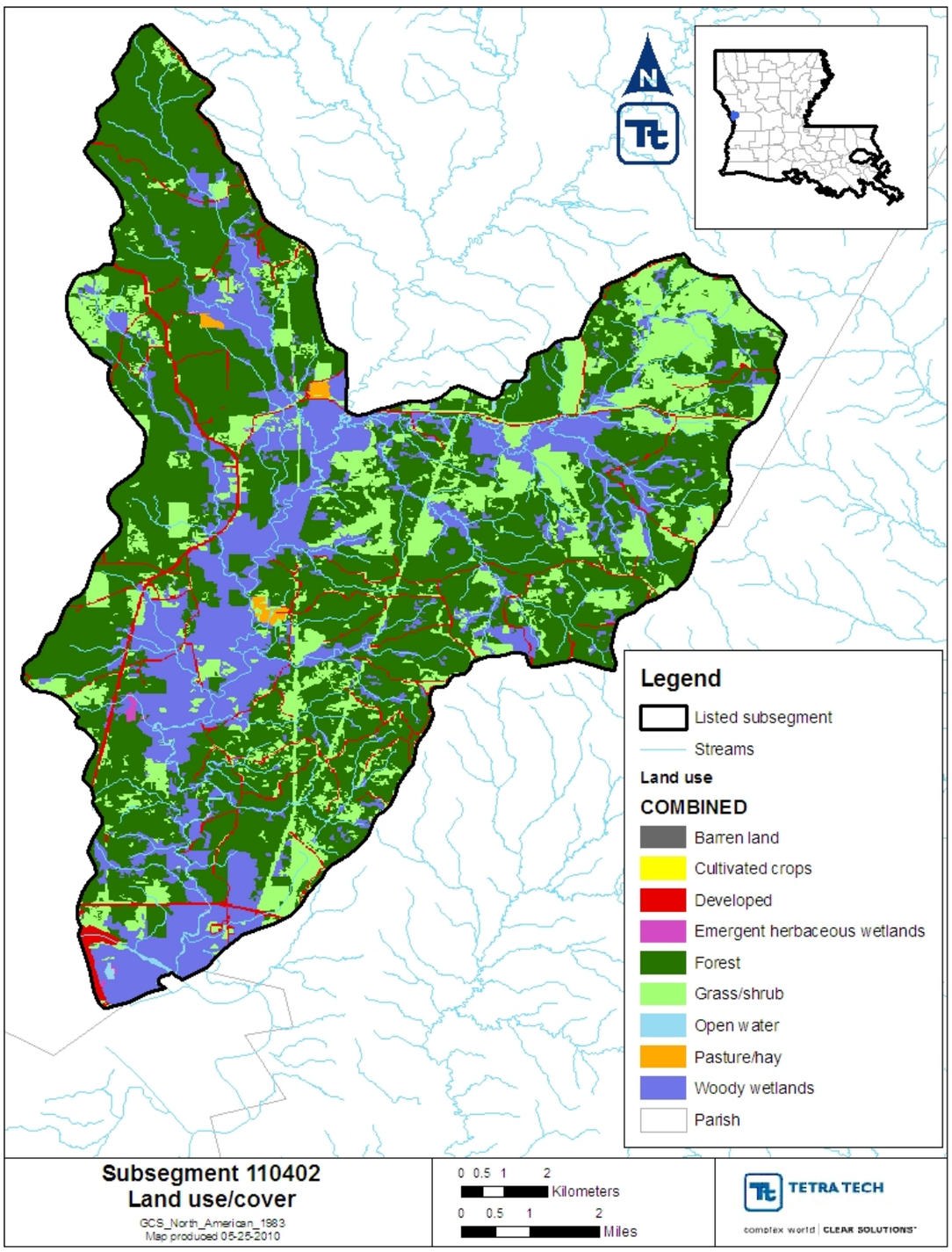

Figure 2-1. Land use in subsegment 110402 (Bayou Toro).

2.2 Water Quality Data

One water quality station is on subsegment 110402 with lead data collected since 2002. Station 1161 (Bayou Toro at Louisiana Highway 392, Louisiana) has had eight dissolved lead observations collected since 2002. Appendix A contains the raw water quality data. The lead data from station 1161 containing current data were plotted over time for subsegment 110402 (Figure 2-2). There are no distinct seasonal trends or patterns can be seen in the water quality data.

