2008

Lower Grand River and Belle River Watershed Implementation Plan

Lower Grand River and Belle River

Subsegment 120201

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1.0 INTRODUCTION

According to the United States Environmental Protection Agency, Nonpoint Source Pollution (NPS), unlike pollution from industrial and sewage treatment plants, comes from many different sources, such as rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and man-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even our underground sources of drinking water. These pollutants can include excess fertilizers, herbicides, and insecticides from agricultural lands and residential areas; oil, grease, and toxic chemicals from urban runoff and energy production; sediment from improperly managed construction sites, crop and forest lands, and eroding stream banks; salt from irrigation practices and acid drainage from abandoned mines; bacteria and nutrients from livestock, pet wastes, and faulty septic systems. The effects of nonpoint source pollutants on specific waters vary and may not always be detrimental. However, some states report that nonpoint source pollution is the leading remaining cause of water quality problems. In addition, it is known that these pollutants have harmful effects on water used for drinking, recreation, and fish and wildlife propagation.

On October 7, 2005**,** a Total Maximum Daily Load Report (TMDL) was prepared for the Lower Grand River/Belle River Watershed, Subsegment 120201, by the Louisiana Department of Environmental Quality (LDEQ), and it was later revised on March 22, 2006. The TMDL summarized the maximum amount of oxygen demand - related pollution that the Lower Grand River/Belle River can assimilate and still meet water quality standards for its designated uses, in addition to meeting the goals for the reduction of those pollutants. Since this water body did not meet the standard for its particular uses 10% of the time, it was subsequently placed on the State of Louisiana's 303(d) List of Impaired Waters.

According to the TMDL analysis, the

suspected causes of impairment are organic enrichment/oxygen depletion (low dissolved oxygen), nutrients (nitrite/nitrate, total phosphorus), salinity/TDS/Sulfates/ Chlorides (sulfates), and pathogens (total and fecal coliform). There were no potential sources reported to the EPA by the state of Louisiana, but the TMDL states the suspected sources as being drainage/filling/loss of wetlands and boat traffic. A calibrated water quality model for the watershed was developed and projections were modeled to quantify the nonpoint source load reductions which would be necessary in order for Lower Grand River/Belle River, Subsegment 120201, to comply with its established water quality standards and criteria. The model extends from the Bayou Pigeon

Bridge to Lake Palourde. Lower Grand River/Belle River is located in south Louisiana and includes Indigo Island Canal, Bayou Postillion, Lake Natchez Pass, Bayou Grosbec, Upper Goddel Bayou, Bayou Calliste, Big Goddel Bayou, Old River, Graveyard Island Oxbow, Bayou Magazille, and Long Canal as tributaries, as well as an unnamed tributary.

Section 319 of the Clean Water Act (PL 100-4, February 4, 1987) was enacted to specifically address problems attributed to nonpoint sources of pollution. Its objective is to restore and maintain the chemical, physical, and biological integrity of the nation's waters (Sec. 101; PL 100-4). The Louisiana Department of Environmental Quality (LDEQ) is presently the designated lead agency to implement the Louisiana State Nonpoint Source Program. The LDEQ Nonpoint Source unit and the Louisiana Department of Agriculture and Forestry (LDAF) provide §319(h) funds to assist in the implementation of BMPs to address water quality problems in subsegments listed on the §303(d) list. USEPA §319(h) funds are utilized to sponsor cost sharing, monitoring, and education projects. These monies are available to all private, profit, and nonprofit organizations that are authentic legal entities or governmental jurisdictions.

This watershed plan lays out a course of action that can be implemented with the goal that nonpoint source (NPS) pollution in the watershed may be reduced so that the streams and rivers meet the water quality standards. This plan will be the basis for outlining how and where the State and local cooperators should focus their efforts and future resources within the watershed in order to improve water quality and help the watershed re-attain its designated uses. Upon reviewing all information used to write this plan, it was determined that the 5 mg/L DO standard is not appropriate for the Lower Grand River/ Belle River during the warm summer months. Since temperatures vary from season to season, natural variation of dissolved oxygen from one season to another is a given. Most slow-moving rivers and bayous in Louisiana exhibit low dissolved oxygen concentrations during the summer months. The dissolved oxygen criterion of 5 mg/L year-round for Lower Grand and Belle River will be addressed with a Use Attainability Analysis (UAA). A use attainability analysis is a structured scientific assessment of the factors affecting the attainment of uses specified in Section 101(a) (2) of the Clean Water Act (also known as the "fishable/swimmable" uses). The factors considered in such an analysis include the physical, chemical, biological, and economic use removal criteria described in EPA's water quality standards regulation. It is therefore recommended that a revision of the DO standard, based upon the use attainability analysis for the Barataria and Terrebonne Basin waterbodies, be prepared. In trying to improve and protect water quality, all residents and interested government parties should partake in public education, with the idea that they will support efforts to implement the best management practices (BMPs). In watersheds similar to the Lower Grand River/Belle River, implementation of BMPs such as strip cropping, conservation tillage, field borders, riparian zones, filter strips, and residue management are some of the recommended courses of action for reducing pollutant runoff from sugarcane, cotton, wheat, and pastures. Creation of a buffer ordinance that directs new development away from streams and rivers, inspecting 100% of newly installed septic systems, and refraining from using septic system additives were among the many BMPs recommended for Urban/Residential Developments. A consolidated list of recommended BMPs for crop agriculture and other land uses can be found in the State of Louisiana Water Quality Management Plan, Volume 6, http://nonpoint.deq.louisiana.gov/wqa/default.htm

1.1 ECOREGION DESCRIPTION

The Mississippi River Alluvial Plain (MRAP) ecoregion extends from the very southern tip of Illinois down through southeastern Missouri, encompasses all of eastern Arkansas, then covers part of the delta region of Mississippi and extends into northeast Louisiana, and then follows the Mississippi River south, where its bottomland forests meet the coastal marshes. The ecoregion includes all or portions of East Carroll, West Carroll, Morehouse, Ouachita, Richland, Madison, Franklin, Caldwell, Tensas, Catahoula, LaSalle, Concordia, Avoyelles, Rapides, Evangeline, St. Landry, Pointe Coupee, West Feliciana, West Baton Rouge, East Baton Rouge, Iberville, St. Martin, Lafayette, Iberia, St. Mary, Assumption, Terrebonne, Lafourche, St. James, Ascension, St. John the Baptist, Livingston, Tangipahoa, St. Charles, Jefferson, Orleans, Plaquemines, and St. Bernard Parishes. The MRAP is rich in alluvial sediments, and is known primarily for its Bottomland Hardwood forests and its Cypress and Cypress-Tupelo swamps. In addition, the northeastern portion of this ecoregion contains both Wet and Mesic Hardwood Flatwoods which are found on Macon Ridge. Federal lands include Indian Bayou WMA (COE), Black Bayou Lake, Handy Break, Tensas River, Bayou Cocodrie, Catahoula Lake, Lake Ophelia, Grand Cote, Cat Island, Atchafalaya, and Bayou Teche NWRs. Wildlife Management Areas include Bayou Macon, Big Colewa Bayou, Floy McElroy, Russell Sage, Ouachita, Big Lake, Buckhorn, Mississippi River Alluvial Plain Ecoregion, Boeuf, Dewey W. Wills, Red River, Three Rivers, Grassy Lake, Spring Bayou, Pomme De Terre, Thistlethwaite, Sherburne, Joyce, Manchac, Maurepas Swamp, Attakapas Island, and Elm Hall. State parks include Chemin A Haut, Lake Bruin, Lake Fausse Point, and Cypremort Point. State historic sites include Poverty Point, Winter Quarters, Marksville, and Longfellow-Evangeline.

1.2 TERREBONNE BASIN DESCRIPTION

The Terrebonne Basin covers approximately 1,712,500 acres in south-central Louisiana, and is bordered by Bayou

Lafourche to the east, the Atchafalaya Basin floodway to the west, the Mississippi River to the north, and the Gulf of Mexico to the south. It varies in width from 18 to 70 miles, and includes all of Terrebonne Parish and parts of Lafourche, Assumption, St. Martin, St. Mary, Iberville, and Ascension Parishes. The topography of the entire basin is lowland, and all of the land, except the natural levees along major waterways, is subject to flooding (LDEQ, 1994). The extreme northern portion of the basin is primarily agricultural land which continues south along its eastern edge within the historic floodplains of the Mississippi River and Bayou Lafourche. The western half of the basin consists of Bottomland Hardwood forests and Cypress-Tupelo-Black Gum swamps. The coastal portion of the basin is prone to tidal flooding and is comprised of fresh and intermediate marshes inland, to brackish and salt marshes near the bays and gulf. Approximately 729,000 acres of the Terrebonne Basin are wetlands which consist of approximately 21% freshwater swamp and 79% marsh. The two primary water sources that enter this system are rainwater and floodwater from the Atchafalaya River, which contain nutrient-rich sediments that overwhelm the southwestern coastal marshes. There are approximately 57 species of freshwater fish, 12 species of mussels, and 10 species of crawfish found within the Terrebonne Basin.

The 2004 Water Quality Inventory Report (LDEQ, 2004) indicated that 31% of the 60 water body subsegments within the basin were fully supporting their three primary designated uses, while 66% of the subsegments were not supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include metals, pesticides, nutrients, fecal coliform bacteria, non-native aquatic plants, organic enrichment and low concentration of dissolved oxygen, dissolved and suspended solids, pH levels, sedimentation/siltation, and turbidity. The suspected sources of the water quality problems include non-irrigated crop production, pasture land, urban runoff, hydromodification, sewers and unsewered areas, surface runoff, and spills. Urban communities, home sewerage systems, and pasture lands are the primary sources of bacteria entering the Terrebonne Basin water bodies, so efforts will be focused on these areas. In addition, action should also be taken to reduce the amount of sediments and nutrients entering the water bodies from agricultural lands in the upper part of the basin, in hopes that these water bodies will meet the requirements for fish and wildlife propagation. The water quality goal for the Terrebonne Basin is to restore the designated uses of the basin by reducing nonpoint source pollutant levels which enter the water bodies that have been identified as not meeting water quality standards.

2.0 WATERSHED LAND USE

The Lower Grand River/Belle River watershed includes five parishes, and is dominated by a low, flood-prone topography. This 10,700 acre drainage area includes St. Martin, St. Mary, Assumption, Iberia, and Iberville parishes. The unique and rich history of the included parishes has greatly influenced the changes in the watershed and subsequent water quality. This subsegment is also tidally influenced. Water flows in either direction depending on tides and wind conditions. The area is typical of the basin, and is primarily comprised of wetlands and agriculture.

The Lower Grand River/Belle River watershed is predominately deciduous wetland forest. Many migratory waterfowl can be seen perched on logs in and adjacent to the river. Lush vegetation provides some sediment control along various points of the Lower Grand River/Belle River and its augmenting canals and tributaries. The second largest use of land in this subsegment is agriculture. Sugarcane crops can be seen along the highways in the subsegment. In many cases, agricultural fields are extremely close to drainage ditches and canals which will ultimately deposit field runoff into the Lower Grand River/Belle River. Significant pesticide use where the edges of agricultural fields meet drainage ditches and canals is evident.

