2019

BAYOU CHENE WATERSHED IMPLEMENTATION PLAN

WATER QUALITY IMPAIRMENTS: DISSOLVED OXYGEN, FECAL COLIFORM, & MERCURY

SUBSEGMENT 050603

DEQ LOUISIANA

Table of Contents

LIST OF FIGURES

List of Tables

1. INTRODUCTION

Bayou Chene, subsegment 050603, is located in southern Louisiana, within the Mermentau River Basin (Figure1). The watershed is approximately 134 mi^2 and flows for 33 miles from the headwaters to Lacassine Bayou and includes Bayou Grand Marais. The lower end of Bayou Chene is affected by backwater from the Gulf of Mexico and occasionally experiences backflow. The watershed is broken down into subwatersheds based on three (3) 12-digit Hydrologic Unit Codes (HUCs), 080802020201 (Gum Gully-West Bayou Grand Marais), 080802020203 (West Bayou Grand Marais-Middle Bayou Grand Marais), and 080802020205 (Bayou Chene).

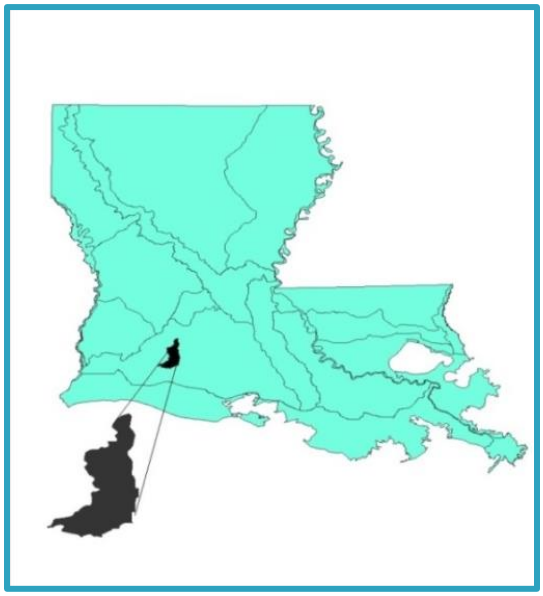

Figure 1 Location of Bayou Chene

Figure 2 illustrates the land use/land cover in Bayou Chene. The watershed is sparsely populated and aquaculture and agriculture are the primary land uses in the bayou, particularly rice and soybeans. After harvest, rice fields are flooded and crawfish are raised in those fields. Irrigation of rice and other crops are considered by Louisiana Department of Environmental Quality (LDEQ) to have a significant impact on water quality in this area. Pollutants often associated with traditional rice production include sediment, pesticides, nutrients, and oxygen- demanding organic matter. Bayou Chene has been identified as a top priority due to water quality concerns, primarily related to the effects of nutrient loading on the health of local waterbodies and, eventually, the Gulf of Mexico. “Dissolved Oxygen (DO) directly correlates with overall nutrient impact as a well-established biological and ecological principle. Thus, when the LDEQ maintains and protects DO, the LDEQ is in effect also limiting and controlling nutrient concentration and impacts. The increased growth of living organisms with accompanying increased respiration, excretion, and decomposition, causes an increased biochemical oxygen demand (BOD) that results in DO depletion” (LDEQ 1996).

The LDEQ conducts a statewide water quality assessment centered on basin subsegments, these results are reported in the Louisiana Integrated Report (IR). The 2016 IR lists Bayou Chene as impaired for not meeting its designated uses of fish and wildlife propagation (FWP) and primary contact recreation (PCR). Mercury in fish tissue is a suspected cause of impairment for FWP, stemming from atmospheric deposition. The source of mercury impacting the use support in Bayou Chene originates from outside of the watershed; therefore, the mercury impairment will not be addressed in this document. An additional suspected cause of impairment for FWP is low DO concentrations from agricultural practices. DO ambient water quality data from 2014/2015 is responsible for the 2016 IR listing, in which seven samples of nine (78 percent exceedance), March to November, were below 3.0 mg/L, and one sample of three (33% exceedance), were below 5 mg/L, December to February. Fecal coliform (FC) is the suspected cause of impairment for PCR, due to runoff from forest/grassland/parkland, drought related impacts, and rural (residential areas). FC ambient water quality data from 2014/2015 is also responsible for the 2016 IR listing, in which three samples of six (50 percent

exceedance) were above the 400 cfu/100mL PCR criteria.

As a result of low concentrations of DO and high concentrations of FC bacteria, Bayou Chene was selected as an area of interest in which funds were used to implement best management practices (BMPs) in the subsegment. Conducting water quality sampling in conjunction with BMP implementation is essential to tracking changes in water quality as implementation progresses. Initially, ambient water quality data was the only indicator of water quality in the bayou. LDEQ has been collecting data on the waterbody since 1998. This data is used to establish water quality criteria or standards, assessment of conditions, establishing water quality discharge permit limits, and nonpoint source (NPS) reduction recommendations for the protection and improvement of surface water quality in Louisiana. Three additional water quality monitoring efforts have been conducted in the subsegment, from 2012 to present.

The United States Department of Agriculture, Natural Resources Conservation Service (USDA-NRCS) has been working with producers and landowners from approximately 2005 through 2015 to implement various conservation practices that improve water quality, restore wetlands, enhance wildlife habitat, and sustain agricultural profitability. The University of Louisiana Lafayette (UL) collected water quality monitoring (2012-2015) during the USDA-NRCS Mississippi River Basin (MRBI) Initiative. The goal of the project was to reduce nutrient loading into the Bayou Chene watershed. At the conclusion of the project, BMP data showed placement was sporadic, based solely on projected participation, and from 2012 through 2015, only 42 BMPs were implemented in 1 of the 3 HUCs (080802020205). Analysis of water quality data before, during, and after project BMP implementation showed there were small improvements in parameters measured. Baseline data was collected during the MRBI project, June 2012 through May 2013. DO data collected at WQN site 0658/project site 1C, showed 23 of 37 samples were below 3.0 mg/L, March to November (62 percent exceedance), and 5 of 12 samples were below 5 mg/L, December to February (42 percent exceedance). Long-term water quality monitoring began June 2013. DO exceedance rates for 2013-2014, were, 87 percent (March to November) and 18 percent (December to February). DO exceedance rates for 2014-2015, were, 82 percent (March to November) and 27 percent (December to February). At the conclusion of the MRBI project, DO, in the bayou did not maintain the waterbody's DO standard of 3.0 mg/L, March to November, and 5 mg/L, December to February; thus, the MRBI project did not result in restoration of the watershed.

To further efforts, the Louisiana Department of Agriculture and Forestry Office of Soil and Water Conservation **(**LDAF-OSWC) began a targeted implementation effort in 2014, in which critical areas for BMP implementation began to be determined by output from the SWAT model, land use/land cover data, projected participation, and DO data. DO exceedance rates for 2015-2016, were, 73 percent (March to November) and 36 percent (December to February). DO exceedance rates for 2016-2017, were, 72 percent (March to November) and 55 percent (December to February). DO exceedance rates for 2017-2018, were, 62 percent (March to November) and 40 percent (December to February). Water quality data continues to be collected to pinpoint additional critical areas where future BMPs may be implemented.

Though the number of BMP's implemented in the watershed increases each year, improvements in water quality after implementation may take time. The number of exceedances at WQN site 0658 has fluctuated through the years; therefore, the focus of this watershed implementation plan (WIP) is to implement BMPs that will reduce FC loads and increase DO concentrations in Bayou Chene, with the goal of restoring

designated use support for FWP and PCR. Currently, on-site disposal systems (OSDS) education and outreach is being conducted in rural residential areas to inform homeowners of proper operation and maintenance of their systems. Additionally, LDAF will be implementing livestock waste management BMPs to reduce FC loads from agricultural sources. Mercury, though an impairment, will not be addressed through NPS funding. With continued implementation within the critical areas, projected watershed restoration for FWP and PCR is estimated for 2027.

Bayou Chene
Subsegment 050603
Land Use/Land Cover

	Land Use/Cover	Acres	Percent
	Rice/Aquaculture	54,663	47.3%
	Row crop agriculture	33,606	29.1%
	Forest	14,409	12.5%
	Developed	4,965	4.3%
	Forested Wetlands	3,576	3.1%
	Pasture/Hay/Other grasses	3,570	3.1%
	Shrubland	381	0.3%
	Herbaceous Wetlands	252	0.2%
	Open Water	88	0.1%
	Barren	2	0.0%