Bayou Toro flows into a channel that by-passes the Toledo Bend dam and power station and carries water from the reservoir via a spillway to the Sabine River below the dam. This channel does not always carry flow from the reservoir. At times, Bayou Toro has backwater flow from the by-pass channel. The assessment site for Toledo Bend Reservoir southwest of Haddens, Louisiana (Station 1154) is at the intake to the power station. Examination of Station 1154 data since January 2000 reveals that the concentrations for lead are lower than the concentrations recorded at Station 1161 (Bayou Toro at Louisiana Highway 392, Louisiana) and Station 1160 (Bayou Toro northeast of Toro, Louisiana). It does not appear that the violations of lead criteria for Bayou Toro are caused by backwatering from water discharging from Toledo Bend Reservoir.

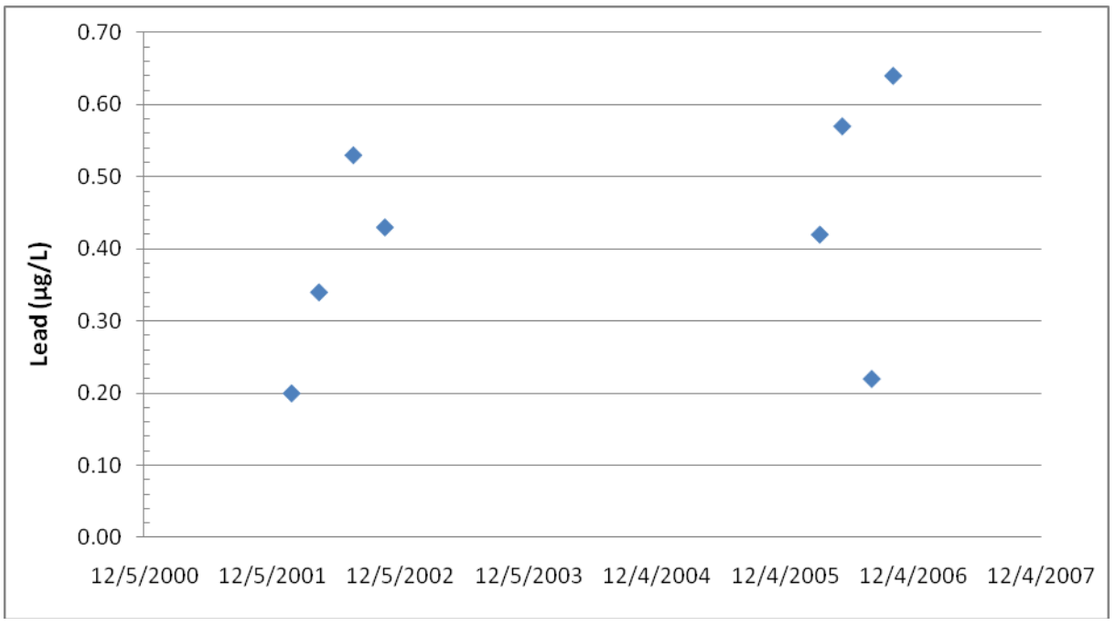

Figure 2-2. Lead data at station 1161.

2.2 Water Quality Standards and Criteria

The designated uses for subsegment 110402 include primary and secondary contact recreation, and propagation of fish and wildlife. Primary contact recreation includes any recreational or other water contact activity involving prolonged or regular full-body contact with the water and in which the probability of ingesting appreciable amounts of water is considerable. Examples of that type of water use include swimming, water skiing, and diving (LDEQ 2007b). Secondary contact recreation includes any recreational or other water contact activity in which prolonged or regular full-body contact with the water is either incidental or accidental, and the probability of ingesting appreciable amounts of water is minimal. Examples of that type of water use include fishing, wading, and boating (LDEQ 2007b). The criteria for protection of aquatic life are based on acute and chronic concentrations in fresh and marine waters and are developed primarily for attainment of the fish and wildlife propagation use.