Table 1 - Land Uses

Land Use / Land Cover	Acres	Percentage
Aquaculture	947	0.8
Bare	5,854	5.1
Cotton	16	0.0
Deciduous Forest Land	29,296	25.3
Forested Wetland	43,138	37.3
Orchards	17	0.0
Pasture / Hay	5,179	4.5
Soybeans	914	0.8
Sugarcane	18,382	15.9
Urban	5,969	5.2
Water	5,976	5.2

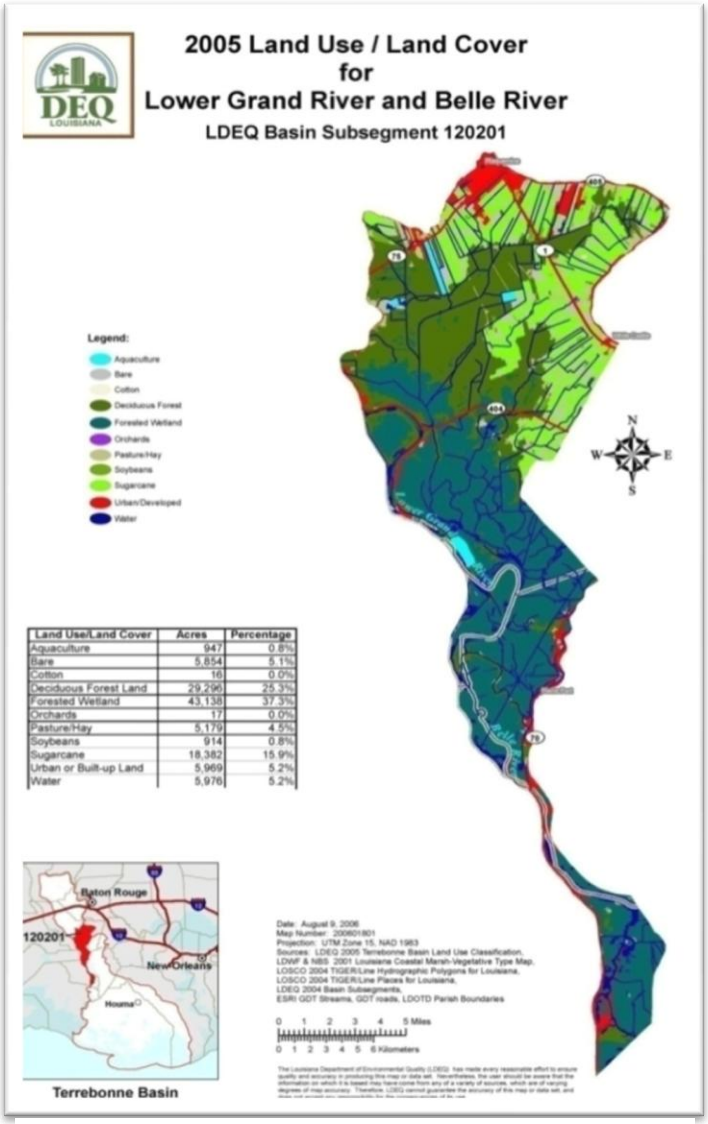


FIGURE 1 - LAND USE MAP

The recreational potential in Assumption parish is an outdoorsman's dream. Grand Bayou, Bayou Corne, Bayou Pierre Part, Lake Verret and other bodies of water offer water sports and fishing. Swamps and woodlands provide excellent hunting areas. A number of smaller bayous to the west offer the trappers and hunters an entrance to areas around Lake Verret, Lake Palourde, and Grand River.

3.0 WATER QUALITY ANALYSIS

Lower Grand River/Belle River was modeled to quantify the point source and nonpoint source waste load reductions necessary in order for the bayou to comply with its established water quality standards and criteria. The designated uses and water quality standards for Lower Grand River/ Belle River are shown in Table 2. The primary standard for the TMDLs was the year-round DO standard of 5 mg/L.

TABLE 2 - WATER QUALITY CRITERIA AND DESIGNATED USES

Parameter	Value
Designated Uses	A,B,C
DO (mg/L)	5.0
Cl (mg/L)	60
SO_4 (mg/L)	40
pH	6.0-8.5
BAC	1
Temperature (°C)	32
TDS (mg/L)	300

Note 1: 200 colonies/100ml maximum log mean and no more than 25% of samples exceeding 400 colonies/100ml for the period of May through October; 1,000 colonies/100 ml maximum log mean and no more than 25% of samples exceeding 2,000 colonies/100ml for the period of November through April. Uses: A-primary contact recreation; B-secondary contact recreation; C-propagation of fish and wildlife; D-drinking water supply; E-oyster propagation; F-agriculture; G-outstanding natural resource water; L-limited aquatic life and wildlife use

These water quality standards form the basis for implementing the best management practices to control the nonpoint sources of water pollution.

3.1 WATER QUALITY ASSESSMENT

Lower Grand River/Belle River, subsegment 120201, of the Terrebonne Basin is listed on the 2004 303(d) list. This subsegment is listed as not supporting Primary Contact Recreation and Fish and Wildlife Propagation. It is, however, meeting its designated use of Secondary Contact Recreation. The suspected causes of impairment are nutrients and low levels of dissolved oxygen. The suspected sources are drainage/filling/loss of wetlands. Because of the impairments, this subsegment required the development of a total maximum daily load (TMDL) for oxygen-demanding substances and nutrients.

The 2006 303(d) list shows that the subsegment is now fully supporting its designated uses of both Primary and Secondary Contact Recreation. However, it is not supporting its use of Fish and Wildlife Propagation. The suspected cause of this impairment is sulfates, which may be a result of drought-related conditions and petroleum/natural gas activities.

Field observation indicates that boat traffic is an additional source of impairment. The Lower Grand River/Belle River serves as an alternate route for barge traffic for the ICWW. Tow boats push barges up and down the river and turn/churn the bottom up into the water column for miles, resulting in increased turbidity (muddiness) and oxygen demand. An extended period of time is required for this material to resettle to the channel bottom.

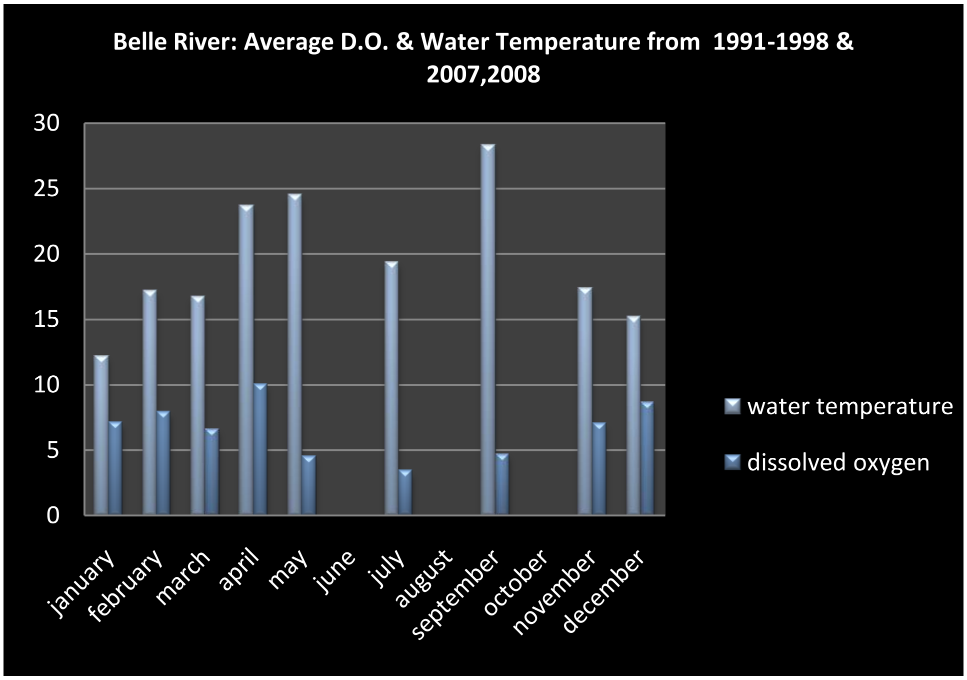
3.1.1 PRIOR STUDIES

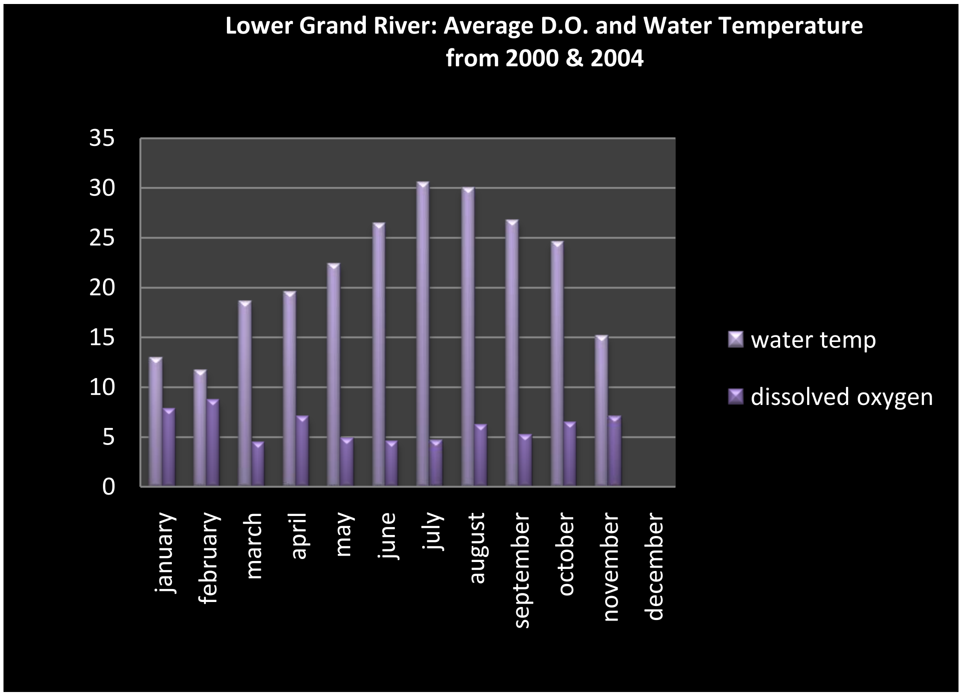
The Louisiana Department of Environmental Quality has two monthly water quality monitoring stations for the Lower Grand River/Belle River. They are designated as Site 337, Belle River north of Morgan City, and Site 979, Lower Grand River. The sites have a monitoring period of record from January 1991 to May 1998 and February 2000 to November 2000, respectively. Site 979 has an additional period of record from January to November 2004. Data collected during the September 2003 TMDL survey included cross-section data, monitoring data, and field in-situ and lab water quality data. This data was used to develop the model on which the TMDL was based.

3.2 AMBIENT DATA

A water quality standard is a definite numerical criterion value or general criterion statement to enhance or maintain water quality and provide for, and fully protect, the designated uses of a waterbody (LDEQ, 2003). LDEQ maintained two monthly water quality monitoring stations for the Lower Grand River/Belle River as part of the Statewide Water Quality Monitoring Network. Data was collected in 2000 and 2004 for the Lower Grand River, and data was collected from 1991 to 1998 and 2007 to 2008 for the Belle River. Data information was obtained from the Water Quality Assessment Division, Standards and Assessment Unit. Comparisons of the data are presented in the graphs in this section. An average value was used for months that had more than one sample taken. The water quality standards for the Lower Grand River/Belle River are listed in Table 2.