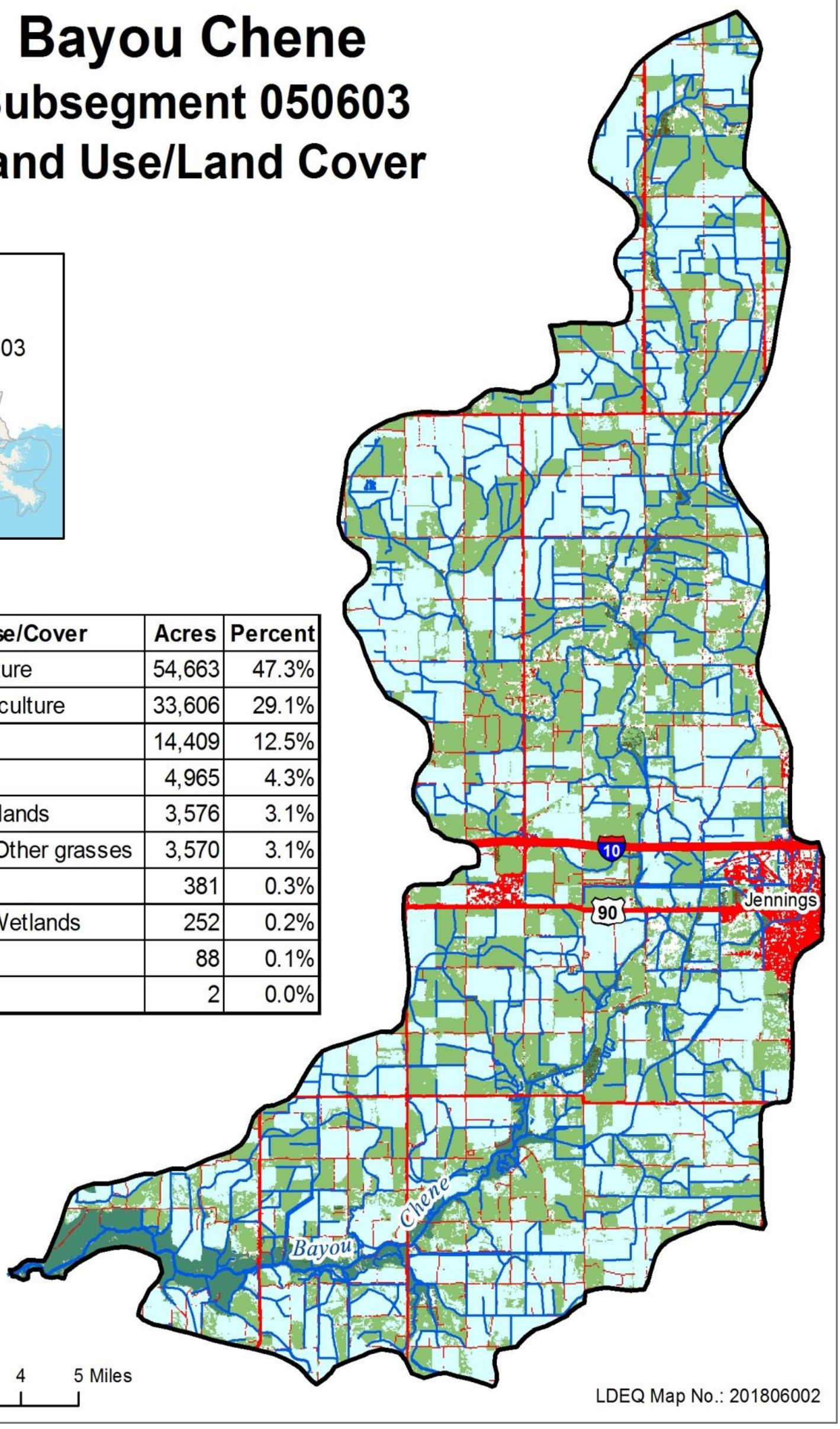

Figure 2 Bayou Chene, subsegment 050603, Land Use/Land Cover Map

2. USEPA'S NINE KEY ELEMENTS

In October 2003, the United States Environmental Protection Agency (USEPA) published NPS Program and Grants Guidelines for States and Territories, which included nine key elements of acceptable WIPs. USEPA requires states to implement incremental funds in watersheds where WIPs have been developed.

a. Identification of sources and causes or groups of similar sources that will need to be controlled to achieve load reductions estimated in the WIP;
b. An estimate of load reductions expected for management measures described in paragraph (c);
c. A description of NPS management measures that will need to be implemented to achieve estimated load reductions in paragraph (b); and an identification of critical areas where those measures need to be implemented;
d. An estimate of technical and financial assistance, and/or associated costs and authorities necessary to implement the WIP;
e. An information/education component used to enhance public understanding of the project and encourage early and continued participation in selecting, designing and implementing NPS management measures;
f. A schedule for implementing management measures identified in the WIP that is reasonably expeditious;
g. A description of interim, measurable milestones or other control actions being implemented;
h. A set of criteria to determine whether load reductions are being achieved over time and whether substantial progress is being made toward meeting water quality standards;
i. A monitoring component to evaluate effectiveness of implementation efforts over time, measured against criteria established in paragraph (h).

A. IDENTIFICATION OF CAUSES OF IMPAIRMENT AND POLLUTANT SOURCES OR GROUPS OF SIMILAR SOURCES THAT NEED TO BE CONTROLLED TO ACHIEVE NEEDED LOAD REDUCTIONS, AND ANY OTHER GOALS IDENTIFIED IN THE WATERSHED PLAN

Bayou Chene fully meets water quality criteria for SCR; however, the waterbody does not meet its criteria for PCR and FWP due to high concentrations of fecal coliform, and low concentrations of DO. The state's 2016 IR identified suspected sources of impairment are agriculture, drought-related impacts, runoff from forest/grass/and/parkland, and rural (residential areas). Potential long-term effects of runoff from agricultural pollutants include high concentrations of nitrogen, phosphorus, sediments, turbidity, and pesticides entering the watershed and decreasing DO concentrations. As stated by Smythe in Water *Quality Model for Evaluation of Nonpoint Source Impacts of Rice Field Runoff*, "As the pollutant enters the waterbody, constituents dissolve, settle, or are suspended in the water column for later dissolution, degradation or settling. Soluble constituents may create the familiar 'hot spots' of DO depletion, in which water column bacteria immediately seize the constituents as a food source, requiring large amounts of oxygen to degrade the materials" (Smythe 72). "Materials that are not readily soluble may settle out, blanketing the stream bottom for some distance. Bacteria present in the sediment degrade these materials. The degradation process may occur at different rates depending upon environmental constraints, bacterial populations and response of the bacteria to the constituents. Constituents that are degraded are then available for resuspension back into the water column in the process termed sediment flux" (Smythe 73). Low DO in Bayou Chene likely results from excessive nutrient deposition.

In 2002, FTN Associates, Ltd. developed a DO total maximum daily load (TMDL) for Bayou Chene, suggesting a 58 percent reduction in loads to achieve restoration of the FWP designated use; however, reductions of existing NPS loads were required for the projection simulation to show the bayou's current DO standard of 5 mg/L, year round, being maintained. Since the drafting of the TMDL, a second addendum to the Mermentau River Basin Use Attainability Analysis (UAA), was submitted to EPA, on January 28, 2019, in which LDEQ proposed DO revisions for Bayou Chene. The DO proposed criterion change was from 5.0 mg/L year round, to 3.0 mg/L from March-November, 5.0 mg/L December-February.

Bayou Chene generally has low concentrations of DO, documented as far back as 1998. DO concentrations ranged from 0.11 mg/L (April and September 2014/2015) to 10.31 mg/L (December 2010/2011). Figure 3 outlines all DO concentrations collected from 1998 through 2015 at the WQN site, December to February. Figure 4 outlines all DO concentrations collected from 1998 through 2015 at the WQN site, March to November. The respective DO standard is shown by a red line on each graph. The exceedance rates were calculated for DO from 1998 through 2015 for March to November and December to February, respectively (Figures 5 and 6).

From March to November, rates fluctuated as high as 90 percent in 2007 and as low as 78 percent in 2003 and 2014/2015. Between 1998 and the most recent ambient cycle, 2014/2015, there has been a four percent reduction in exceedance rates. Between 1998 and 2003, there was a four percent decrease in exceedance. Since the onset of BMP implementation in 2005, DO ambient water quality data showed an increase in DO exceedance rates, March to November 2007 (90 percent exceedance), followed by a decline in 2010/2011 (80 percent exceedance), followed by a 78 percent exceedance in 2014/2015. In 2007, there were ten samples taken between March and November, of which nine samples did not meet the standard. In the 2010/2011 sampling season, there were ten samples taken, of which eight did not meet the state's standard between March and November. In the 2014/2015 sampling season, there were nine samples taken between March and November, of which seven samples did not meet the standard of 3.0 mg/L.

From December to February, DO rates fluctuated as high as 33 percent in 2003, 2010/2011, and 2014/2015, and as low as zero percent in 1998 and 2007. Between 1998 and the most recent ambient cycle, 2014/2015, there has been a 33 percent increase in exceedance rates. Between 1998 and 2003, there was a 33 percent increase in DO exceedance rates. Since the onset of BMP implementation in 2005, DO ambient water quality data showed an increase in DO exceedance rates, December to February 2007 (zero percent exceedance), followed by an increase in 2010/2011 (33 percent exceedance), followed by a 33 percent exceedance in 2014/2015. In 2007, there were no samples that exceeded the standard. In the 2010/2011 sampling season, there were three samples taken, between December and February, of which one sample did not meet the state's standard. In the 2014/2015 sampling season, there were three samples taken between December and February, of which one sample did not meet the standard of 5.0 mg/L.

Data also shows DO levels were highest in the cooler months (October through March) and lowest in the warmer months (May through September) of each year (Figure 7). From December to February, 1998 through 2015, 9 of 12 samples were above the 5 mg/L standard. From March to November, 1998 through 2015, only 9 of 49 samples were above the 3 mg/L standard.

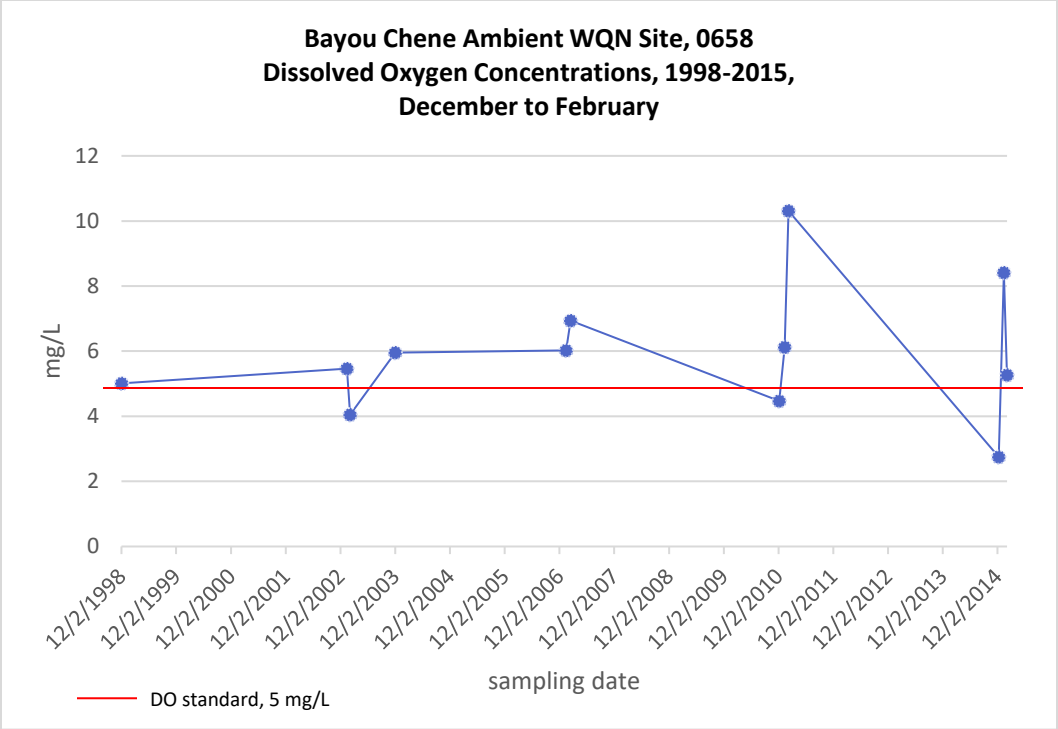

Figure 3 Bayou Chene dissolved oxygen concentrations at water quality network site 0658, 1998-2015, December to February. The red line represents the DO standard of 5 mg/L.