The aquatic life criterion was used for this TMDL along with the 7Q10 flow for the waterbody. Metals criteria are based on hardness concentrations in ambient waters. The criterion was calculated from the freshwater chronic criteria equation (LDEQ 2009):

$$\text{Criterion} = e^{((1.2730 \times (ln(\text{hardness}))) - 4.7050)} \times (1.46203 - (0.145712 \times ln(\text{hardness})))$$

Hardness concentrations from 2002–2006 at station 1161 were averaged and used in calculating the lead criteria. The average hardness concentration for the subsegment 110402 is 23.98 milligrams per liter (mg/L). The minimum and maximum hardness concentration to be used for criteria calculation is 25 mg/L, as specified in 40 CFR 131.36 (LDEQ 2007b). Since the average hardness concentration was less than the minimum value, 25 mg/L was used to calculate the lead criterion. The applicable chronic lead criterion, therefore, is 0.54 µg/L. The criterion applies at all times. The available dissolved lead data and the sample exceedances are shown in Appendix A.

The Louisiana water quality standards also include an antidegradation policy (*Louisiana Administrative Code* Title 33, Part IX, Section 1109.A), which states that state waters exhibiting high water quality should be maintained at that high level of water quality. If that is not possible, water quality of a level that supports the designated uses of the waterbody should be maintained. The designated uses of a waterbody may be changed to allow a lower level of water quality only through a use attainability study. LDEQ has developed this TMDL to be consistent with the state's antidegradation policy (LDEQ 2000).

2.3 Flow

One active U.S. Geological Survey (USGS) flow monitoring gage, 08025500 (Bayou Toro near Toro, Louisiana), is on subsegement 110402. The critical low flow (7Q10) is 1.2 cubic feet per second (cfs) (Ensminger and Wright 2003).

2.4 Identification of Sources

Louisiana's draft 2008 *Integrated Report* lists Bayou Toro as not supporting its designated use of fish and wildlife propagation because of lead from unknown sources (LDEQ 2008). LDEQ has established a group of reference streams throughout the state that exhibit near-pristine characteristics and have no man-made sources discharging or contributing runoff into them. Two of the reference streams in the Calcasieu Basin—Six Mile Creek and Beckwith Creek—were found as not supporting the lead criteria during the 2000 305(b) assessment. Therefore, LDEQ concluded that natural background loading is the dominant source of lead in other waterbodies in the state (LDEQ 2004).

Information on point source dischargers in the subsegment was obtained from LDEQ files. According to the LDEQ discharger database, no active point sources are discharging into subsegment 110402. There are five permits located upstream of subsegment 110402 in subsegment 110401: Boise Cascade Wood Products – Fisher Sawmill (AI 9377); Village of Florien (AI 41543); Boise Building Solutions Manufacturing (AI 1647); Milbrooke Apartments (AI 18229); and Emerald Hills Golf Resort (AI 77357).

3. TMDL Load Calculations

A TMDL is the total amount of a pollutant that can be assimilated by the receiving waterbody while still achieving water quality standards. In TMDL development, allowable loadings from all pollutant sources that cumulatively amount to no more than the TMDL must be established and thereby provide the basis for establishing water quality-based controls.

A TMDL for a given pollutant and waterbody is composed of the sum of individual WLAs for point sources, LAs for nonpoint sources and natural background levels. In addition, the TMDL must

include an implicit or explicit MOS to account for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. The TMDL components are illustrated using the following equation:

$$TMDL = \sum WLAs + \sum LAs + MOS.$$

TMDLs are typically expressed as a mass loading (e.g., pounds per day).

Both section 303(d) of the Clean Water Act and the regulations at 40 CFR 130.7 require that TMDLs include an 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 using conservative assumptions in establishing the TMDL. For a more detailed discussion of the MOS, see Section 3.4.

3.1 Load Determination for Bayou Toro (110402)

The sampling events used as the basis for this TMDL were performed to meet the needs of the state to develop the *Integrated Report*, which includes the biennial section 305(b) report (*Water Quality Inventory*) and the section 303(d) list of impaired waters. The data are adequate for a conservative TMDL according to the assumption that no fate and transport mechanisms are present in the waterbody. Data gathering did not include any flow measurements, any hardness measurements, nor any upstream sampling and measurements for background conditions. Without such data, fate and transport modeling and calculating reductions required from current loads are not possible.