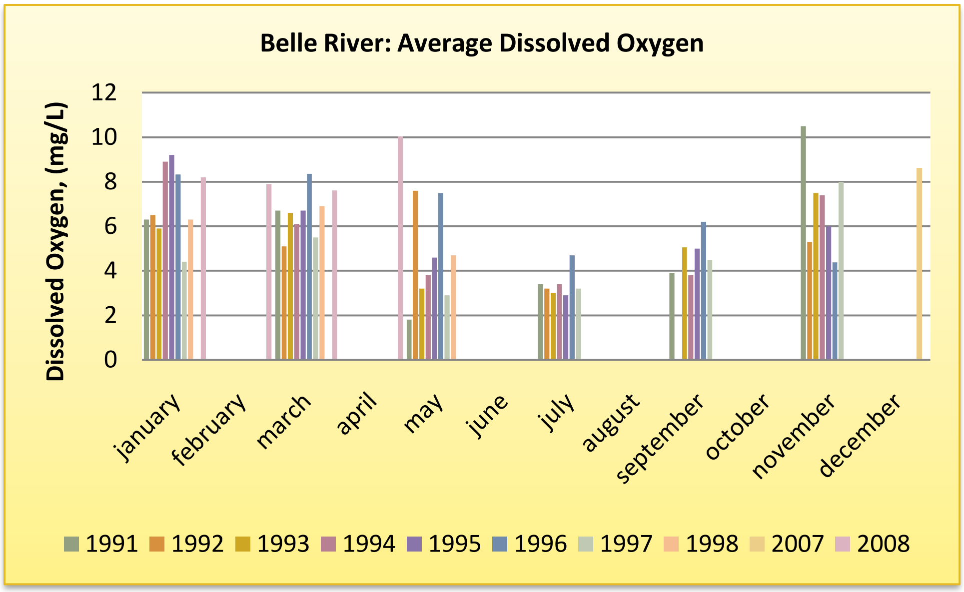
The DO monthly average and water temperature data were used for the years 2000 and 2004 for the Lower Grand River and years 1991 to 1998 and 2007 to 2008 for the Belle River, to construct graphs that showed the inverse relationship between DO and water temperature. In the Lower Grand River/Belle River, this trend was followed as DO levels increased when the water temperature decreased. For the Lower Grand River, dissolved oxygen was lowest when the temperature was highest - May through July. For the Belle River, dissolved oxygen concentrations were also lowest when temperatures were high - May, July, and September. In comparison, dissolved oxygen concentrations were higher when temperatures were milder - November through March - for the Belle River.

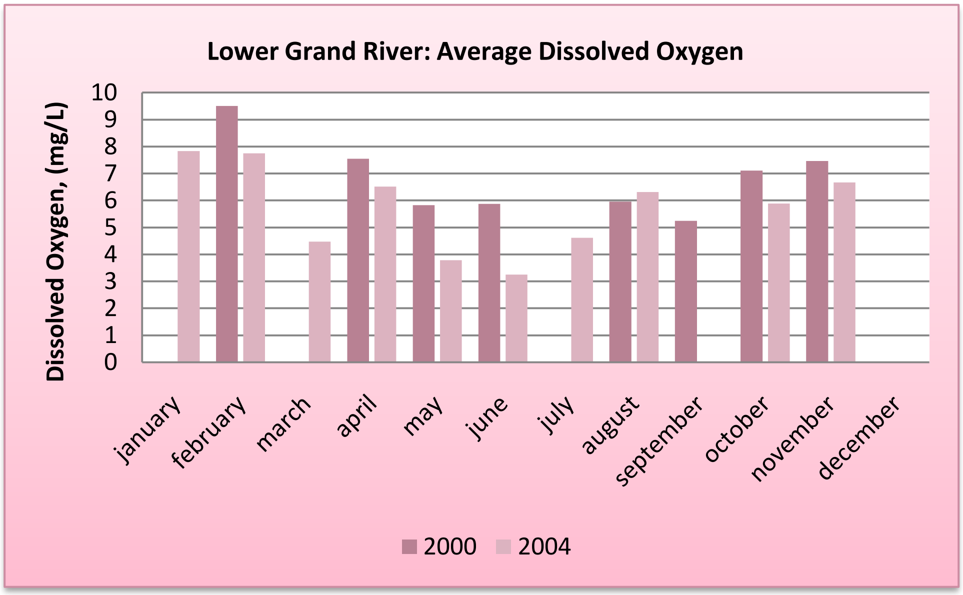

Belle River: Average D.O. & Water Temperature from 1991-1998 & 2007,2008
30
25
20
15
10
5
0
january
february
march
april
may
june
july
august
september
october
november
december
water temperature
dissolved oxygen


Lower Grand River: Average D.O. and Water Temperature from 2000 & 2004
35
30
25
20
15
10
5
0
january
february
march
april
may
june
july
august
september
october
november
december
water temp
dissolved oxygen

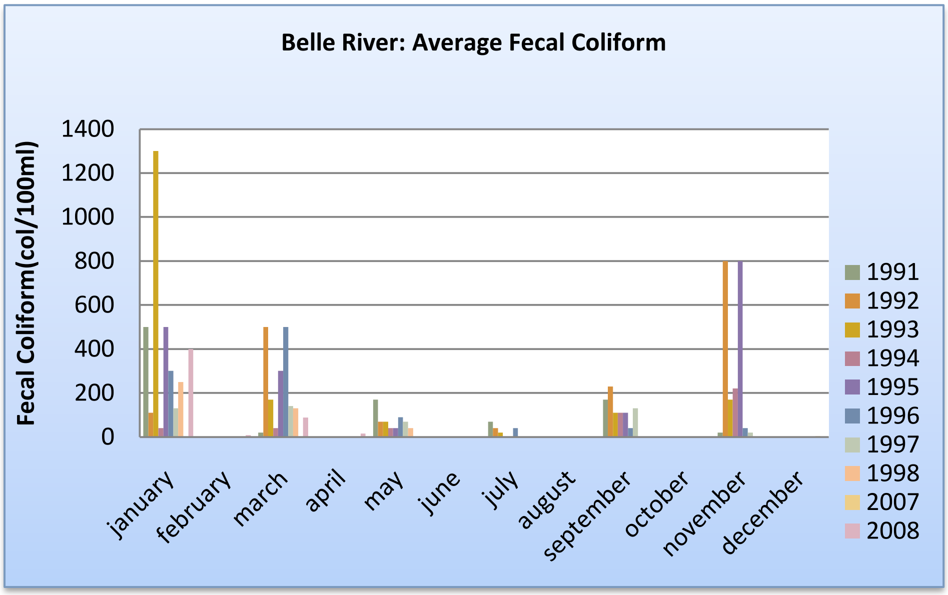
For the remaining graphs, the data collected were plotted on the same chart to illustrate comparisons over the years within a parameter. This format shows water quality improvement or deterioration. Agricultural activities, such as fertilizing, irrigation, and tilling, occur during certain times of the year and can cause seasonal water quality deterioration. If seasonal trends are present, they will be apparent.

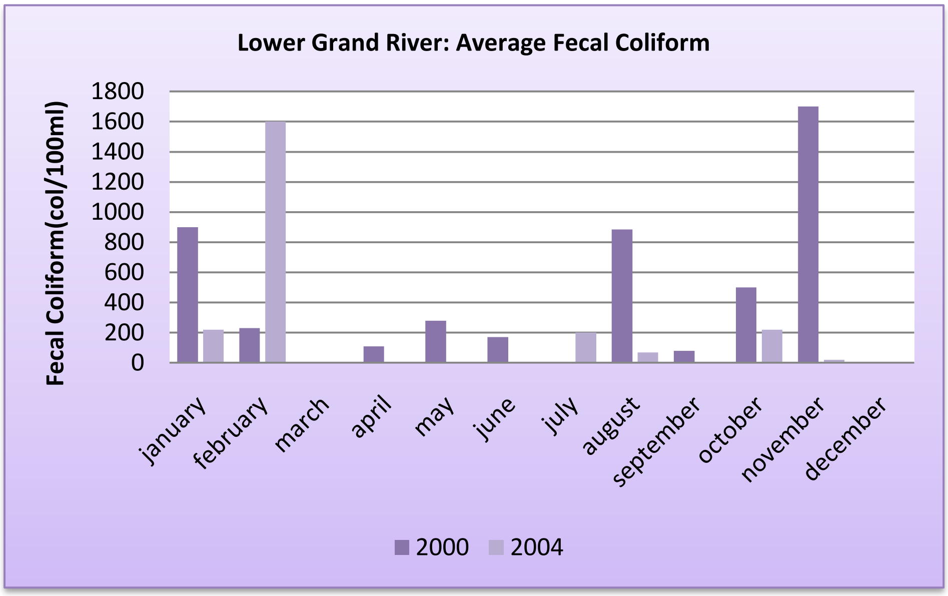
The DO concentration in the Belle River appears to be increasing over the years. It is apparent that the dissolved oxygen concentration is typically higher in the cooler months - January, November, and December - and lower in the warmer months – July and September.





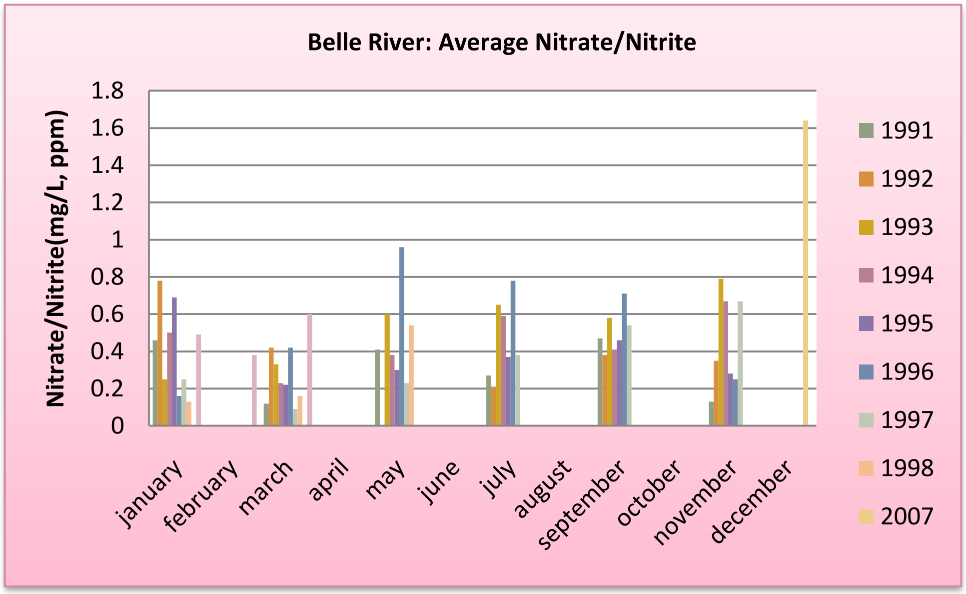
The DO in the Lower Grand River appears to follow the same trend: when temperatures are high DO concentrations are low, and when temperatures are low, dissolved oxygen concentrations are higher. DO concentrations hit an all-time low in May and June of 2004, but increased substantially in August 2004.