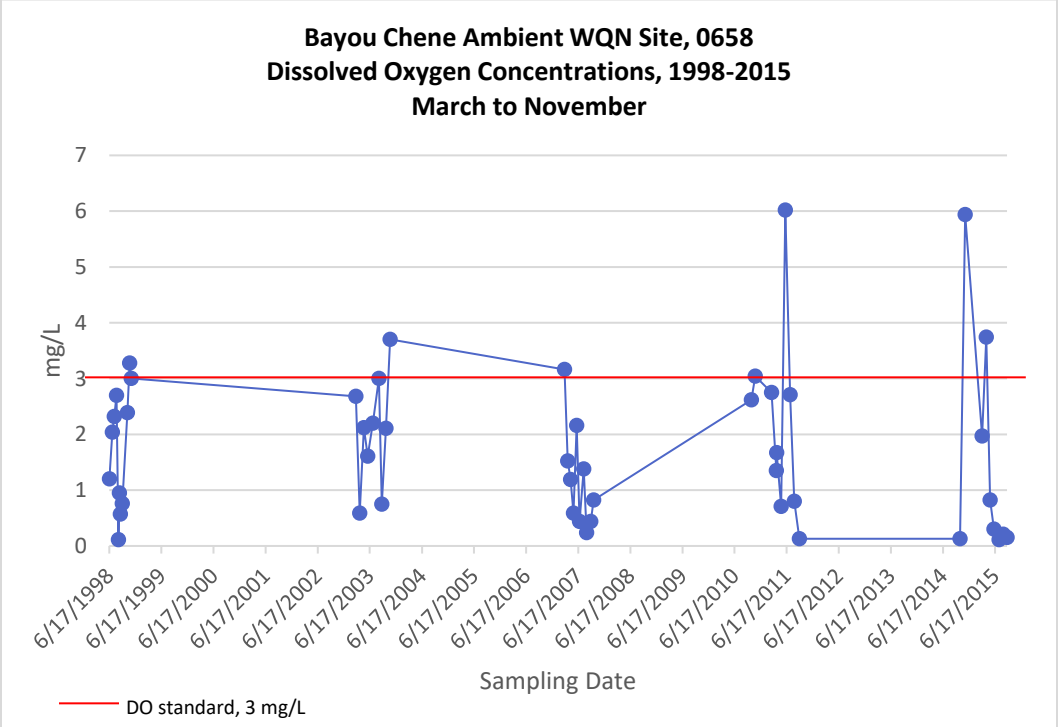

Figure 4 Bayou Chene dissolved oxygen concentrations at water quality network site 0658, 1998-2015, December to February. The red line represents the DO standard of 3.0 mg/L .

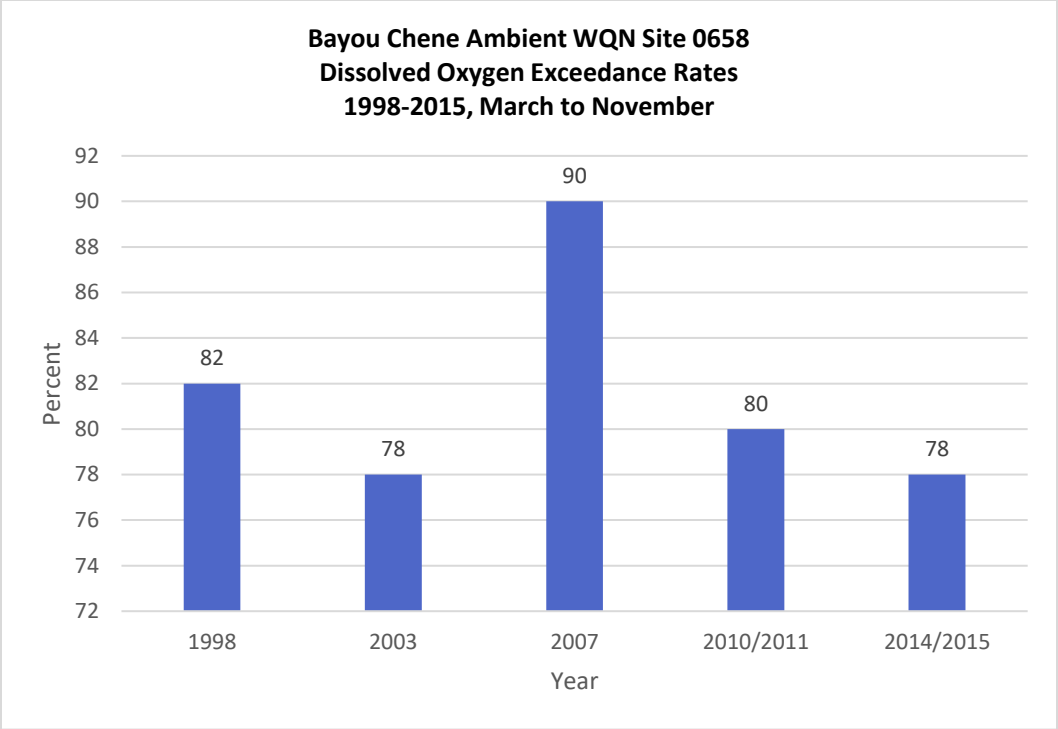

Figure 5 Bayou Chene, water quality network site 0658, dissolved oxygen concentration exceedance rates, 1998-2015, March to November

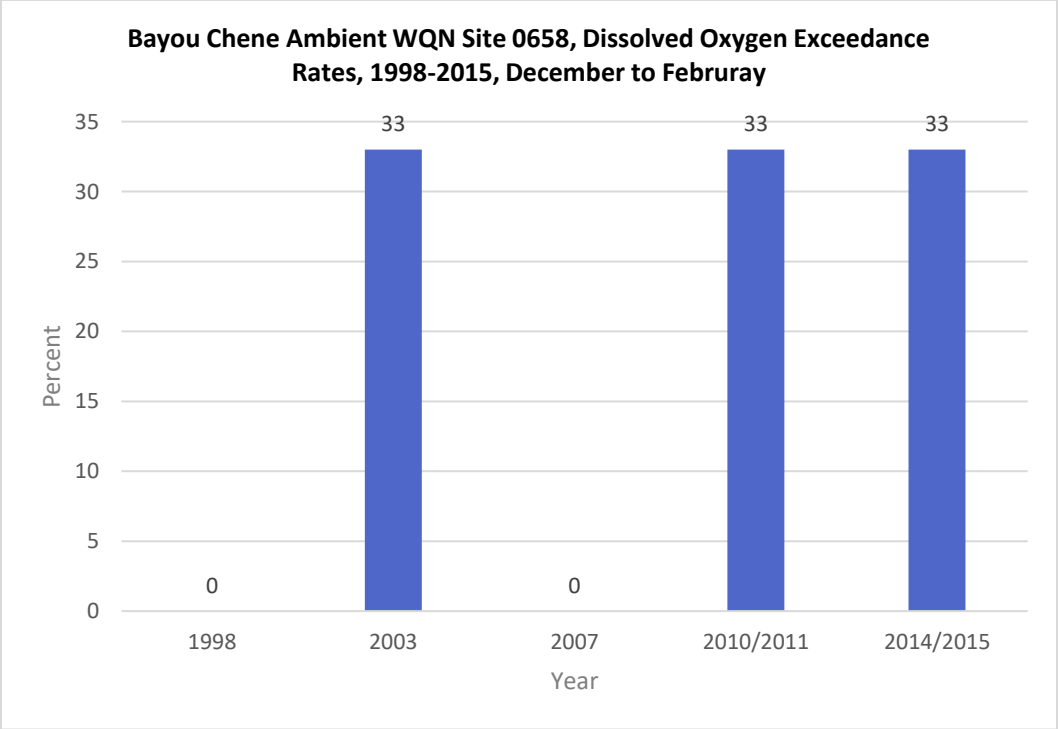

Figure 6 Bayou Chene, water quality network site 0658, dissolved oxygen concentration exceedance rates, 1998-2015, December to February