Calculating the TMDL

Dissolved lead was treated as a conservative parameter. The following equation was used to calculate the dissolved lead TMDL, and the TMDL calculations are shown below.

$$TMDL \text{ (lb/day)} = (\textit{lead criterion} \text{ [mg/L]}) \times (\textit{critical flow} \text{ [mgd]}) \times 8.345$$

where 8.345 is a conversion factor. Only data collected during 2002 and 2006 were used in this TMDL. To calculate the TMDL for subsegment 110402, the loadings from the entire Bayou Toro watershed, which also includes subsegment 110401, was calculated using the criterion at the base of the basin at Station 1161. The loading from the upstream portion of the watershed (subsegment 110401) was then determined using the critieron at Station 1160, which was determined to be 0.565 mg/L using the hardness concentrations at that station. The difference of these loadings was determined to be the TMDL for subsegment 110402. The drainage area of the USGS gage is 148 square miles, which also represents the upstream area of subsegment 110401. The area of subsegment 110402 is 59.45 square miles. Using these areas, the critical flow for the entire watershed was determined to be 1.68 cfs of 1.09 mgd.

Loading for the entire Bayou Toro drainage area

Lead criterion = 0.54 µg/L = 0.00054 mg/L

Critical flow (7Q10) = 1.68 cfs = 1.09 mgd

Loading = (0.00054 mg/L) × (1.09 mgd) × 8.345 = 0.00491 lb/day

Loading for the Station 1161 drainage area

Lead criterion = 0.565 µg/L = 0.000565 mg/L

Critical flow (7Q10) = 1.2 cfs = 0.776 mgd

Loading = (0.000565 mg/L) × (0.776 mgd) × 8.345 = 0.00365 lb/day

TMDL for Subsegment 110402
TMDL = 0.00491 – 0.00365 = 0.00126 lb/day

3.2 Wasteload Allocation (WLA)

The WLA portion of the TMDL equation is the total loading of a pollutant that is assigned to point sources. Subsegment 110402 does not contain actively permitted facilities with lead limitations. Therefore, the WLA is zero. The point sources identified in Section 2.4 are in an upstream subsegment and are included in the water quality data and assessments for subsegement 110402. These upstream point sources are not believed to be impacting subsegment 110402 and will not require a WLA.

3.3 Seasonal Variability

Because ambient monitoring data indicate that there is little variability of trace metals levels throughout the year, LDEQ has not defined a critical season.

3.4 Margin of Safety (MOS)

The Clean Water Act requires that TMDLs take into consideration an MOS. The MOS is the portion of the pollutant loading reserved to account for any uncertainty in the data. There are two ways to incorporate the MOS. One is to implicitly incorporate it by using conservative model assumptions to develop allocations. The other is to explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations (USEPA 1991). For this TMDL, an explicit MOS of 20 percent was used. The MOS is 0.00025 lb/day.

3.5 Load Allocation (LA)

The LA is the portion of the TMDL assigned to natural background loadings and nonpoint sources urban runoff and other anthropogenic sources. The LA was calculated (see below) for this TMDL by subtracting the WLA and MOS from the total TMDL. LAs were not allocated to separate nonpoint sources because of the lack of available source characterization data. The LAs include natural background sources.

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

$$\sum \text{LAs} = 0.00126 - 0 - 0.00025$$

$$\sum \text{LAs} = 0.00101 \text{ lb/day}$$

4. Monitoring Plan

LDEQ uses funds provided under section 106 of the Clean Water Act and under the authority of the Louisiana Environmental Quality Act to run a program for monitoring the quality of the state's surface waters. The LDEQ Surveillance Section collects surface water samples at various locations using appropriate sampling methods and procedures to ensure 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, develop a long-term database for water quality trend analysis, and monitor the effectiveness of pollution controls. The data obtained through the surface water monitoring program are used to

develop the state's biennial *Water Quality Inventory* and the section 303(d) list of impaired waters. That information is also used to establish priorities for LDEQ's nonpoint source program.

LDEQ has implemented a watershed approach to surface water quality monitoring. Through that approach, the entire state is sampled on 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 monthly to yield approximately 12 samples per site during each year the site is monitored. Sampling sites are where they are considered representative of the waterbody. Within each basin, all monitored subsegments will be sampled over the year or years specified under each cycle period. Bayou Toro was monitored with the Sabine River Basin in 2006, 2007, and 2010. Water quality assessments for the 305(b)/303(d) Integrated Report will be conducted for each basin following the last year of its monitoring period. Usually 125 waterbody subsegments are monitored each month under the program. Under the current monitoring schedule, approximately one-half of the state's waters are newly assessed for section 305(b) and section 303(d) listing purposes for each 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. Monitoring allows LDEQ to determine whether any improvement has occurred in water quality after the TMDLs have been implemented. When LDEQ evaluates monitoring results at the end of each year, it may add waterbodies to or remove them from the section 303(d) list of impaired waterbodies.