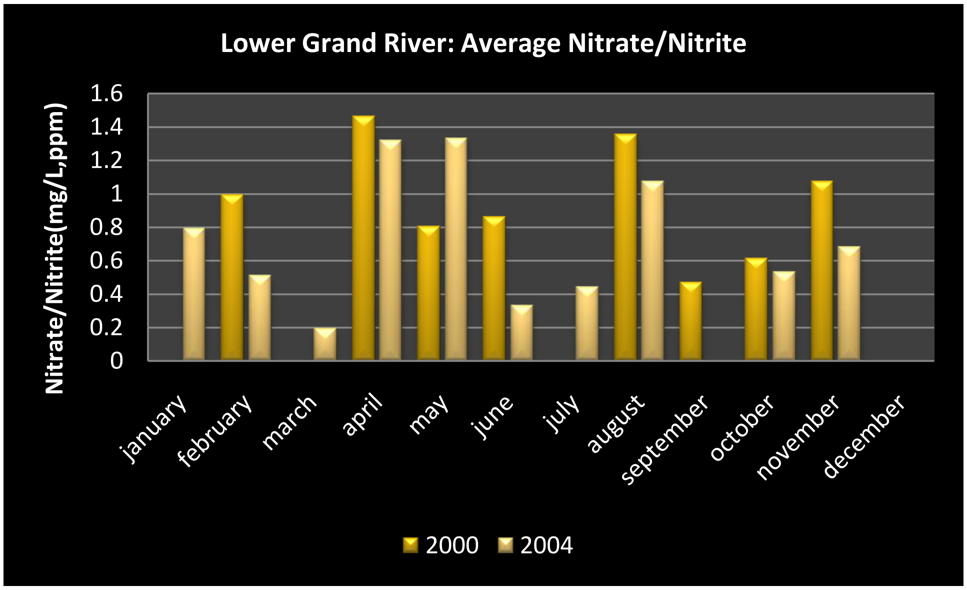




The Belle River and the Lower Grand River appear to have been adhering to the fecal coliform standard of 200 colonies/100ml and no more than 25% of samples exceeding 400 colonies/100 ml for the period of May through October. The standard of 1,000 colonies/100 ml maximum log mean and no more than 25% of the samples exceeding 2,000 colonies/100 ml for the period of November through April appears to have been met.

In general, the fecal coliform concentrations in the Lower Grand River and the Belle River have decreased over the years.

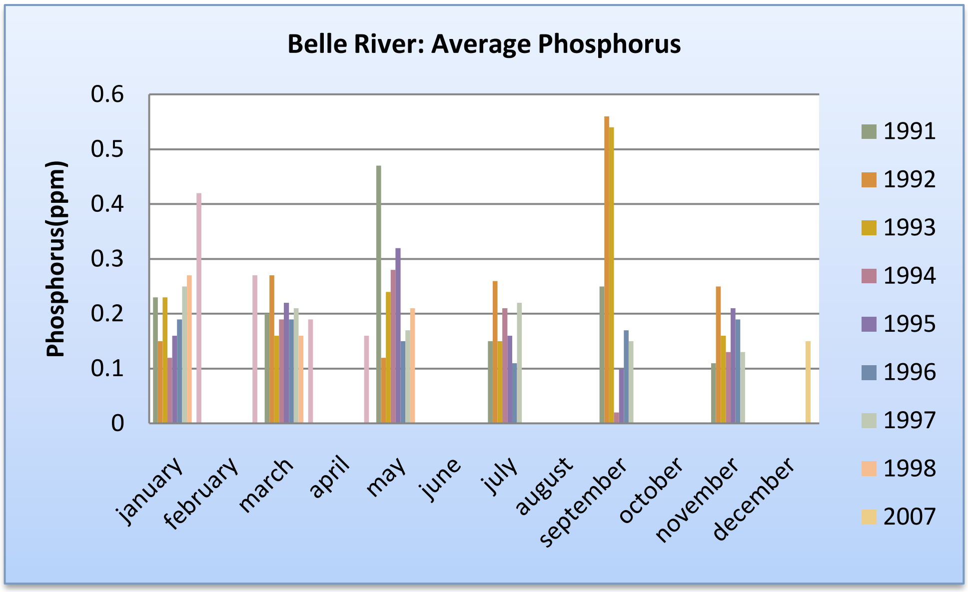




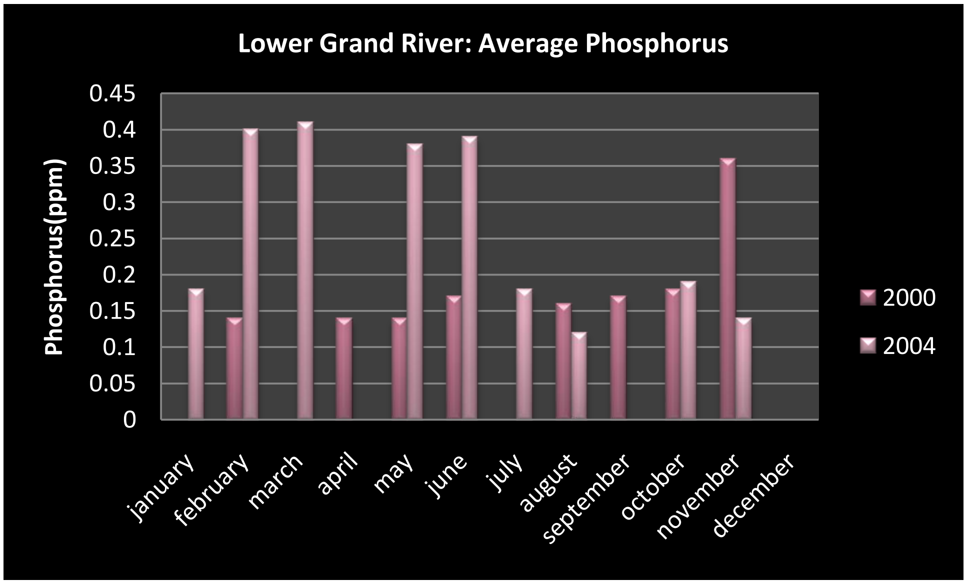
The average levels of nitrate/nitrite for the Belle River increase around May and June, with the highest level measured in December of 2007. Spikes in concentration are present in September and November, and may be the result of a number of factors. In 1991, the overall concentration of nitrate/nitrite was relatively low, and there was a spike in concentration in 1996.

Average levels of nitrate/nitrite for the Lower Grand River have apparently declined from 2000 to 2004, despite increases around April and May.

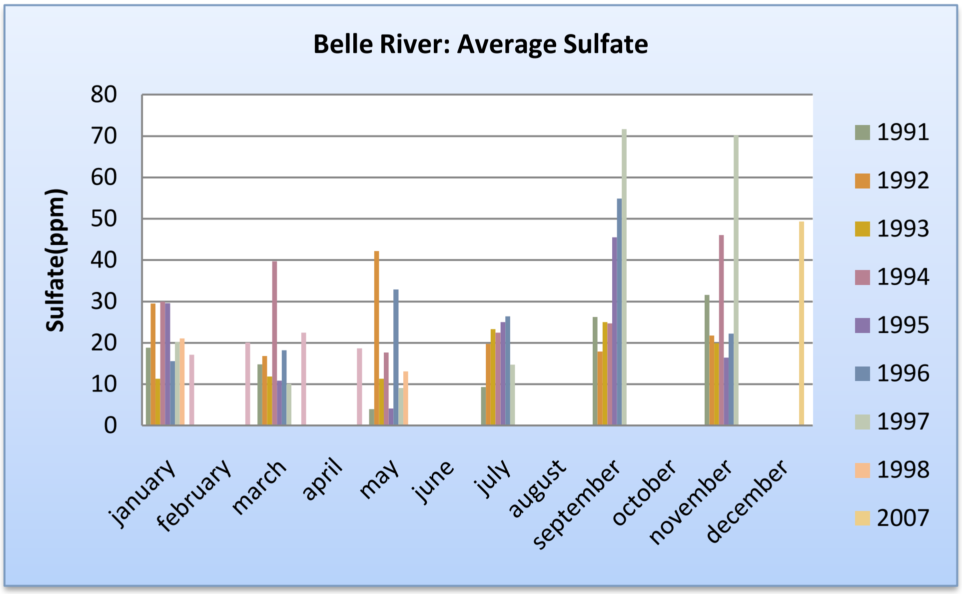
Phosphorus levels in the Belle River typically remained steady with the exception of a few spikes. In 1998 and 1991 to 1993, there were sharp increases in phosphorus levels in January, May, and September.



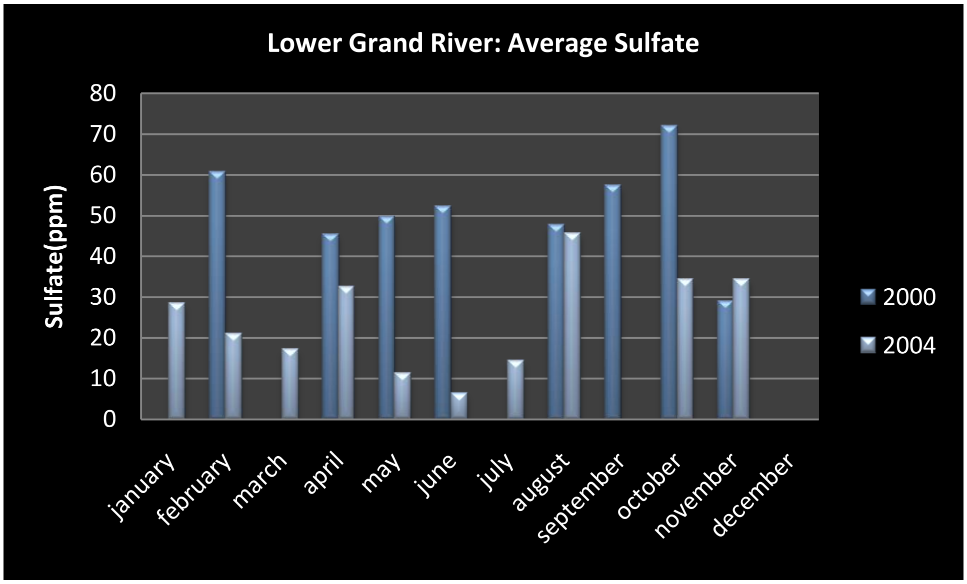
In 2000, concentrations of phosphorus for the Lower Grand River appeared low, except for a sudden spike in November which may have been due to agricultural practices. However, in 2004, phosphorus concentrations were higher than they had been four years earlier, with spikes in February, March, May, and June. The level of phosphorus decreased sharply towards the end of the summer, and during the winter months of 2004.



The numerical criterion for sulfate is set at 40 mg/L or below.



According to the data from 1991 to 1998 and 2007, the Belle River is meeting the standards from January to July, except for one spike in May of 1992. Concentrations for the months of September, November, and December in 1995 to 1997 and 2007 are higher.



For the Lower Grand River, sulfate concentrations were higher in 2000 than they were in 2004. The standard was only met in November of 2000. However, in 2004, the standard was exceeded just once in August, which indicates that sulfate concentrations are potentially improving in the Lower Grand River.

d

o

x

3.2.1 WATER QUALITY AND OXYGEN DEPLETION

Dissolved oxygen is an accurate indicator of a body of water's ability to support aquatic life. A dissolved oxygen analysis measures the amount of gaseous oxygen (O_2) dissolved in an aqueous solution. Aquatic life depends on oxygen to breathe. Fish "breathe" by absorbing dissolved oxygen through their gills. Natural stream purification processes require adequate oxygen levels in order to sustain aerobic life. If dissolved oxygen levels in water drop below 5.0 mg/l, aquatic life may be stressed. Oxygen levels that remain below 1-2 mg/l for an extended period of time can result in fish kills.

For oxygen to be available in water, it must first be dissolved. Oxygen dissolves in water when tiny air bubbles are formed by the churning or movement of water, by wind blowing across the water, and as a byproduct of aquatic plant photosynthesis. Oxygen is removed from the water by respiration and decomposition of organic matter. Rivers that have excess amounts of nutrients can become low in dissolved oxygen due to overproduction of algae, and the subsequent die-off and decomposition of the algae.