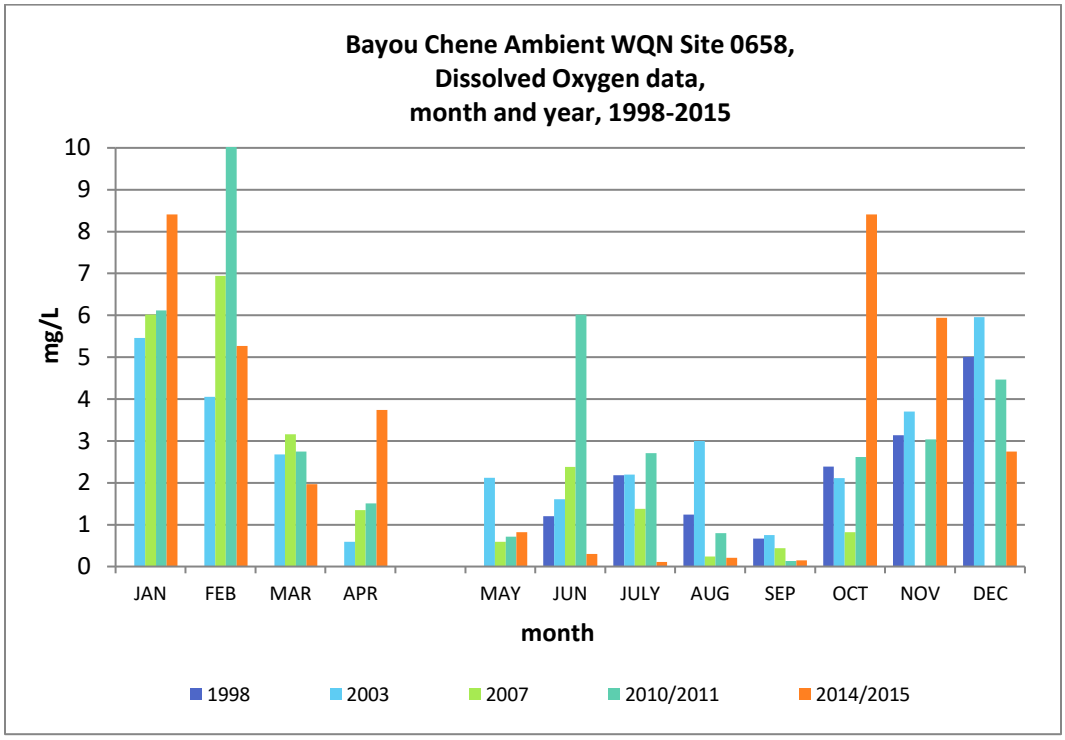

Figure 7 Bayou Chene monthly dissolved oxygen concentrations, 1998-2015.

Currently, the TMDL priority for FC in Bayou Chene is listed as “low” in the 2018 IR. Currently, subsegments which have Oyster Propagation (OYS), or Drinking Water Supply (DWS) use impairments have higher priority due to a more immediate threat to human health caused by the bacteria. For FC, the standard for PCR states that no more than 25 percent of samples collected on a monthly to near-monthly basis during the period of May 1 through October 31 may exceed the standard of 400 colony-forming units (cfu)/100 ml.

Figure 8 outlines all FC concentrations collected from May 1 through October 31, 1998 through 2015 at the WQN site. The FC standard is shown by a red line on the graph. FC concentrations ranged from 7 cfu/100 mL (October 2007) to 2400 cfu/mL (June 2007). The trend line shows increasing concentrations of fecal coliform. The exceedance rates were calculated for PCR from FC from 1998 through 2015 (Figure 9). Exceedance rates fluctuated from 0 to 50 percent. Exceedance rates in 1998, 2003, 2007, 2010/2011, and 2014/2015, were 0, 0, 14, 0, and 50 percent, respectively. Exceedance Rates show fecal coliform concentrations have increased by approximately 50 percent over the past 17 years. Peaks in concentrations occur during June of each year. The ambient data for FC (Figure 10) for the PCR period of May 1 through October 31 show 4 of 32 samples collected from 1998-2015, exceeded the criteria for PCR. Table 1 displays fecal coliform monitoring data at WQN site 0658 from October 2014 through September 2015. The numbers in red indicate PCR exceedances. In addition, exceedances have been calculated for each sampling date and for the PCR sampling period 2014/2015. LDEQ Water Surveys began collecting fecal coliform data under the “Bayou Chene Water Quality Sampling” project in June 2018.

Past discharge monitoring reports (DMR) from the City of Jennings indicated an issue meeting the effluent limitations and monitoring requirements; consequently, the city sought help through the Environmental Protection Agency (EPA) Revolving Loan Fund to rehabilitate the wastewater collection system and to construct a wastewater treatment facility. In addition, Louisiana Rural Water Association continues to conduct on-site disposal system inspections in the watershed, as needed. To track water quality data, LDEQ performs ambient water quality monitoring, LDEQ Water Surveys continues to conduct water quality monitoring under the “Water Quality Monitoring in Bayou Chene” NPS Project, and the City of Jennings is required to analyze the effluent discharge from the collection system and the wastewater treatment facility. Grab samples were performed, to illustrate existing conditions in the facility, at the time of the waste water treatment facility’s permit application submittal. Data can be found in Table 2. The City of Jennings has maintained compliance with their discharge permit. Permit limits for five day carbonaceous biochemical oxygen demand ($CBOD_5$), total suspended solids, ammonia-nitrogen, dissolved oxygen, fecal coliform, and pH are available, see Table 3. At this time, LDEQ does not have standards for nitrogen and phosphorus; therefore, there are no permit limits for nitrogen and phosphorus; however, under the permit guidelines, sampling data will be reported for the parameters. The most recent compliance evaluation inspection was conducted by LDEQ’s Office of Environmental Compliance on September 13, 2019. A review of the Electronic Data Management System (EDMS) for the City of Jennings Waste Water Treatment Plant shows that this facility has no outstanding compliance orders with LDEQ, in relation to water media. A prior compliance evaluation inspection was conducted on August 28, 2017. The inspection revealed no areas of concern. LDEQ-NPS is optimistic that once the collection system is rehabilitated and the wastewater treatment facility is constructed, the fecal coliform concentrations will remain below the permit limits.

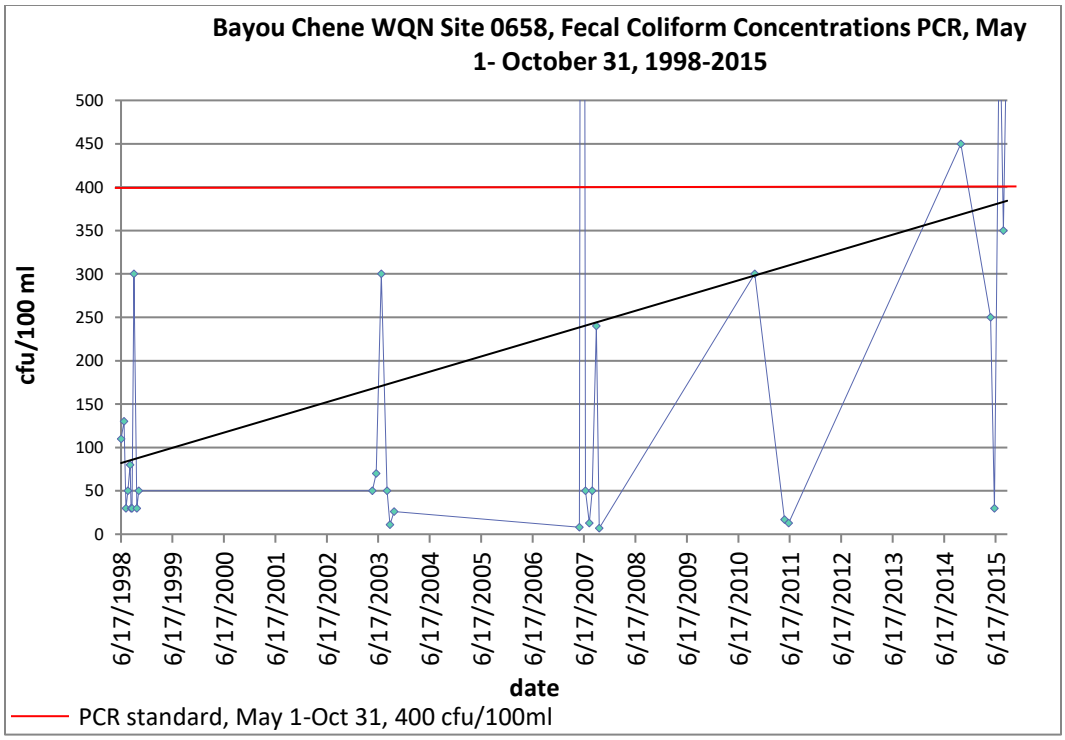

Figure 8 Bayou Chene PCR fecal coliform concentrations at water quality network site 0658, May 1 through October 31, 1998-2015

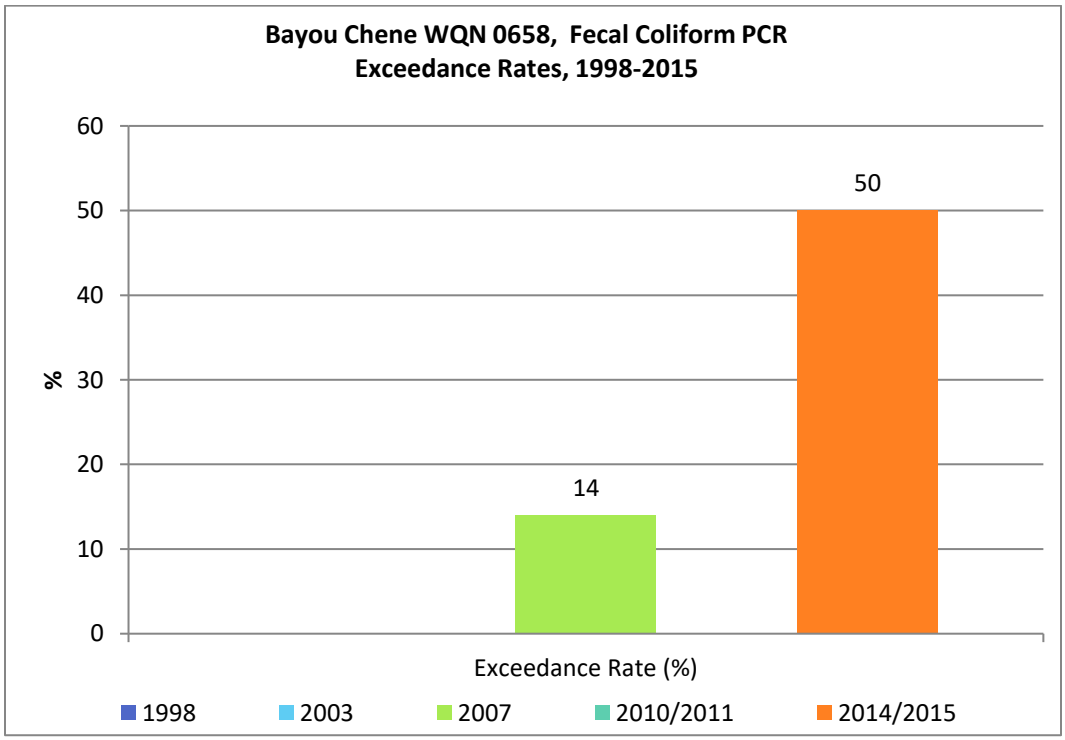

Figure 9 Bayou Chene, water quality network site 0658, fecal coliform PCR exceedance rates, May1 through October 31, 1998-2015