5. Public Participation

Federal regulations require LDEQ to notify the public and seek comments concerning the TMDLs it prepares. This TMDL was developed under contract to LDEQ, and LDEQ will hold a public review period seeking comments, information, and data from the public and any other interested party. The notice for the public review period will be published in local and state newspapers and on LDEQ's electronic notification system. The TMDL report will be available on LDEQ's TMDL Web site at www.deq.louisiana.gov/portal/default.aspx?tabid=1563. The public review period will last for 30 days. LDEQ will review all comments received, and this TMDL might be revised to reflect comments if appropriate.

6. References

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Appendix A. Hardness and Lead Monitoring Data

Table A-1. Hardness data for station 1161

Site	Collection date[a]	Result (mg/L)
Bayou Toro at Louisiana Highway 392, Louisiana	2/25/2002	21.9
Bayou Toro at Louisiana Highway 392, Louisiana	3/26/2002	20.2
Bayou Toro at Louisiana Highway 392, Louisiana	4/16/2002	22.1
Bayou Toro at Louisiana Highway 392, Louisiana	5/21/2002	23.8
Bayou Toro at Louisiana Highway 392, Louisiana	6/18/2002	23.7
Bayou Toro at Louisiana Highway 392, Louisiana	7/23/2002	20.8
Bayou Toro at Louisiana Highway 392, Louisiana	8/20/2002	19.3
Bayou Toro at Louisiana Highway 392, Louisiana	9/23/2002	26.2
Bayou Toro at Louisiana Highway 392, Louisiana	10/21/2002	23.6
Bayou Toro at Louisiana Highway 392, Louisiana	11/19/2002	21.6
Bayou Toro at Louisiana Highway 392, Louisiana	12/17/2002	19
Bayou Toro at Louisiana Highway 392, Louisiana	1/24/2006	31.9
Bayou Toro at Louisiana Highway 392, Louisiana	2/14/2006	20.2
Bayou Toro at Louisiana Highway 392, Louisiana	3/14/2006	26.2
Bayou Toro at Louisiana Highway 392, Louisiana	4/4/2006	29
Bayou Toro at Louisiana Highway 392, Louisiana	4/25/2006	22.6
Bayou Toro at Louisiana Highway 392, Louisiana	5/17/2006	27.9
Bayou Toro at Louisiana Highway 392, Louisiana	6/6/2006	28.4
Bayou Toro at Louisiana Highway 392, Louisiana	7/12/2006	30.6
Bayou Toro at Louisiana Highway 392, Louisiana	8/9/2006	25.5
Bayou Toro at Louisiana Highway 392, Louisiana	10/9/2006	22.1
Bayou Toro at Louisiana Highway 392, Louisiana	10/24/2006	21
Bayou Toro at Louisiana Highway 392, Louisiana	12/4/2006	24

a. Data from before 2002 were not included in TMDL analysis.

Table A-2. Hardness summary statistics for station 1161

Statistic	Value
Minimum (mg/L)	19
Maximum (mg/L)	31.9
Average (mg/L)	23.98
Count	23

a. Data from before 2002 were not included in TMDL analysis.

Table A-3. Lead data for station 1161

Site	Collection date	MDL (µg/L)	Type	Result (µg/L)[a]
Bayou Toro at Louisiana Highway 392, Louisiana	1/28/2002	0.001	Filtered	0.2
Bayou Toro at Louisiana Highway 392, Louisiana	4/16/2002	0.002	Filtered	0.34
Bayou Toro at Louisiana Highway 392, Louisiana	7/23/2002	0.002	Filtered	0.53
Bayou Toro at Louisiana Highway 392, Louisiana	10/21/2002	0.01	Filtered	0.43
Bayou Toro at Louisiana Highway 392, Louisiana	3/14/2006	0.15	Filtered	0.42
Bayou Toro at Louisiana Highway 392, Louisiana	5/17/2006	0.015	Filtered	**0.57**
Bayou Toro at Louisiana Highway 392, Louisiana	8/9/2006	0.003	Filtered	0.22
Bayou Toro at Louisiana Highway 392, Louisiana	10/9/2006	0.003	Filtered	**0.64**

a. Exceedances of the calculated standard are bold. Data from before 2002 were not included in TMDL analysis.