Total dissolved gas concentrations in water should not exceed 110 percent saturation. Concentrations above this level can be harmful to aquatic life. Fish in waters containing a disproportionate amount of dissolved gases may suffer from "gas bubble disease". The bubbles or emboli block the flow of blood through blood vessels and cause death. External bubbles (emphysema) can also occur and be seen on fins, skin, and other tissue. A fish that is under stress due to low oxygen levels in water is also more susceptible to poisoning by insecticides or heavy metals. Aquatic invertebrates are also affected by the "gas bubble disease", but at levels higher than those lethal to fish.

There are a number of factors that contribute to the concentration of dissolved oxygen. Some of these factors are volume and velocity of water flowing in the body of water, climate and season, type and number of organisms in the body of water, amount of dissolved or suspended solids, altitude, concentration of nutrients in the water, organic wastes, riparian vegetation, and groundwater inflow. Dissolved oxygen is directly proportional to atmospheric pressure - as atmospheric pressure increases, so does DO. In addition, as temperature increases, DO decreases.

3.3 WATER QUALITY AND NUTRIENTS

Eutrophication is the single greatest threat to coastal ecosystem health. It may be defined as excessive vegetative or algal growth. Some lakes and streams in Louisiana have high levels of eutrophication. It is unclear as to how many phosphorus or nitrogen-based compounds contribute to eutrophication at any specific time and/or locale. Regardless, it is clear that both phosphorus and nitrogen loadings to aquatic systems have increased since pre-industrial times due to increased inputs of phosphate and nitrate-based fertilizers, atmospheric nitrogen deposition, and domestic and agricultural wastewater ru noff.

Nutrient enrichment may cause an increase in plant/algal biomass in an aquatic ecosystem. This increase in biomass can lead to decreased light levels that hinder benthic photosynthetic processes and increase biological oxygen demand (BOD), due to decomposition of the biomass.

Increased amounts of phosphorus and nitrate/nitrite are among the four impairments to the Lower Grand River/ Belle River watershed. Runoff from agricultural land can have significantly higher nutrient concentrations than drainage waters from forested watersheds. Increased nutrient levels may be a result of fertilizer application and animal wastes. Nutrient concentrations are generally proportional to the percentage of agricultural land, and inversely proportional to the percentage of forested land (EPA, 1977).

Nutrients are essential for plant growth but over-enrichment leads to excessive algal growth, an imbalance in natural nutrient cycles, changes in water quality, and a decline in the number of desirable fish species in a body of water (LDEQ, 2000). When phosphorous and nitrogen are applied in excess, they may move until they reach a water body, and can eventually become harmful to life in the water body. Soluble nutrients may reach surface waters through runoff and ground waters through percolation, while others may be adsorbed onto soil particles and reach surface waters with eroding soil. Factors that influence nutrient losses are precipitation, temperature, soil type, crop, conservation practices, nutrient mineralization, and de-nitrification.

Nitrogen is naturally present in soil, but it is sometimes added to increase crop production. One form of nitrogen that can be measured is Total Kjeldahl Nitrogen (TKN), which is the sum of organic nitrogen (N_{org}) and ammonia nitrogen (NH_3-N). Organic nitrogen is the nitrogen incorporated into organic compounds, mainly as unassimilated proteins. Bacteria degrade the material in organic compounds and release ammonia (NH_3). Oxidation of ammonia by bacteria such as *nitrosomonas* results in the formation of nitrite (NO_2^-**)**, which becomes nitrate (NO_3^-) when oxidized by *nitrobacter* bacteria. Other sources of nitrates in water runoff include municipal and industrial wastewater, septic tanks, feedlot discharges, animal wastes (including birds and fish), and vehicle exhaust.

Phosphorus can also contribute to eutrophication in both freshwater and estuarine systems. Phosphorus concentrations in soil are typically very low and may be found in dissolved and particulate forms. Dissolved inorganic phosphorus is probably the only form that is directly available to algae. Runoff and erosion can carry the excess applied phosphorus to nearby water bodies. Particulate and organic phosphorus delivered to water bodies may later be released and cause water quality problems if it is made available to algae when the bottom sediment in a stream becomes anaerobic.

3.4 WATER QUALITY AND OTHER IMPAIRMENTS

There are four impairments to the Lower Grand River/Belle River: organic enrichment/oxygen depletion (low dissolved oxygen), nutrients (nitrite/nitrate, total phosphorus), salinity/TDS (total dissolved solids/Sulfates/Chlorides), and pathogens (total and fecal coliform). All of these play a part, whether small or large, in affecting water quality

Total dissolved solids (TDS) is a term that refers to all minerals, salts, metals, cations, and anions dissolved in water. This includes anything present in water other than the pure water molecules and suspended solids. Dissolved solids can come from inorganic materials such as rocks and may contain calcium bicarbonate, nitrogen, iron, phosphorus, sulfur, and other minerals. Some dissolved solids may also come from organic sources such as leaves, silt, plankton, and industrial waste and sewage. Other sources are runoff from urban areas, road salts placed on streets during the winter, and fertilizers and pesticides used on lawns and farms. Water may also pick up metals such as lead and copper as it travels through pipes used to distribute water to consumers.

Fecal coliform bacteria are present in large numbers in the feces and intestinal tracts of humans and other warm-blooded animals, and can enter water bodies via human and animal waste. If a large number of fecal coliform bacteria (over 200 colonies/100 milliliters ml per of water sample) are found in water, it is possible that pathogenic (disease- or illness-causing) organisms are also present in the water. Fecal coliform per se are usually not pathogenic; they are indicator organisms, which means they may indicate the presence of other pathogenic bacteria. Pathogens are typically present in such small amounts that it is impractical to monitor them directly.

Swimming in waters with high levels of fecal coliform bacteria increases the chance of developing an illness (fever, nausea or stomach cramps) from pathogens entering the body through the mouth, nose, ears, or cuts in the skin. Diseases and illnesses that can be contracted in water with high fecal coliform counts include typhoid fever, hepatitis, gastroenteritis, dysentery, and ear infections. Fecal coliform, like other bacteria, can usually be killed by boiling water or by treating water with chlorine. Washing thoroughly with soap after contact with contaminated water can also help prevent infections.

There are many sources and factors that affect the concentration of fecal coliform bacteria. Community wastewater and septic system effluent are sources of bacteria, and fecal coliform is present in human waste. The bacteria travel down the drains in our buildings and can enter streams from illegal or leaky sanitary sewer connections, poorly functioning septic systems, and effluent from malfunctioning wastewater treatment plants. Fecal coliform is also found in wastes produced by domestic animals and wildlife. This can be a serious problem for waters near cattle feedlots, hog farms, dairies, and barnyards if waste is not properly contained. In urban areas, fecal coliform can be transported to surface water by animals when feces is carried into storm drains, creeks, and lakes during storms. Bacteria multiply faster at higher temperatures. Their growth rate slows drastically at very low temperatures.

Pathogens, namely fecal coliform, were cited as a cause of impairment for the Lower Grand River/Belle River system. In this watershed one source may be on-site treatment systems (septic systems).

4.0 TMDL FINDINGS

The calibration model showed that the DO standard of 5 mg/L was not being met in any of the modeled reaches of Subsegment 120201 during the September 2003 survey period. The calibration model minimum DO on the main stem was 3.89 mg/l, therefore traditional summer and winter projections were performed. A no-load projection was not run because background loading could not be calculated.

Summer critical season projections were run for the current standard of 5.0 mg/L May to November. In order to meet the standard, a 65% reduction of total nonpoint sources is necessary. With these percentage reductions in the benthic oxygen loads, Lower Grand/Belle River would meet the dissolved oxygen criterion. The minimum DO on the main stem is 5.10 mg/L.

The results of the model show that the water quality criterion for dissolved oxygen of Lower Grand/Belle River of 5.0 mg/l can be maintained during the winter critical season. The minimum dissolved oxygen is 6.59 mg/l and acceptable. To achieve the criterion, the model assumed a 65% reduction from all man-made nonpoint sources.

A summary of the loads is presented in Table 3.

TABLE 3 - SUMMARY OF LOADS

ALLOCATIONS	Summer		Winter	
	% Reduction Required	Mar-Nov (lbs/day)	% Reduction Required	Dec-Feb (lbs/day)
Point Source WLA	0	302	0	919
Point Source Reserve MOS (20%)	0	75	0	229
Manmade Nonpoint Source LA	65	46,078	65	38,330
Nonpoint Source Reserves MOS (20%)	0	11,519	0	9,583
TMDL		57,974		49,061

5.0 IDENTIFICATION OF HIGH PRIORITY AREAS

These areas were selected based on the land use type and water quality information within the Lower Grand River/Belle River Watershed. High priority areas for this watershed are mainly agricultural fields which drain into ditches that subsequently flow into a bayou, septic systems that drain into a bayou, and illegal dumping grounds which are submerged in the waters of a bayou when it floods. All of these causes can contribute to low DO levels and high fecal coliform levels. The forested wetlands of the area are believed to filter out a substantial portion of the pollutants before they enter a water body.

6.0 SOURCES OF NONPOINT SOURCE POLLUTION LOADING

Nonpoint source pollution (NPS) may be thought of as pollution which is not discharged through a pipe, including, but not limited to urban, agricultural, or silvicultural runoff. Nonpoint source pollution occurs when water runs over land or through the ground, then picks up pollutants and deposits them into lakes, rivers and groundwater. Nonpoint pollutants and sources that threaten or impair designated uses in bodies of water include:

- Excess fertilizers (nutrients), herbicides, and insecticides from agricultural and residential and urban areas
- Sediments (siltation, suspended solids), pesticides, pathogens (animal waste), from agricultural, residential, and urban areas
- Oil, grease, and toxic chemicals from urban runoff and energy production
- Sediment from improperly managed construction sites, crop and forest lands, and eroding streambanks

- Bacteria and nutrients from livestock operations, pet wastes, and faulty septic systems
- Atmospheric deposition, hydromodification, and habitat alteration are also sources of NPS pollution (EPA)

6.1 URBAN IMPACTS

Urban nonpoint source pollution has severely impacted many of the water bodies receiving runoff from major cities in Louisiana. However, urban NPS pollution is not limited only to large communities. Rural areas, such as those along the Lower Grand/Belle River Watershed, contribute to urban nonpoint source pollution as well. Impacts associated with urbanization include:

- Elimination of natural channels, including the loss of wetlands, wildlife, fisheries, and riparian habitats
- Increased sedimentation due to construction activities

FIGURE 2 - SILT FENCING INCORRECTLY INSTALLED

- Unmitigated changes in hydrology that upset the geomorphic equilibrium of streams, causing destabilization and erosion of channels and more frequent flooding

FIGURE 3 - NON-NATIVE WATER HYACINTH

- Introduction and perpetuation of non-native invasive species of plants and animals (from landscaping, aquaria, etc.)
- Increased pollutant loads associated with urban human activity: nutrients, pathogens, pesticides, PCBs (polychlorinated biphenyl [pathogenic]), PAHs (polycyclic aromatic hydrocarbon [carcinogenic]), petroleum, salts, nitrates, metals, trash, sediment, etc.
- Petroleum discharges from fueling stations and vessels

6.2 HYDROMODIFICATION IMPACTS

Most new urban development projects involve some level of hydromodification. Hydromodification may be defined as an action which alters the geometry and physical characteristics of a source of water in such a way that flow patterns change. Hydromodification impacts are also caused by the construction of highways and railways, utility projects, marinas, and flood protection projects for existing urban development. The adverse impacts to water quality associated with hydromodification projects in the Grand and Belle Rivers are:

- Elimination of natural channels and associated habitat complexity, including loss of wetlands, wildlife, fisheries and riparian habitat
- Increased sedimentation due to construction activities
- Changes in hydrology that upset the geomorphic equilibrium of streams causing destabilization and erosion of channels
- Increased water temperatures
- Introduction and perpetuation of non-native invasive species of plants and animals
- Decreased natural water quality purification functions that could otherwise intercept and assimilate or detoxify pollutants

6.3 AGRICULTURAL IMPACTS

Agricultural production can generate contaminants which may have negative effects on surface and ground water supplies. Contaminants that are associated with cropping and livestock practices include sediment, nutrients (nitrogen and phosphorus) from inorganic fertilizers and organic livestock wastes, crop protection chemicals such as herbicides and insecticides, microorganisms from livestock wastes, and salts and trace elements from irrigation residues. Contaminants may be transported, either attached to sediment or dissolved in water, to surface and ground water through all phases of the hydrologic cycle. Agricultural activities can have a significant impact on the quality of our water resources. Impaired water quality may restrict the amount of water available for uses such as drinking, stock watering, irrigation, sport fishing, and recreation.