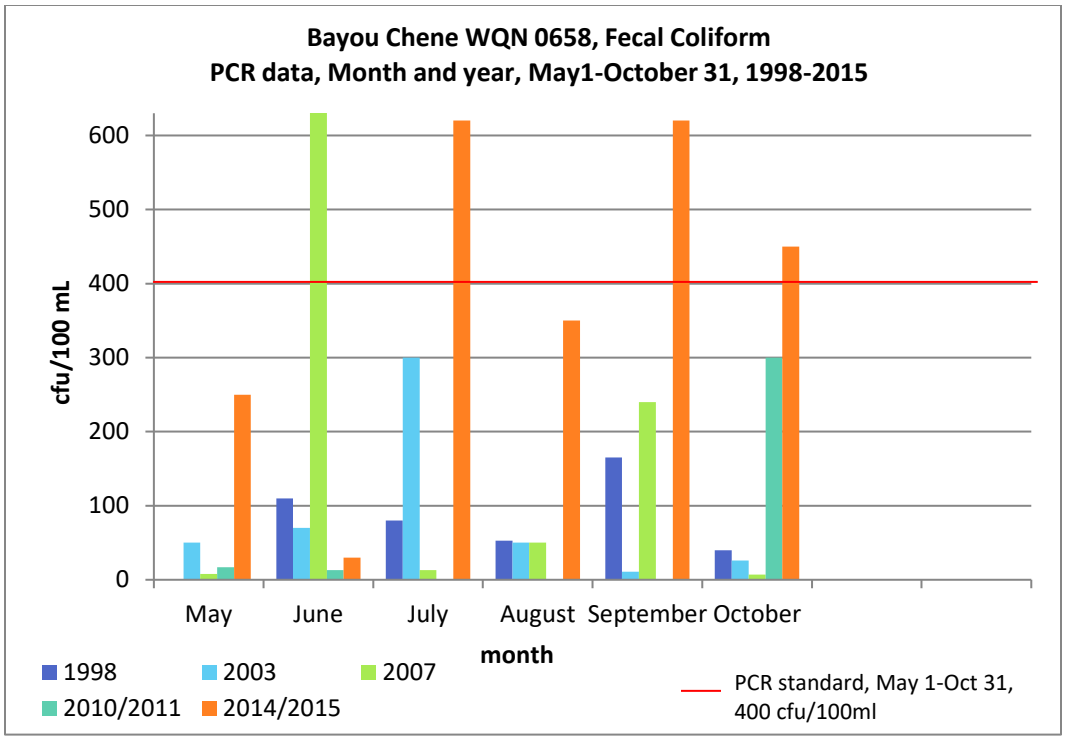

Figure 10 Bayou Chene, water quality network 0658, monthly fecal coliform PCR data. The red line indicates the 400 cfu/100 mL PCR standard, May 1 through October 31

Bayou Chene Primary Contact Recreation Fecal Coliform Ambient Monitoring, 2014/2015 PCR, Fecal Coliform Standard, 400 cfu/100mL							
WQN Site 0658	Sampling Date	10/14/2014	05/13/2015	06/09/2015	07/14/2015	08/12/2015	09/08/2015
	Concentration, (cfu/100mL)	**450**	250	30	**620**	350	**620**
	Exceedances: By sampling date	13% exceedance	Meets standard	Meets standard	55% exceedance	Meets standard	55% exceedance
	Exceedances: PCR period	50% exceedance from October 2014-September 2015					

Table 1 Fecal coliform monitoring data at WQN site 0658 from October 2014 through September 2015. Red numbers indicate PCR exceedances

Pollutants	Maximum Weekly Average		Existing Maximum Monthly Average		Long Term Average Value	
	Mass lbs/day	Concentration mg/l	Mass lbs/day	Concentration mg/l	Mass lbs/day	Concentration mg/l
$CBOD_5$		5.5		3.7		2.53
Total Suspended Solids-All Phases		21		9		4.33
Ammonia Nitrogen		1.2		0.6		0.42
Oil & Grease		<1.6				
Total Dissolved Solids		348				
TKN		19.8				
Total Phosphorus		2.02				
Fecal Coliform (cfu/100 ml)		value 19.1		value 11		value 4.4

Table 2 Grab Samples taken from City of Jennings Wastewater Treatment Facility

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	lb/day (unless otherwise stated)		mg/l (unless otherwise stated)			
	Monthly Average	Weekly Average	Monthly Average	Weekly Average	Frequency	Type
Flow (MGD)	Report	Report	---	---	Continuous	Recorder
$CBOD_5$	104	---	5	7.5	2/week	6 hr. Comp
Total Suspended Solids	313	---	15	23	2/week	6 Hr. Comp
Ammonia Nitrogen, March-November	42	---	2	4	2/week	6 Hr. Comp
Ammonia Nitrogen December-February	83	---	4	8	2/week	6 Hr. Comp
Dissolved Oxygen	---	---	6	---	2/week	Grab
Fecal Coliform (col/100 ml)	---	---	200	400	2/week	Grab
pH	---	---	6.0 s.u.	9.0 s.u.	2/week	Grab
Nitrogen	---	---	---	---	2/week	Grab
Phosphorus	---	---	---	---	2/week	Grab

Table 3 City of Jennings Wastewater Treatment Facility Discharge Limits

MODELING BAYOU CHENE

In addition to analyzing ambient water quality data, LDEQ also utilized a watershed model to pinpoint areas of high NPS loads in Bayou Chene. The SWAT model identified critical areas of high-suspected sediment yield, within the 12-digit HUCs where BMP implementation would be most essential. The SWAT model employed soil type, elevation, land use, and weather data to identify pollutant sources on a subwatershed basis. The model broke the watershed down into additional subwatersheds, based on sub-basins delineated by the SWAT model. The SWAT map (Figure 11) was distributed to partners to assist in the ranking process for BMP implementation. Producers in the watershed are given a score depending on the suitability of their agricultural lands to reduce pollutant loading in streams through BMPs. Those with land in the high areas (red) are given additional points and typically score higher and are therefore targeted for implementation practices.

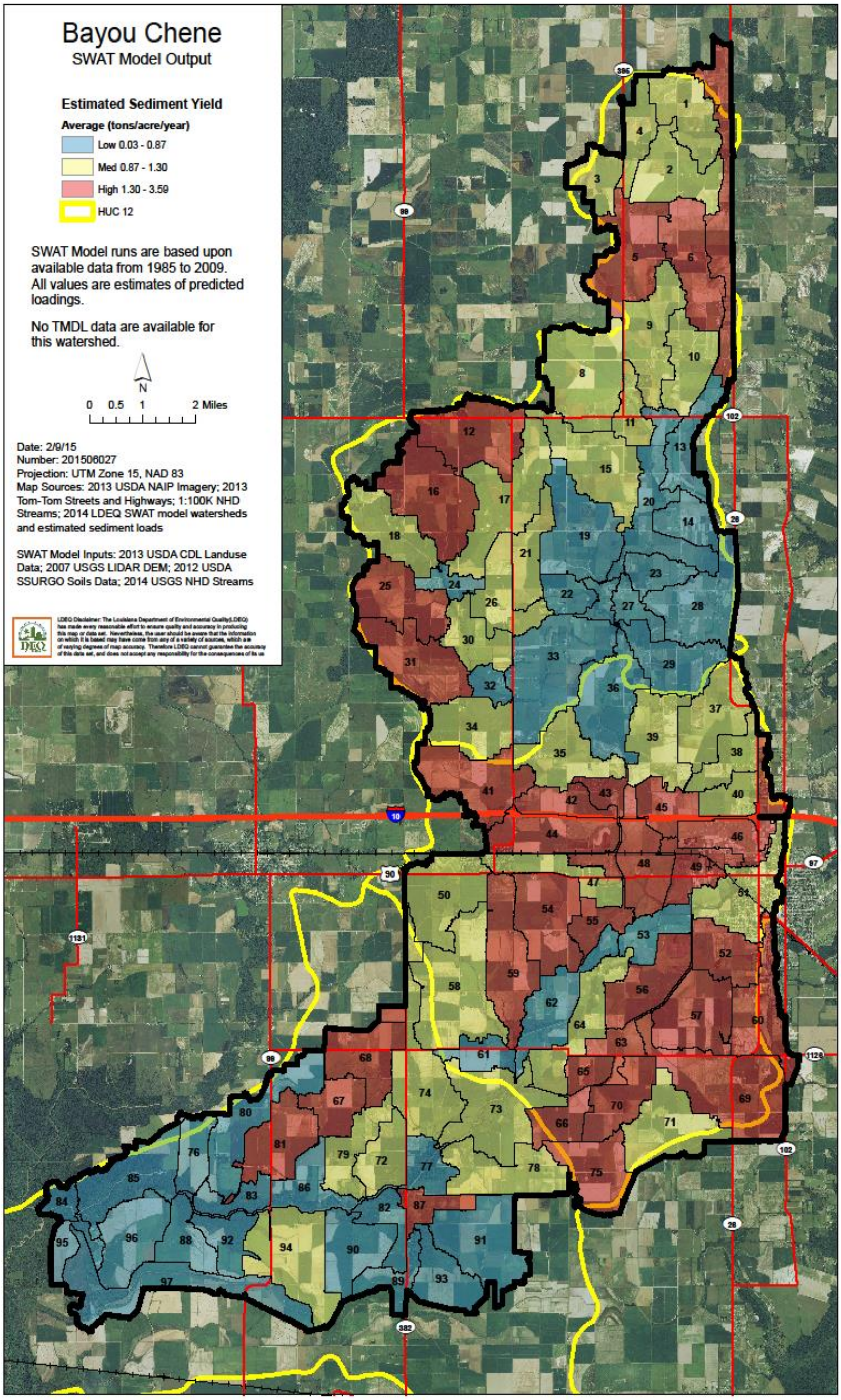

Figure 11 Bayou Chene critical areas depicted by SWAT model output

B. An estimate of the load reductions expected from management measures

Nitrogen, Phosphorus, Biochemical Oxygen Demand, and Sediment Estimated Load Reductions

To provide load reduction estimates for nitrogen, phosphorus, BOD, and sediment, based on the BMPs that LDAF will implement, a Spreadsheet Tool for Estimating Pollutant Loads (STEPL) model was run for the Bayou Chene subsegment. Percent reductions ranged from 0 to 24.5 percent.