Table A-4. Lead summary statistics for station 1161

Statistic	Value[a]
Minimum (µg/L)	0.2
Maximum (µg/L)	0.64
Average (µg/L)	0.419
Count	8
Percentage of data that violate the standard	25%

a. Data from before 2002 were not included in TMDL analysis.

Table A-5. Hardness data for station 1160

Site	Collection date[a]	Result (mg/L)
Bayou Toro northeast of Toro, Louisiana	1/28/02	22.8
Bayou Toro northeast of Toro, Louisiana	2/25/02	24.9
Bayou Toro northeast of Toro, Louisiana	3/26/02	32.7
Bayou Toro northeast of Toro, Louisiana	4/16/02	25.8
Bayou Toro northeast of Toro, Louisiana	5/21/02	24.1
Bayou Toro northeast of Toro, Louisiana	6/18/02	29.2
Bayou Toro northeast of Toro, Louisiana	7/23/02	21.1
Bayou Toro northeast of Toro, Louisiana	8/20/02	15.8
Bayou Toro northeast of Toro, Louisiana	9/23/02	25.4
Bayou Toro northeast of Toro, Louisiana	10/21/02	27.8
Bayou Toro northeast of Toro, Louisiana	11/19/02	26.6
Bayou Toro northeast of Toro, Louisiana	12/17/02	21.8
Bayou Toro northeast of Toro, Louisiana	1/24/06	26.4
Bayou Toro northeast of Toro, Louisiana	2/14/06	23.2
Bayou Toro northeast of Toro, Louisiana	3/14/06	31
Bayou Toro northeast of Toro, Louisiana	4/4/06	32.8
Bayou Toro northeast of Toro, Louisiana	4/25/06	25.1
Bayou Toro northeast of Toro, Louisiana	5/17/06	32.4
Bayou Toro northeast of Toro, Louisiana	10/9/06	24.4
Bayou Toro northeast of Toro, Louisiana	10/24/06	23.9
Bayou Toro northeast of Toro, Louisiana	12/4/06	28.2
Bayou Toro northeast of Toro, Louisiana	10/14/09	40
Bayou Toro northeast of Toro, Louisiana	11/3/09	26
Bayou Toro northeast of Toro, Louisiana	12/9/09	32
Bayou Toro northeast of Toro, Louisiana	1/13/10	38
Bayou Toro northeast of Toro, Louisiana	2/10/10	20
Bayou Toro northeast of Toro, Louisiana	3/10/10	42

a. Data from 2002–2006 were included in TMDL analysis.

Table A-6. Hardness summary statistics for station 1160

Statistic	Value
Minimum (mg/L)	15.8
Maximum (mg/L)	32.8
Average (mg/L)	25.97
Count	21

a. Data from 2002–2006 were included in TMDL analysis.

Table A-7. Lead data for station 1160

Site	Collection date	MDL (µg/L)	Type	Result (µg/L)[a]
Bayou Toro northeast of Toro, Louisiana	1/28/02	0.001	Filtered	0.13
Bayou Toro northeast of Toro, Louisiana	4/16/02	0.002	Filtered	0.28
Bayou Toro northeast of Toro, Louisiana	7/23/02	0.002	Filtered	0.45
Bayou Toro northeast of Toro, Louisiana	10/21/02	0.01	Filtered	0.41
Bayou Toro northeast of Toro, Louisiana	3/14/06	0.15	Filtered	0.4
Bayou Toro northeast of Toro, Louisiana	5/17/06	0.015	Filtered	0.62
Bayou Toro northeast of Toro, Louisiana	10/9/06	0.017	Filtered	0.74
Bayou Toro northeast of Toro, Louisiana	10/14/09			0.63
Bayou Toro northeast of Toro, Louisiana	1/13/10			0.14
Bayou Toro northeast of Toro, Louisiana	4/14/10			0.43

a. Data from before 2002 were not included in TMDL analysis.

Table A-8. Lead summary statistics for station 1160

Statistic	Value[a]
Minimum (µg/L)	0.13
Maximum (µg/L)	0.74
Average (µg/L)	0.423
Count	10

a. Data from before 2002 were not included in TMDL analysis.