6.4 PASTURELAND/GRAZING IMPACTS

Pastures may require substantial amounts of fertilizer in order to produce hay and keep a healthy food supply for grazing animals. Excessive fertilizer concentrations near waterways can increase the probability of nutrients getting washed into the river. In addition, livestock can produce large amounts of fecal waste, and this waste may contain considerable amounts of nutrients. Rainfall can carry this waste to nearby waterways where high nutrient concentrations may lead to eutrophic conditions that promote algal and vegetative growth and eventually reduce oxygen levels. Livestock may also contribute to increased loads of sediments entering a water body. When cattle are concentrated in a single location, such as feeding and watering areas, they often remove vegetative cover and expose the soil beneath. This soil can be dislodged by rainfall and then carried to water bodies by runoff. Sediment increases the turbidity of water, thereby reducing light penetration, impairing photosynthesis, and altering oxygen relationships, which consequently may reduce food supplies for certain aquatic organisms. Sediment can adversely affect fish populations in areas where deposits cover spawning beds. Sediment may also fill bayous, lakes, and shipping channels (LSU AgCenter, 2002).

FIGURE 4 - GOATS AND HORSES GRAZING

7.0 NONPOINT SOURCE POLLUTION SOLUTIONS

When selecting strategies to solve nonpoint problems, we need to take advantage of opportunities that will enhance and restore the systems on which all life depends. Effective approaches to controlling nonpoint sources often involve the use of Best Management Practices (BMPs). BMPs are environmental protection practices which help ensure that land uses are conducted in an environmentally responsible manner.

There are ongoing efforts in the state of Louisiana to reduce and control nonpoint sources of pollution. These efforts are implemented through various programs in federal, state, tribal, and local governments, as well as by nongovernmental citizen and volunteer groups.

State Agencies

State agencies provide:

- **Technical assistance**
  State agencies provide technical assistance to local governments, tribes, and each other to implement environmental programs. Most regulatory agencies provide assistance to try to solve a problem before taking enforcement action.

- **Financial assistance**
  The legislature appropriates money to fund tasks mandated by state laws and decrees. State agencies administer a variety of grant and loan programs that can help to achieve compliance with state water quality standards. Most state financial assistance programs can only award money to public agencies or non-profit groups.
  Grants to businesses, individuals, and non-profit organizations are limited by the state constitution and various statutes.

- **Regulatory assistance**

Local Governments

Nonpoint source pollution can often be characterized as a local land-use issue. People who are important in helping to solve pollution problems include members of local governments, special purpose districts, tribes, businesses, nonprofit organizations, and individual citizens.

Many state laws are implemented by local governments, and state agencies often function in an oversight and/or support role. Local governments and special districts may have primary or major implementation authority regarding environmental issues such as:

- Solid waste management
- Growth management and land use
- Stream restoration and rehabilitation
- Sewage systems, both on- and off-site
- Road construction and maintenance
- Coastal management
- Stormwater management
- Provision of drinking water
- Used oil and household toxics
- Irrigation water and return flows

7.1 BEST MANAGEMENT PRACTICES (BMPS)

Filter Strips

Filter strips are areas of vegetation that intercept runoff into lakes, rivers, and bayous. They can remove various pollutants such as heavy metals, sediment loads, and excess organic materials. Filter strips perform well with small, light-intensity rainfalls, and they should be shaped uniformly so that water moves into the vegetative strip without being concentrated. The cost of constructing a filter strip is very low, especially if constructed before the development of the surrounding area. According to an NRCS Field Guide, the cost of a filter strip in 2008 ranges from $50 to $150 per acre. Filter strips have been shown to be effective in reducing sediment runoff.

Swales

Swales are broad, shallow, channel depressions with a dense stand of vegetation that covers the side slopes and bottom. Swales can be natural or man-made, and are designed to trap particulate pollutants such as suspended solids (81% removal) and trace metals (approximately a 51% removal rate for copper and 71% for

zinc), promote infiltration, and reduce the flow velocity of stormwater runoff. Swales slow the flow of the runoff water and allow particulates to settle out while the water infiltrates into the soil. And swales can also remove small amounts of excess nutrients (34% of total phosphorus and 31% of nitrate/nitrite nitrogen) and heavy metals. Other benefits include:

- Swales help control peak discharges by reducing runoff velocity, lengthening flow paths, and improving time of concentration
- Infiltration through a pervious surface helps to reduce total stormwater runoff volume
- Swales provide effective pretreatment for downstream BMPs by trapping, filtering, and infiltrating particulates and associated pollutants. The design rates for total suspended solids (TSS) removal are 81% and 67% for oxygen-demanding substances (EPA Storm Water Technology Fact Sheet, September 1999.)
- Swales accent the landscape and may help to satisfy landscaping and greenspace requirements
- Roadside swales can keep stormwater flow away from street surfaces
- Construction may cost less than conventional curb and gutter systems. Costs vary from $28 to $164 per linear meter ($8.50 to $50.00 per linear foot), with a maintenance cost of approximately $0.58 per linear foot for a 0.5 meter (1.5 foot) deep channel (Southeastern Wisconsin Regional Planning Commission, 1991)
- Can also be used as an agricultural BMP

Constructed Wetlands

Constructed wetlands are alternative wastewater treatment structures that clean water by mimicking natural processes. They are often used to mitigate other areas that have lost wetlands due to development. Natural and constructed wetland areas are saturated for sufficient time periods and

support unique vegetation adapted for life in such conditions. Wetlands are extremely efficient in filtering sediment, nutrients, and some heavy metals from stormwater runoff and overflow of nearby water systems. A properly constructed wetland should produce effluent with less than 30 mg/L biochemical oxygen demand (BOD), 25

FIGURE 5 - EROSION TAKEN ON MAY 22, 2008

mg/L total suspended solids (TSS), and 10,000 cfu/100mL fecal coliform bacteria. Costs to build a constructed wetland vary with site conditions, design, and local requirements.

Grazing Management

Grazing management is the manipulation of animal grazing to achieve optimum and sustained animal, plant, land, environmental, and economic results while ensuring a continuous supply of forages to grazing animals. Water quality impacts from livestock grazing and browsing activities on pasture and range lands are minimized by controlling the conditions in which the livestock will graze. For example, by installing troughs and tanks to supply water for livestock, farmers can provide drinking sources at specific locations that will protect vegetative cover. Water facilities range in price depending on size ($150.00 for a 50-100 gallon trough, $270.00 for 570 gallon trough, $406.00 for 720 gallon trough and $450.00 for a trough larger than 720 gallons). This practice reduces or eliminates the need for livestock to be in or near the streams, and therefore

FIGURE 6 - SAME SITE TAKEN ON JUNE 19, 2008

reduces livestock waste in waterways (LSU AgCenter, 2002).

Please refer to the "Beef Production Best Management Practices" document located on the website www.lsuagcenter.com for more information.

Nonpoint source pollution prevention in urban areas involves managing existing sources of pollution and preventing new ones. Public education, awareness, and participation combine to create a powerful defense against nonpoint source pollution. Another consideration involves decision-making regarding land-use planning for current and future development. BMPs are best implemented though site plan controls, stormwater management plans, local ordinances, and erosion control guidelines and standards. The following are simple tasks that everyone can use to reduce nonpoint source pollution:

- Keep litter, pet wastes, leaves, and other debris out of street gutters and storm drains
- Mark storm drains with messages to warn citizens of the environmental hazards of dumping materials into them
- Apply lawn and garden chemicals sparingly and according to directions
- Dispose of used oil, antifreeze, paints and other household chemicals properly, not in sewer or drains
- Clean up spilled brake fluid, oil, grease and antifreeze. Do not hose it into the street where it will eventually reach local streams, lakes, and bayous
- Control soil erosion on your property by planting ground cover and stabilizing erosion- prone areas
- Encourage local government officials to develop construction erosion/sediment control ordinances in your community
- Purchase household detergents and cleaners that are low in phosphorus to reduce the amount of nutrients discharged in our water bodies
- Wash your car on grass so the soapy water soaks into the ground. Use a hose nozzle to prevent water from flowing when not in use

8.0 MAKING THE PLAN WORK

BMPs and/or other conservation practices will need to be implemented in order to reduce the NPS pollution load in the Lower Grand River/Belle River Watershed so it can meet its designated uses and no longer appear on the 303(d) list. This will require programs that provide technical assistance, funding, incentives, and also foster a sense of stewardship. Many of these programs that are designed to assist the landowner are already in place. The LDEQ's Nonpoint Source Unit provides monies distributed through the EPA under Section 319 of the Clean Water Act. These funds are utilized to implement BMPs for all types of land uses within the watershed in order to reduce and/or prevent NPS pollution and achieve the watershed's designated use goals. The USDA and NRCS are federal government agencies that have several such programs made available via the Farm Security and Rural Investment Act of 2002. These programs are offered through the local Soil and Conservation District (SWCD), and the NRCS has a list of BMPs for many types of programs.

Parish-wide cooperation and coordination will be necessary in order to protect water quality within the Lower Grand River/Belle River watershed. Though challenging, it is an opportunity for leaders, officials, and local citizens to unite for a common interest. As a result, people develop new relationships that will benefit the community and their watershed. The watershed approach helps build new levels of cooperation and coordination, which is necessary to successfully control NPS loading and thus restore and protect the Lower Grand River and the Belle River.

Every stakeholder in a watershed partnership brings important information, viewpoints, and ideas to the group. Local citizens have a good idea of issues within their watershed. They are able to provide input as practical solutions are developed. Valuable historical information essential to watershed planning concerning past land use and associated problems can be provided by residents. Environmental scientists, biologists, engineers, and resource managers can provide their technical expertise as well. This partnership works together to prioritize problem areas and develop viable solutions. The water body itself helps promote cooperation among stakeholders in the watershed partnership because most people want to protect and restore their natural resources for future generations. The locally-based watershed partnership provides a means for stakeholders to communicate with each other, share resources, work on common goals, and assist in bringing funding into the area for special projects, BMP cost-share programs, and education.

8.1 REGULATIORY AUTHORITY

Section 319 of the Clean Water Act (PL 100-4, February 4, 1987) was enacted to specifically address problems attributed to nonpoint sources of pollution. Its objective is to restore and maintain the chemical, physical, and biological integrity of the nation's waters (Sec. 101; PL 100-4). Section 319 directs the governor of each state to prepare and submit a nonpoint source management program for reduction and control of pollution from nonpoint sources to navigable waters within the state by implementation of a four year plan, submitted within 18 months of the day of enactment (LDEQ, 2000).