Table 4 shows total nitrogen, phosphorus, BOD, and sediment loading estimates for Bayou Chene. Table 5 illustrates Bayou Chene loading estimates from runoff by land use type, with no BMPs being implemented. Using a 50 percent BMP application rate, the STEP-L model predicted the percent reductions for each BMP LDAF proposes to implement (Table 6). Nitrogen (N) should be reduced by 0.3 to 8.8 percent, phosphorus (P) 0.3 to 18.5 percent, BOD 0 to 1.3 percent, and sediment 0 to 24.5 percent.

	Total Load			
Bayou Chene	N Load (no BMP) lb/year	P Load (no BMP) lb/year	BOD Load (no BMP) lb/year	Sediment Load (no BMP) t/year
	913755.9	155577.1	2152540	21267.5

Table 4 Total Nitrogen, Phosphorus, BOD, and sediment loading estimates for Bayou Chene

STEP-L LOADING ESTIMATES FROM RUNOFF BY LAND USE TYPE WITHIN BAYOU CHENE SUBSEGMENT

NUTRIENT LOAD FROM RUNOFF (LB/YEAR) WITHOUT BMPS															
LAND USE TYPE	CROPLAND			PASTURELAND			FOREST			USER DEFINED			TOTAL		
CONSTITUENT	N	P	BOD	N	P	BOD	N	P	BOD	N	P	BOD	N	P	BOD
NUTRIENT LOAD	717654.1	113313.8	1510850.8	52100.5	3907.5	169326.8	2724.9	1362.5	6812.4	0	0	0	772479.6	118583.8	1686990

Table 5 Bayou Chene loading estimates from runoff by land use type, with no BMPs implemented

BAYOU CHENE WATERSHED										
			REDUCTION AMOUNT				REDUCTION PERCENT (%)			
CODE	PRACTICE	RATE APPLIED	N (LB/YR)	P (LB/YR)	BOD (LB/YR)	SEDIMENT (T/YR)	N	P	BOD	SEDIMENT
328	Conservation Crop Rotation	50%	38,967	27,995	27,698	4,328	4.3	18.5	1.3	24.5
344	Residue Management Seasonal	50%	36,260	15,373	15,108	2,361	4	10.2	0.7	13.4
410	Grade Stabilization Structures	50%	79,319	8,574	15,108	2,361	8.8	5.7	0.7	13.4
449	Irrigation Water Management	50%	35,001	10,922	12,590	1,967	3.9	7.2	0.6	11.2
DS	Dry Seeding*	50%	35,001	10,922	12,590	1,967	3.9	7.2	0.6	11.2
464	Irrigation Land Leveling*	50%	35,001	10,922	12,590	1,967	3.9	7.2	0.6	11.2
528A	Prescribed Grazing	50%	2,672	495	134	21	0.3	0.3	0	0.1
561	Heavy Use Area for Protection	50%	7,926	629	223	35	0.9	0.4	0	0.2
590	Nutrient Management	50%	68,177	15,864	0	0	7.6	10.5	0	0
590A	Nutrient Management (Precision Ag)**	50%	68,177	15,864	0	0	7.6	10.5	0	0

Table 6 Load reductions for Nitrogen, Phosphorus, Biochemical oxygen demand, and sediment based on a 50 percent BMP application rate

Fecal Coliform Estimated Load Reductions

A TMDL for FC has not been developed to aid in establishing the reductions needed to achieve state PCR standard. The LDEQ assessment method specifies that for PCR no more than 25 percent of the total samples collected on a monthly or near-monthly basis may exceed a FC density of 400 cfu/100 mL.

Thirty-two PCR samples were collected from 1998 through 2015, in which four samples exceeded the PCR standard, resulting in a 13 percent exceedance for the combined five sampling years. During the 2014/2015 ambient sampling season, 3 samples of 6 exceeded the PCR standard, resulting in a 50 percent exceedance. Concentrations ranged from 30 cfu/100mL to 620 cfu/100mL. Sampling date, October 14, 2014, yielded a fecal coliform concentration of 450 cfu/100mL, resulting in a 13 percent exceedance over the PCR standard. The highest percent exceedance at the WQN sampling site occurred on July 4th and September 8th, 2015, resulting in concentrations of 620 cfu/100mL, causing a 55 percent exceedance over the PCR standard, for each sampling date.

The targeted percent reduction is set by the largest reduction needed to achieve the water quality PCR criterion of 400 cfu/100mL from May through October in the watershed. Using the greatest exceedance, 55 percent, a 30 percent reduction in fecal coliform loads at the ambient monitoring site is required to restore the PCR use in the Bayou Chene Watershed.

Reduction strategies are based on BMPs as well as education and outreach for which success cannot be measured. Through previous research and project review, it has been shown that BMPs have been successful in reducing loads in watersheds and improving the overall health of waterbodies. When BMPs are implemented strategically based on site visits, data analysis, and knowledge of local stakeholders and landowners, results are significantly more effective. With additional effort through education and outreach, specifically OSDS inspections, the target of 30 percent is reasonable to achieve at WQN site 0658, which may also be mildly influenced by OSDS in the area upstream from that site.

To calculate possible fecal coliform load reductions in the watershed, from onsite disposal systems, LDEQ-NPS researched results from similar projects and utilized demographics of Bayou Chene for more accurate calculations. According to Louisiana Department of Health (LDH) 2016 data, there are approximately 653 OSDS units in the Bayou Chene subsegment. Based on other OSDS inspection programs, it is assumed all fecal coliform bacteria in the area will reach the ambient site. It is anticipated that the malfunctioning systems, approximately 131, will be repaired. The EPA bacterial indicator tool estimates a 10,000 cfu/100mL reduction in fecal coliform bacteria; therefore, an estimated load reduction of approximately 9.3 billion cfu/day, is expected. See calculation below.

(10,000 cfu/100mL) * (3,785.4 ml/gal) * (70 gallon/person) * (2.7 person/system) * (130.6 systems) = $9.3*10^{11}$ gallons/day

Utilizing water quality ambient data at the WQN site to calculate fecal coliform PCR exceedances and load reduction calculations/estimations, LDEQ-NPS is confident significant load reductions are possible, over time.

C. DESCRIPTION OF THE NONPOINT SOURCE MANAGEMENT MEASURES THAT WILL NEED TO BE IMPLEMENTED TO ACHIEVE LOAD REDUCTIONS IN PARAGRAPH 2, AND A DESCRIPTION OF THE CRITICAL AREAS IN WHICH THOSE MEASURES WILL BE NEEDED TO IMPLEMENT THIS PLAN

LDAF and the Jefferson Davis Soil and Water Conservation District (SWCD) continue to work together in the selection of the tracts of land, and BMPs to be implemented within the targeted HUCs. SWAT model output, land use/land cover data, projected participation, priority HUCs, drainage patterns, highest runoff potential, farming practices, and DO data were the primary factors for establishing critical areas for BMP implementation.

BMPs are one of the most important tools for controlling NPS runoff. The intent of BMPs is to provide producers with practices they can implement to reduce agricultural impacts to the environment. Management practices are utilized by agricultural producers to control the generation and delivery of pollutants from agricultural activities to waters of the state; thereby reducing the amount of agricultural pollutants entering surface and ground waters.

The LDAF-OSWC in conjunction with the Jefferson Davis SWCD will continue to focus its implementation efforts in Bayou Chene, and foresee an increase in DO and a decrease in FC. When properly implemented, BMPs can help improve water quality without placing unreasonable burdens on the agricultural industry of Louisiana.

DISSOLVED OXYGEN MANAGEMENT MEASURES TO BE IMPLEMENTED

Practices in Table 7, have been identified for use within the project area to address the resource management concerns related to DO. All practices will be implemented by project participants as identified in the resource management plan (RMS) and will provide for part of the project matching costs. Tables 8-15 illustrate BMPs to be implemented in 2017 through 2019 within the three HUCs.