Table A-9. Hardness data for station 1154

Site	Collection date[a]	Result (mg/L)
Toledo Bend Reservoir southwest of Haddens, Louisiana	1/28/02	32.5
Toledo Bend Reservoir southwest of Haddens, Louisiana	2/25/02	34.4
Toledo Bend Reservoir southwest of Haddens, Louisiana	3/26/02	31.4
Toledo Bend Reservoir southwest of Haddens, Louisiana	4/16/02	31.7
Toledo Bend Reservoir southwest of Haddens, Louisiana	5/21/02	30.9
Toledo Bend Reservoir southwest of Haddens, Louisiana	6/18/02	31.8
Toledo Bend Reservoir southwest of Haddens, Louisiana	7/23/02	31.6
Toledo Bend Reservoir southwest of Haddens, Louisiana	8/20/02	33.7
Toledo Bend Reservoir southwest of Haddens, Louisiana	9/23/02	33.7
Toledo Bend Reservoir southwest of Haddens, Louisiana	10/21/02	35.8
Toledo Bend Reservoir southwest of Haddens, Louisiana	11/19/02	33.7
Toledo Bend Reservoir southwest of Haddens, Louisiana	12/17/02	34.1
Toledo Bend Reservoir southwest of Haddens, Louisiana	1/24/06	36.2
Toledo Bend Reservoir southwest of Haddens, Louisiana	2/14/06	34.9
Toledo Bend Reservoir southwest of Haddens, Louisiana	3/14/06	33.3
Toledo Bend Reservoir southwest of Haddens, Louisiana	4/4/06	35.9
Toledo Bend Reservoir southwest of Haddens, Louisiana	4/25/06	33.1
Toledo Bend Reservoir southwest of Haddens, Louisiana	5/17/06	36
Toledo Bend Reservoir southwest of Haddens, Louisiana	6/6/06	38.2
Toledo Bend Reservoir southwest of Haddens, Louisiana	7/12/06	38.4
Toledo Bend Reservoir southwest of Haddens, Louisiana	8/9/06	38.1
Toledo Bend Reservoir southwest of Haddens, Louisiana	10/9/06	37.5
Toledo Bend Reservoir southwest of Haddens, Louisiana	10/24/06	34.3
Toledo Bend Reservoir southwest of Haddens, Louisiana	12/4/06	37.7
Toledo Bend Reservoir southwest of Haddens, Louisiana	10/14/09	38
Toledo Bend Reservoir southwest of Haddens, Louisiana	11/3/09	34
Toledo Bend Reservoir southwest of Haddens, Louisiana	12/9/09	38
Toledo Bend Reservoir southwest of Haddens, Louisiana	1/13/10	36
Toledo Bend Reservoir southwest of Haddens, Louisiana	2/10/10	36
Toledo Bend Reservoir southwest of Haddens, Louisiana	3/10/10	36

a. Data from before 2002 were not included in TMDL analysis.

Table A-10. Hardness summary statistics for station 1154

Statistic	Value[a]
Minimum (mg/L)	30.9
Maximum (mg/L)	38.4
Average (mg/L)	34.90
Count	30

a. Data from before 2002 were not included in TMDL analysis.

Table A-11. Lead data for station 1154

Site	Collection date	MDL (µg/L)	Type	Result (µg/L)[a]
Toledo Bend Reservoir southwest of Haddens, Louisiana	4/16/02	0.002	Filtered	0.02
Toledo Bend Reservoir southwest of Haddens, Louisiana	10/21/02	0.01	Filtered	0.01
Toledo Bend Reservoir southwest of Haddens, Louisiana	3/14/06	0.15	Filtered	0.15
Toledo Bend Reservoir southwest of Haddens, Louisiana	5/17/06	0.015	Filtered	0.08
Toledo Bend Reservoir southwest of Haddens, Louisiana	8/9/06	0.003	Filtered	0.07
Toledo Bend Reservoir southwest of Haddens, Louisiana	10/9/06	0.003	Filtered	0.02
Toledo Bend Reservoir southwest of Haddens, Louisiana	10/14/09			Not detected
Toledo Bend Reservoir southwest of Haddens, Louisiana	1/13/10			0.05
Toledo Bend Reservoir southwest of Haddens, Louisiana	4/14/10			0.16

a. Data from before 2002 were not included in TMDL analysis.

Table A-12. Lead summary statistics for station 1154

Statistic	Value[a]
Minimum (µg/L)	0.01
Maximum (µg/L)	0.16
Average (µg/L)	0.07
Count	9

a. Data from before 2002 were not included in TMDL analysis.