In response to the federal law, the State of Louisiana passed the Revised Statute 30:2011, which was signed by the Governor in 1987 as Act 272. Act 272 designated the Louisiana Department of Environmental Quality (LDEQ) as the lead agency to develop and implement the State's Non-point Source Management Plan. LDEQ's Office of Water Resources (OWR) was given the responsibility to protect and preserve the quality of waters in the state and has developed the nonpoint source management program, ground water quality program, and a conservation and management plan for estuaries. These programs and plan were developed in coordination with the appropriate state agencies, including the Department of Natural Resources, Department of Wildlife and Fisheries, Department of Agriculture and Forestry, and the state Soil and Water Conservation Committees in various jurisdictions (La.R.S. 30:20). LDEQ's Water Quality Assessment Division is responsible for managing federal funds to implement projects that will restore or protect water quality, providing matching State funds when required, and complying with terms and conditions necessary to receive federal grants.

Water quality standards are described in LAC 33:IX.1101.D in chapter 11 (LDEQ, 2003). These standards are applicable to the surface waters of the state and are utilized through the waste load allocation and permit process to develop effluent limitations for point source discharges to surface waters of the state. The water quality standards also form the basis for implementing the best management practices for control of nonpoint sources of water pollution.

Chapter 11 also describes the anti-degradation policy (LAC 33:IX.1109.A.2) which states that the administrative authority will not approve any wastewater discharge or certify any activity for federal permit that would impair water quality or the use of state waters. Waste discharges must comply with applicable state and federal laws for the attainment of water quality goals. Any new, existing, or expanded point source or nonpoint source discharging into state waters, including land clearing, which is the subject of a federal permit application, will be required to provide the necessary level of waste treatment to protect state waters as determined by the administrative authority. Furthermore, the highest statutory and regulatory requirements shall be achieved for all existing point sources and best management practices for nonpoint sources. Additionally, no degradation shall be allowed in high-quality waters that constitute outstanding natural resources, such as waters of ecological significance as designated by the office. Those water bodies presently designated as outstanding resources are listed in LAC 33:IX.1123.

8.2 ACTIONS BEING IMPLEMENTED BY LDEQ

The LDEQ is currently designated as the lead agency for implementation of the Louisiana Nonpoint Source Program. The LDEQ Nonpoint Source Unit provides USEPA §319(h) funds to assist in implementation of BMPs and to address water quality problems on subsegments listed on the §303(d) list, or on those subsegments which are located within Category I Watersheds as identified under the Unified Watershed Assessment of the Clean Water Action Plan. USEPA §319(h) funds are utilized to sponsor cost sharing, monitoring, and educational projects. These monies are available to all private, for-profit, and non-profit organizations which are authenticated legal entities, and governmental jurisdictions including cities, counties, tribal entities, federal agencies, or agencies of the state. LDEQ is presently cooperating with such organizations on approximately 60 nonpoint source projects which are active throughout the state.

8.3 ACTIONS BEING IMPLEMENTED BY OTHER AGENCIES

The U.S. Department of Agriculture (USDA) and Natural Resource Conservation Service (NRCS) offer landowners financial, technical, and educational assistance to implement conservation practices and/or BMPs on privately owned land to reduce soil erosion, improve water quality, and enhance crop land, forest land, wetlands, grazing land and wildlife habitats. The "Farm Security and Rural Investment Act of 2002", known as the 2002 Farm Bill, provides funding to various conservation programs in each state by way of the NRCS and the state's local Soil and Water Conservation Districts (SWCD). Although most of these programs are designed to assist agriculture, there may be cases where they can be utilized for conservation practices for other land uses. A complete list of agricultural BMPs is provided by the NRCS in their "Technical Guide Handbook", which includes a description of the BMP and its recommended uses. Each BMP is listed by a code, i.e., Field Border (386). The following are just a few examples of the USDA Natural Resources Conservation Service national priorities and programs:

Agricultural Management Assistance Program

This program provides cost-share assistance to agricultural producers who will voluntarily address issues such as water management, water quality, and erosion control by incorporating conservation into their farming operations. Such practices might include constructing an irrigation structure, planting trees to improve water quality, or adopting a resource conservation strategy such as soil erosion control.

Environmental Quality Incentives Program (EQIP)

EQIP was reauthorized in the 2002 Farm Bill to provide a voluntary conservation program for farmers and ranchers who promote agricultural production and environmental quality as compatible goals. This program offers financial and technical assistance to eligible participants to develop management practices on their agricultural land.

Conservation Reserve Program (CRP)

The CRP provides technical and financial assistance on a voluntary basis to eligible farmers and ranchers in addressing soil, water, and related natural resource concerns to protect highly erodible and environmentally sensitive lands.

Watershed Operations

Watershed Operations is a voluntary program under the authority of the Watershed Protection and Flood Prevention Act of 1054 (P.L. 83-566) and the Flood Control Act of 1944 (P.L. 78-534). Under this program, the NRCS provides technical and financial assistance to states, local governments, and tribes to implement authorized watershed project plans for the purpose of watershed protection, flood mitigation, soil erosion reduction, irrigation water management, sediment control, fish and wildlife enhancement, and wetlands creation and restoration.

Rapid Watershed Assessments

NRCS is encouraging the development of rapid watershed assessments in order to increase the speed and efficiency needed to guide conservation implementation. In summary, this program will provide quick and inexpensive plans for setting priorities in a watershed and taking necessary action.

Wetlands Reserve Program

This voluntary program provides technical and financial assistance from the NRCS to help landowners in protecting, restoring, and enhancing wetlands on their property. The goal of this program is to achieve the greatest wetland functions and values along with an optimum wildlife habitat on all wetlands enrolled in the program.

Wildlife Habitat Incentives Program (WHIP)

WHIP is a voluntary program for those interested in developing and improving wildlife habitats primarily on private land. Technical assistance and up to 75% cost-share assistance is provided in order to establish and improve fish and wildlife habitats. A WHIP agreement between the NRCS and the participant generally lasts from 5 to 10 years.

Master Farmer Program

The Louisiana State University Agricultural Center developed the Master Farmer Program. This voluntary program is based on educating farmers about environmental stewardship, resource- based production, and resource management. Becoming a certified Master Farmer involves classroom instruction on water quality regulations, conservation practices, crop-specific best management practices and implementation, and USDA conservation funding. Participants will visit model farms to view the implementation of best management practices to reduce sediment runoff. Finally, a farm-specific conservation plan will be developed. Attainment of “Master Farmer” status can set an example for the agricultural community to become involved in implementing best management practices and in helping to control nonpoint source pollution. Economically and effective best management practices can make a huge impact on reducing agriculture’s contribution to water quality problems.

Barataria-Terrebonne National Estuary Program

The Barataria-Terrebonne National Estuary Program's (BTNEP - www.btnep.org) main goals are to help prevent activities that threaten an estuary's public water supply, are harmful to fish, shellfish, and wildlife populations, and negatively impact recreational opportunities for estuary residents. BTNEP's challenge is to coordinate all agency and stakeholder efforts related to restoration in the Barataria – Terrebonne system to create a sense of environmental stewardship for the natural resources of the estuary complex. BTNEP's water quality action plans to reduce NPS pollution include a reduction of agricultural pollution and storm water management. The plans propose to reduce agricultural nonpoint source pollution components by introducing BMPs. The results are improved water quality and estuarine ecosystem health. LDEQ's monitoring program provides data to measure the success of the implemented action plans. Long-term success with the implementation of BMPs will be seen in the reduction of urban NPS pollutants and a reduction in the number of water subsegments not meeting water quality criteria due to urban runoff. The plan promotes the use of alternative methods for the disposal of stormwater. Stormwater management will be accomplished by performing studies that will increase the knowledge base of alternative stormwater disposal. These programs will focus on reducing 1) loadings of nutrients, fecal coliform bacteria, and pollutants to water bodies, 2) improved water quality in support of natural resources, and 3) enhanced wetland vegetation.

BTNEP will soon be partnering with LDEQ in the 319 Clean Waters Program. The agencies will work together to identify nonpoint source-related contributions to watersheds, develop contacts with watershed stakeholder groups, establish watershed committees which will assist in the development of watershed plans for impaired water bodies, review ambient data, and develop educational material for middle and high schools as well as outreach material for laypersons to promote environmental awareness and activities that protect and enhance area surface waters.

In addition to the programs mentioned, the following organizations have signed a Memorandum of Understanding (MOU) with LDEQ under the state's NPS Management Plan that each will aid LDEQ in achieving the goals of the plan:

- Louisiana Department of Agriculture and Forestry
- Louisiana Department of Health and Hospitals
- Louisiana Department of Wildlife and Fisheries
- Louisiana Department of Transportation and Development
- Louisiana Department of Natural Resources
- Louisiana State University Agricultural Center
- Natural Resources Conservation Service
- USDA – Farm Services Agency
- Louisiana Forestry Association
- US Fish and Wildlife Service
- USDA Forest Service

- US Army Corps of Engineers
- US Geological Survey
- Federal Emergency Management Agency
- Louisiana Farm Bureau Federation

9.0 TIMELINE FOR IMPLEMENTATION

The NPS Implementation Plan for the Grand and Belle Rivers outlines a four-year management plan to reduce the amount of NPS pollutants that reach the waterway. LDEQ intensively samples each watershed in the state once every four years to see if the waterbodies are meeting water quality standards.

Basin	***First 4-Year Cycle***	***Second 4-Year Cycle***
Mermentau	2004, 2005, 2006, 2007	*2008, 2009, 2010, 2011*
Vermilion-Teche	2004, 2005, 2006, 2007	*2008, 2009, 2010, 2011*
Calcasieu River	2004, 2005	*2008, 2009*
Ouachita River	2004, 2005	*2008 ,2009*
Barataria	2004, 2005	*2008, 2009*
Terrebonne	2004, 2005	*2008, 2009*
Mississippi River	2004, 2005	*2008, 2009*
Lake Pontchartrain	2006, 2007	*2010, 2011*
Pearl River	2006	*2010*
Red River	2004, 2005, 2006, 2007	*2008, 2009, 2010, 2011*
Sabine River	2006, 2007	*2010, 2011*
Atchafalaya River	2004, 2005	*2008, 2009*

Prior to 2004, waterbodies were sampled once every five years. Thus, sampling began during 2000 for the Terrebonne Basin, including the Grand and Belle Rivers, and occurred again in 2005. Sampling will also take place in 2009 and 2013. The data from 2005 will be used as a baseline to measure the rate of water quality improvement for samples taken in subsequent years. If no improvement in water quality is shown by the 2009 sampling, LDEQ will revise the NPS Implementation Plan to include supplemental corrective actions to bring the waterway into compliance. Additional BMPs and/or other options will be employed, if necessary, until water quality standards are achieved and the Grand and Belle Rivers are restored to their designated uses.

9.1 TRACKING AND EVALUATION

As stated in the Louisiana Nonpoint Management Plan, program tracking will be performed at several levels to determine if the watershed approach is an effective method to reduce nonpoint source pollution and improve water quality. The following actions will be taken to evaluate the effectiveness of this approach:

1. Tracking of BMP's implemented as a result of Section 319, EQIP, or other sources of cost-share and technical assistance within the watershed (short-term)
2. Tracking of actions with the Watershed Restoration Action Strategy (short-term)
3. Tracking progress in reducing nonpoint source pollutants such as solids, nutrients, and organic carbon from various land uses (sugarcane, crawfish farms, pasture land) within the watershed (short-term)
4. Tracking water quality improvement in the river (i.e., total dissolved oxygen)
5. Documenting the results of tracking to the residents within the watershed and to EPA (short and long-term)

10.0 SUMMARY OF THE WATERSHED IMPLEMENTATION PLAN

Restoring the designated uses in Subsegment 120201 will require a concerted effort from all of the stakeholders within, including government (local, state, and federal), private and public groups, and local citizens. A person who lives and/or owns property in the watershed is a stakeholder and stands to benefit from his or her contribution towards protecting it.