NRCS Practice Code	BMP
328	Conservation Crop Rotation
329	Residue and Tillage Management-No Till/Strip Till/Direct Seed
382	Fencing
410	Grade Stabilization Structure
561	Heavy Use Area Protection
464	Irrigation Land Leveling
449	Irrigation Water Management
590	Nutrient Management
342	Critical Area Planting
595	Pest Management
516	Pipeline
528	Prescribed Grazing
748	Record Keeping
344	Residue Management, Seasonal
646	Shallow Water Area for Wildlife
614	Watering Facility

Table 7 DO BMPs to be implemented in the Bayou Chene subsegment

NRCS Practice Code	Implemented Ac/ No	Ac/ No Planned
328		1972.92
344		1392.32
410		8
449		1081.82
DS		1306.42
464	428.72	685.6
590		730.4
590 PA		1081.82
595		1812.22

Table 8 DO BMPs planned and implemented in HUC 080802020205 in 2017

NRCS Practice Code	Ac/No Planned	Ac/No. Implemented
328	1043.41	
344	495.13	
410	0	
449	469.04	
DS	285.6	
464	240.69	0
590	377.95	
590 PA	376.79	
595	754.64	

Table 9 DO BMPs planned and implemented in HUC 080802020201 in 2017

NRCS Practice Code	Ac/No Planned	Ac/No Implemented
328	289.9	
344	131.8	
410	0	
449	131.8	
DS	99.4	
464	95.49	197.33
590	158.6	
590 PA	0	
595	158.6	

Table 10 BMPs planned and implemented in HUC 080802020203 in 2017

NRCS Practice Code	Ac/ No Planned
328	2191.72
344	1395.01
410	5
449	505.8
DS	1219
464	776.87
590	631.02
590 PA	1093.78
595	1724.8

Table 11 BMPs planned in HUC 080802020205 in 2018

NRCS Practice Code	Ac/No Planned
328	1062.97
344	752.27
410	0
449	72.05
DS	216.68
464	234.25
590	0
590 PA	288.73
595	288.73

Table 12 BMPs planned in HUC 080802020201 in 2018

NRCS Practice Code	Ac/No Planned
328	289.9
344	58.7
410	0
449	0
DS	131.5
464	131.8
590	0
590 PA	102.9
595	131.8

Table 13 BMPs planned in HUC 080802020203 in 2018

NRCS Practice Code	Ac/No Planned
328	1043.41
344	731.78
410	13
449	167.55
DS	525.69
464	528.96
590	527.1
590 PA	166.14
595	693.24

Table 14 BMPs planned in HUC 080802020201 in 2019

NRCS Practice Code	Ac/No Planned
328	289.9
344	131.8
410	0
449	0
DS	158.6
464	0
590	158.6
590 PA	0
595	158.6

Table 15 BMPs planned in HUC 080802020203 in 2019

Proposed Fecal Coliform Management Measures to be Implemented

Practices in Table 16, have been identified for future use to address resource management concerns related to FC, once funding becomes available. All practices will be implemented by project participants as identified in the management plans and will provide for part of the project matching costs. Tables 17, 18, and 19 display BMPs that were previously implemented in HUCs 080802020201, 080802020203, and 080802020205, from 2005 through 2016.

NRCS Practice Code	BMP
382	Fencing
561	Heavy Use Area Protection
595	Pest Management
528	Prescribed Grazing
748	Record Keeping
614	Watering Facility
642	Water Well
578	Stream Crossing
146	Pollinator Habitat Enhancement
327	Conservation Cover-Native Grass
516	Pipeline (Livestock)
590	Nutrient Management
717	Livestock Shade Structure
342	Critical Area Planting
329	Residue and Tillage Management-No Till/Strip Till/Direct Seed
644	Wetland Wildlife Habitat Management
N/A	Prescribed Feral Swine Control and Eradication

Table 16 Proposed fecal coliform BMPs for future implementation in Bayou Chene

Best Management Practice Descriptions

Pollinator Habitat Enhancement (NRCS Code 146) is a site-specific conservation plan that addresses the improvement, restoration, enhancement, or expansion of flower-rich habitat that supports native and/or managed pollinators.

Conservation Cover (NRCS Code 327) is used to establish and maintain permanent vegetative cover. Conservation cover reduces ground and surface water quality degradation by nutrients and surface water quality degradation by sediment.

Conservation Crop Rotation (NRCS Code 328) refers to growing crops in a recurring sequence on the same field. A conservation crop rotation may include crops planted for cover or nutrient enhancement. The crops selected should produce sufficient quantities of biomass at the appropriate time to reduce erosion by water or wind to within acceptable soil loss levels.

Residue and Tillage Management-No Till/Strip Till/Direct Seed (NRCS Code 329) limits soil disturbance to manage the amount, orientation and distribution of crop and plant residue on the soil surface year around.

Critical Area Planting (NRCS Code 342) establishes permanent vegetation on sites that have, or are expected to have, high erosion rates, and on sites that have physical, chemical or biological conditions that prevent the establishment of vegetation with normal practices. Critical area plantings are used to stabilize stream and channel banks, and shorelines.

Residue and Tillage Management, Reduced Till (NRCS Code 345) involves managing the amount, orientation, and distribution of crop and other plant residue on the soil surface year round while limiting the soil-disturbing activities used to grow and harvest crops in systems where the field surface is tilled prior to planting.

Fencing (NRCS Code 382) controls the movement of animals and people, including vehicles. This practice may be applied on any area where management of animal or human movement is needed.

Grade Stabilization Structures (NRCS Code 410) are used to control the grade and head cutting in natural or artificial channels. These structures are used to control erosion, prevent formation of gullies, and to enhance environmental quality and reduce pollution hazards.

Irrigation Water Management (NRCS Code 449) refers to the process of determining and controlling the volume, frequency and application rate of irrigation water in a planned, efficient manner.

Irrigation Land Leveling (NRCS Code 464) provides for uniform and efficient application of surface irrigation water without significant erosion, loss of water quality, or damage to soil and crops from prolonged saturation.

Pipeline, Livestock (NRCS Code 516) is used to convey water from a source of supply to point of use for livestock, wildlife, or recreation.

Prescribed Grazing (NRCS Code528) is used to manage the harvest of vegetation with grazing and/or browsing animals to reduce accelerated soil erosion, maintain or improve soil condition, and to improve or maintain surface and/or subsurface water quality and quantity.

Heavy Use Area Protection (NRCS Code 561) provides for the stabilization of areas frequently and intensively used by people, animals or vehicles by establishing vegetative cover, surfacing with suitable materials, and/or installing needed structures.

Stream Crossing (NRCS Code 578) is a stabilized area or structure constructed across a stream to provide a travel way for people, livestock, equipment, or vehicles. Stream crossings improve water quality by reducing sediment, nutrient, organic, and inorganic loading of the stream, and reduced streambank and streambed erosion.

Nutrient Management (NRCS Code 590) refers to balancing all sources of nutrient inputs with a crop's requirements for producing a realistic yield. Nutrients, like nitrogen and phosphorus are essential for crop production; overbalance of these nutrients can cause water quality problems.

Nutrient Management Precision Agriculture (NRCS Code 590 PA) must meet all the requirements of the Conservation Practice Code 590, Nutrient Management. There are certain components that must be addressed in more detail when dealing with a precision nutrient management design. These components include aerial imagery or site map(s) and a soil survey map of the site; results of soil, water, manure, and/or organic by-product sample analysis; results of plant tissue analyses, when used for nutrient management; a complete nutrient budget design for nitrogen, phosphorus, and potassium for the crop rotation or sequence; adaptive nutrient management application rates, timing, form and method of application and incorporation, and guidance for implementation, operation, maintenance, and recordkeeping.

Integrated Pest Management (NRCS Code 595) involves a site-specific combination of pest prevention, pest avoidance, pest monitoring, and pest suppression strategies to mitigate risks to water quality. A substantial improvement is expected if this BMP is implemented.

Watering Facility (NRCS Code 614) provides livestock with drinking water at planned locations that will protect vegetative cover through proper distribution of grazing or other management techniques.

Water Well (NRCS Code 642) provides water for livestock, wildlife, irrigation, and

general water needs of farming/ranching operations.

Wetland Wildlife Habitat Management (NRCS Code 644) is designed to actively promote, restore, enhance or create habitat for wildlife.

Livestock Shade Structure (NRCS Code 717) provides shade areas for livestock, helping protect surface waters from pollution and the livestock from excessive heat.

Record Keeping (NRCS Code 748) is the documentation of activities and data that affects the conservation of natural resources, and environmental aspects of an operation. This practice is used to systematically and continuously record activities and data to provide information for natural resource management decisions.

Dry Seeding (NRCS Code DS) involves rice being planted into a dry seedbed to reduce irrigation water requirements and eliminate high suspended sediment loads in irrigation water runoff in lieu of using the traditional method of seedbed preparation referred to as “water-leveling” or “mudding in”. Irrigation water will be applied and managed to minimize waste and soil loss. Water levels will be adjusted throughout the growing season for the specific needs of the variety. Surface water quality in receiving streams and other waterbodies will be improved by reducing the nutrient, suspended sediment, and organic material load runoff, and reducing soil erosion.

Prescribed Feral Swine Control and Eradication does not have a practice code because it is not an established NRCS practice; however, the practice is USDA recommended for reducing agricultural land damage caused by feral swine. Recommendations will often vary from one tract to another, due to size, tree/shrub canopy, crops, proximity to residential areas, etc. For the purpose of the WIP, it is suggested that an annual target reduction of 70 percent of the feral swine population is necessary to level the additive mortality necessary for long-term population reduction.

HUC	NRCS Code	Practice Name	Unit	2005-2016
080802020201 Gum Gully-West Bayou Grand Marais	328	Conservation Crop Rotation	acre	4,516.7
	464	Irrigation Land Leveling	acre	1458.38
	528	Prescribed Grazing	acre	109.2
	561	Heavy Use Area Protection	acre	246.5
	590	Nutrient Management	acre	719.4
	410	Grade Stabilization Structure	acre	3

Table 17 Best Management Practices Implemented in HUC 080802020201, 2005-2016

HUC	NRCS Code	Practice Name	Unit	2005-2016
080802020203, West Bayou Grand Marais-Middle Bayou Grand	328	Conservation Crop Rotation	Acre	2,570.2
	464	Irrigation Land Leveling	Acre	1,106.8
	528	Prescribed Grazing	Acre	602.1
	590	Nutrient Management	Acre	617.4