Public education is the first critical element needed to accomplish goals and objectives, because it is imperative that the public understands and supports efforts to implement BMPs. Public education is a proactive approach to many nonpoint source pollution problems. Education may instill a greater concern about the environment, and inspire the community to take action without additional regulation. Awareness of these problems is needed, along with education regarding the various BMPs for home and business owners. More information on nonpoint source pollution can be found at LDEQ's NPS website - http://nonpoint.deq.louisiana.gov

Successful outcomes are more likely when citizens understand what is occurring and why. When stakeholders volunteer to demonstrate conservation practices on their land they should receive positive recognition and other incentives, thereby encouraging others to do the same.

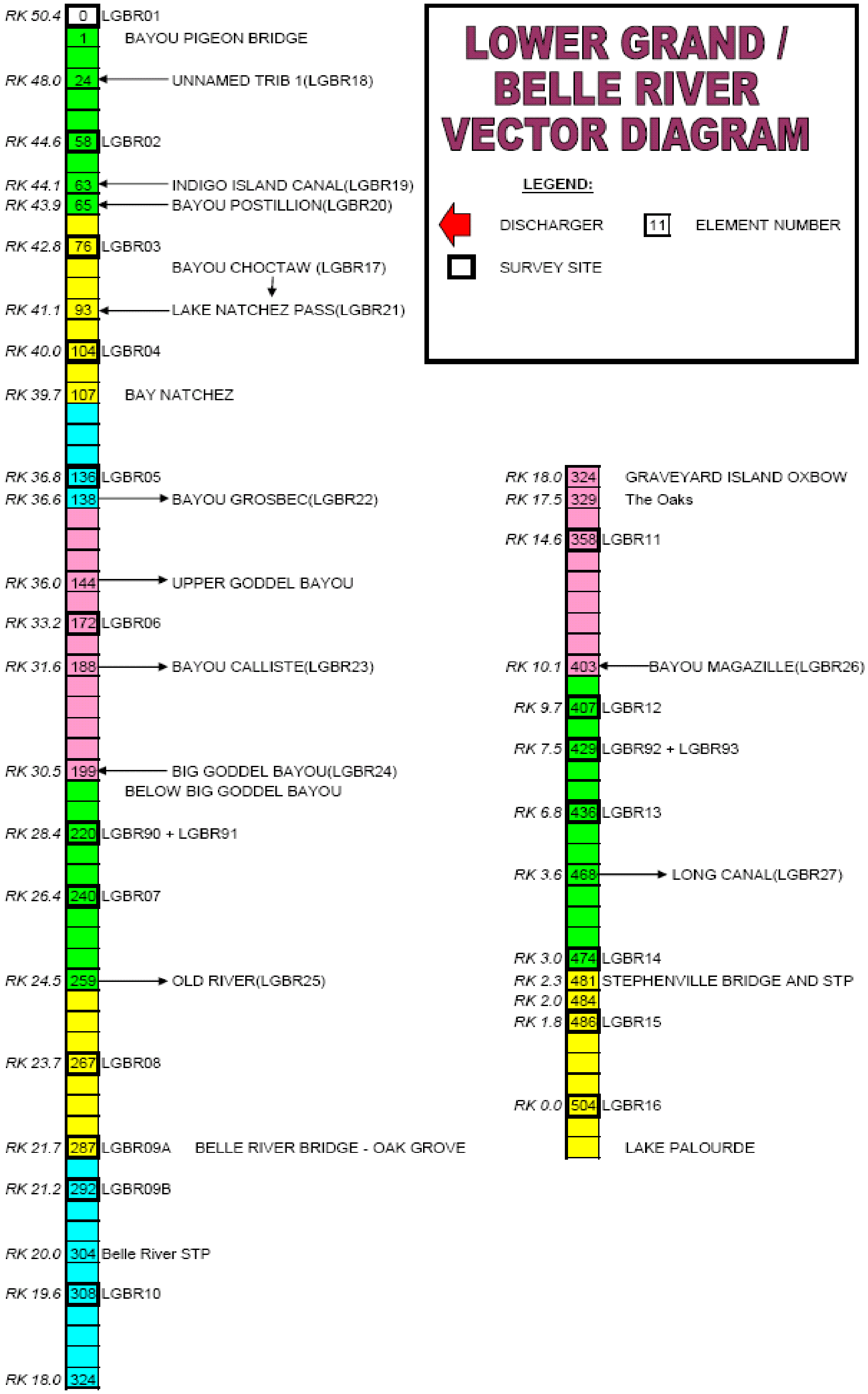
The dominant land uses in Subsegment 120201 are agriculture (mainly sugarcane), and urban/residential development, with the majority of the lower watershed covered by deciduous forests and forested wetlands. Each type of land use that is identified within Subsegment 120201 has BMPs that are known for reducing NPS pollutant loads. These practices will aid in reducing the sulfate, fecal coliform bacteria, and nutrients in runoff. Prevention of sediment in runoff and runoff containing excess nutrients from land use activities occurring within the watershed will lead to improvements in water quality.

Urban stormwater runoff BMPs should be implemented and maintained to reduce and/or eliminate nonpoint source pollution from entering waterbodies. Education and participation are the best approaches for controlling NPS loading from urban residential sites. The use of maps for identifying nearby streams, topography, and drainage patterns can improve a residential area's strategy for developing a plan to prevent NPS loading by implementing BMPs. Additionally, vegetation can be established on sloping areas of a site. These types of BMPs are very simple and cost-effective, although there may be other types which could be more effective at preventing NPS loading.

Although some of the BMPs and the recommended courses of action were described within this plan, a consolidated list of BMPs recommended for various land uses can be viewed in the State of Louisiana Water Quality Management Plan, Volume 7, *Louisiana's Nonpoint Source Management,* 2005.

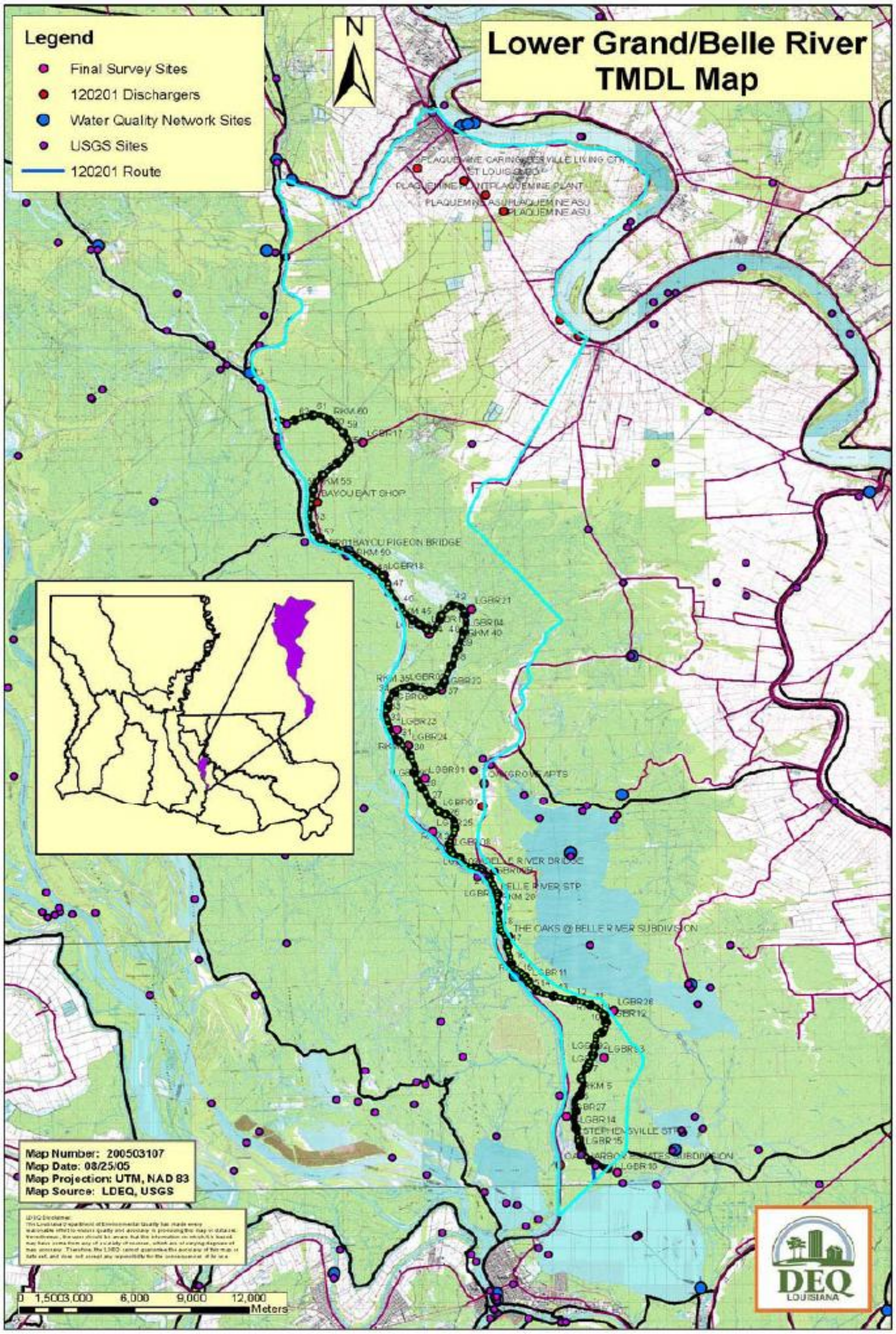
APPENDIX

Figure 1. Model Layout



Lower Grand/Belle River Watershed TMDL
Subsegment 120201
Originated: October 7, 2005
Revised: March 22, 2006

Figure 2. Map of Study Area



DATA TYPES 25 - WASTELOAD DATA FOR DO, BOD, AND NITROGEN							
Wasteload / Withdrawal Name	**EL #**	**DO, mg/l**	**Data Source**	**UCBOD1, mg/l**	**UNBOD, mg/l**	**UCBOD2, mg/l**	**Data Source**
B PIGEON BRIDGE	1	2	Permit	69.000	64.500	0.000	Permit
LAKE NATCHEZ PASS	93	5	Criteria	1.780	0.710	1.500	65% Reduction to meet criteria.
BAYOU GROSBEC	138	5	Criteria	0.000	0.000	0.000	Distributary
UPPER GODDEL	144	5	Criteria	0.000	0.000	0.000	Distributary
BAYOU CALLISTE	188	5	Criteria	1.260	0.580	0.870	65% Reduction to meet criteria.
BIG GODDEL	199	5	Criteria	2.860	0.890	1.260	65% Reduction to meet criteria.
OLD RIVER	259	5	Criteria	0.000	0.000	0.000	Distributary
OAK GROVE - APTS	287	2	Permit	69.000	64.500	0.000	Permit
BELLE RIVER STP	304	2	Permit	23.000	43.000	0.000	Permit
THE OAKS	329	2	Permit	46.000	43.000	0.000	Permit
BAYOU MAGAZILLE	403	5	Criteria	0.940	0.370	0.750	65% Reduction to meet criteria.
LONG CANAL	468	5	Criteria	0.000	0.000	0.000	Distributary
STEPHENVILLE STP	481	2	Permit	23.000	43.000	0.000	Permit