Table 18 BMPs implemented in HUC 080802020203, 2005-2016

HUC	NRCS Code	Practice Name	Unit	2005-2016
080802020205, Bayou Chene	328	Conservation Crop Rotation	acre	34,109.97
	329	Residue and Tillage Management, No-Till	acre	1,223.5
	344	Residue Management, Seasonal	acre	7,118.74
	345	Residue and Tillage Management, Reduced Till	acre	5850.7
	410	Grade Stabilization Structure	acre	5
	449	Irrigation Water Management	acre	8,336.1
	464	Irrigation Land Leveling	acre	2,823.61
	528	Prescribed Grazing	acre	935.4
	561	Heavy Use Area Protection	acre	73.2
	590	Nutrient Management	acre	10,026.2
	595	Integrated Pest Management (IPM)	acre	9,907.46
	644	Wetland Wildlife Habitat Management	acre	512.3
	645	Upland Wildlife Habitat Management	acre	469.1
	646	Shallow Water Development and Management	acre	1,361.3
	666	Forest Stand Improvement	acre	69.4
	AIR04	Use drift reducing nozzles, low pressures, lower boom height and adjuvants to reduce pesticide drift	acre	20,083.8
	AIR07	GPS, targeted spray application (Smart Sprayer), or other chemical application electronic control etc.	acre	20,083.8
	AIR08	Nitrification inhibitors or urease inhibitors	acre	4,059.5
	ANM11	Patch-burning to enhance wildlife habitat	acre	110
	ANM25	Stockpiling Forages to Extend the Grazing Season	acre	40
	ANM29	On-farm forage based grazing system	acre	165
	WQL03	Rotation of supplement and feeding areas	acre	165.4
	WQL05	Apply nutrients no more than 30 days prior to planned planting date	acre	6,289.3
	WQL06	Apply controlled release nitrogen fertilizer	acre	237.3
	WQL07	Split nitrogen applications 50% after crop/pasture emergence/green up	acre	1,538.3
	WQT03	Irrigation pumping plant evaluation	no	1
	ANM38	Retrofit watering facility for wildlife escape and enhanced access for bats and bird species	no	2
	590 PA	Nutrient Management	acre	193.34
	DS	Dry Seeding	acre	262.4

Table 19 BMPs implemented in HUC 080802020205, 2005-2016

Critical Areas for BMP Implementation

Initially, high priority areas for BMP implementation were determined by output from the SWAT model (Figure 11), land use/land cover data, and projected participation. Critical areas in the SWAT model depicted where the various sources of pollutants may originate. Areas in red have the highest sediment yield, representing the most critical areas in the watershed, followed by sub-basins highlighted in yellow, followed by those in blue. The critical areas were provided to LDAF, and were used to develop ranking criteria for choosing applications for BMP implementation.

BMP implementation in the subsegment is focused on increasing DO concentrations. LDAF began implementing in the most critical area first, HUC, 080802020205 in 2015. The HUC of focus was identified by LDAF as being closest to the WQN site and having significantly larger coverage and total acreage of intense agricultural land uses known to cause the identified impairment, than in all other areas within the subsegment. Subsequently, BMP implementation began in HUC 080802020201 in 2016 and 080802020203 in 2017. Implementation in HUC 080802020205 was completed in 2018, and will continue through 2021 in HUCs 080802020201 and 080802020203.

Figure 12 illustrates the critical areas for 2019 BMP implementation, based on DO exceedance rates calculated from March to November 2017/2018 data, under LDEQ-NPS section 319 “Water Quality Monitoring in Bayou Chene” project. The highest priority ranking for implementation, for March to November, was assigned to the site with the highest exceedance rate, 76 percent (site 6C), followed by sites 5C, 3C, 2C, 1C (WQN 0658), 8c, 10c, 9c, and 4C, with a 67, 65, 63, 62, 60, 59, 24, and 14 percent exceedance, respectively. The DO exceedance rates for December to February, were 40 percent (site 1C/WQN 0658) followed by sites 5C, 6C, 2C, 3C, 4C, 8C, 9C, and 10C, with a 17, 17, 0, 0, 0, 0, 0, and 0 percent exceedance, respectively.

Although site 1C/0658 is ranked as fifth priority, the water quality ambient site, is where subsegments are listed and restored; therefore, future implementation should begin around the ambient site and above site 6C/2220, in hopes of restoring the ambient site expeditiously. Refer to Element I for information concerning the water quality monitoring project in Bayou Chene.

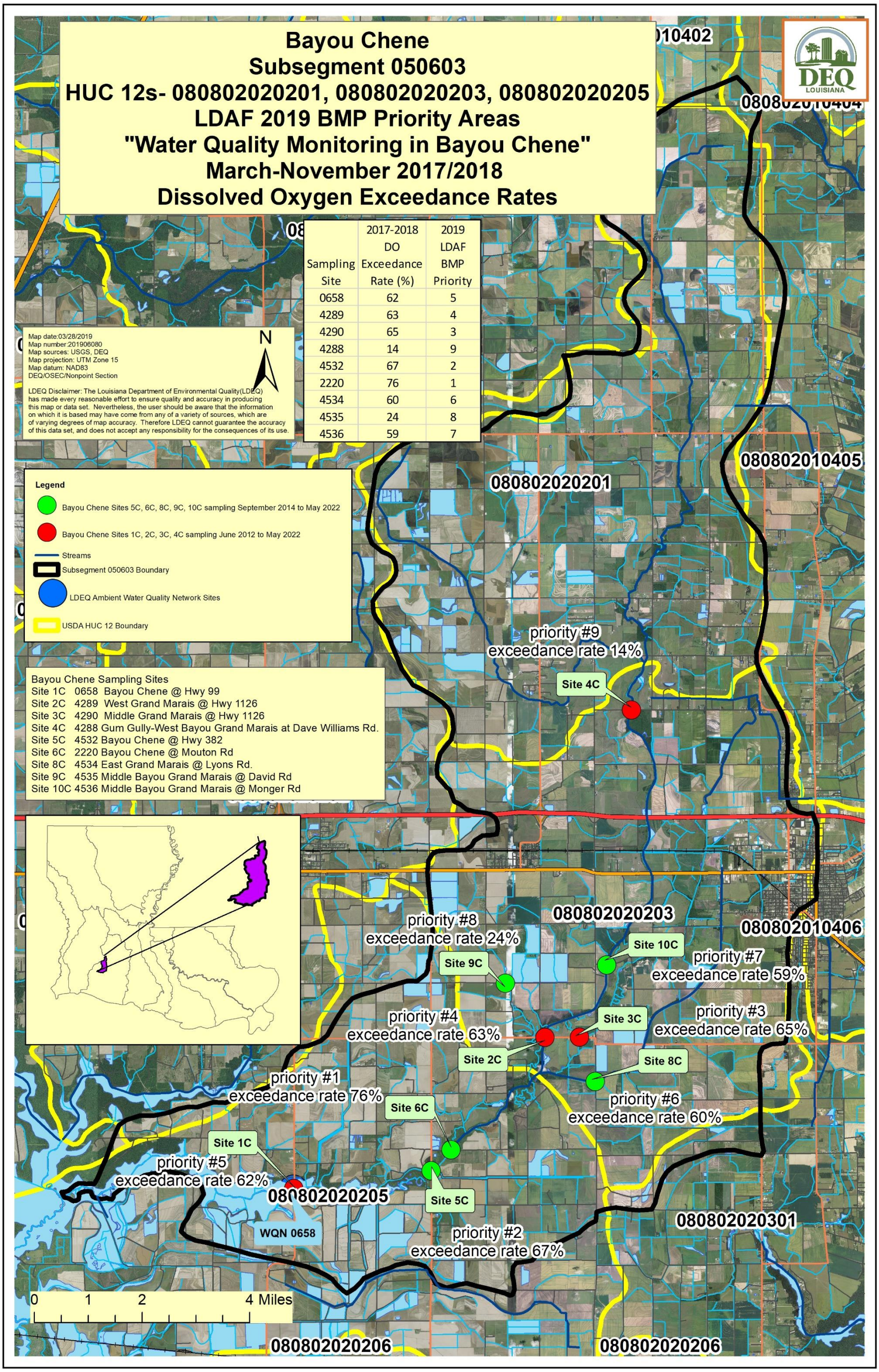

Figure 12 Water quality sampling site priorities depicting critical areas in which future BMPs may be implemented. Priorities are based on March to November 2017/2018 DO exceedance rates calculated from data collected by the University of Louisiana and LDEQ Water Surveys under the "Water Quality Monitoring in Bayou Chene" project.

D. ESTIMATE OF THE AMOUNTS OF TECHNICAL AND FINANCIAL ASSISTANCE NEEDED, ASSOCIATED COSTS, AND/OR THE SOURCES AND AUTHORITIES THAT WILL BE RELIED UPON TO IMPLEMENT THIS PLAN

Louisiana Department of Agriculture & Forestry is the lead agency for BMP implementation. They will provide project management on a day-to-day basis, assist in developing and implementing BMPs, and provide reimbursement to project participants for cost-share. Table 20 illustrates LDAF's estimated budget for BMP implementation in the watershed for FFY's 2014 through 2016. Currently, exact funding has not been allocated for the Bayou Chene watershed under FFY's 2017 and 2018. Table 21 displays the BMPs to be implemented, the targeted pollutant, BMP type, and unit cost based on the 2015 NRCS statewide average costs list, for HUC 080802020205. Table 22 shows the BMPs to be implemented, the targeted pollutant, BMP type, and unit cost based on the 2016 NRCS statewide average costs list, for HUCs 080802020201 and 080802020203.

The Louisiana Department of Environmental Quality NPS Program worked closely with LDAF-OSWC to identify the priority areas designated by the SWAT modeling map. In addition, all project partners collaborated to identify additional areas of interest in the project area, to address resource management problems, assess the project plan, implementation schedules, and to coordinate state Section 319 (H) program components with LDAF. Beginning August 2017, LDEQ-NPS has provided monetary assistance from EPA's Section 319 Program, for water quality sampling in the Bayou Chene subsegment. Approximately $62,974 from Clean Water Act Section 319(H) funding is expended annually in the Bayou Chene watershed. Approximately $40,000 supports LDEQ-NPS staff, $11,850 is used for water quality sampling, conducted by LDEQ Water Surveys, and approximately $11,124 is utilized for sample analysis, conducted by LSU Ag Center and SGS North America, Inc.

United States Department of Agriculture-Natural Resources Conservation Service staff will assist LDAF and LDEQ in collecting field information, meeting with local commodity groups, and identifying cropland in the Bayou Chene watershed. Project ranking criteria has been developed, by the USDA-NRCS, LDAF and the Jefferson Davis SWCD. USDA-NRCS staff will continue to assist LDAF and local SWCDs with outreach and education activities to ensure landowners and operators are aware of program opportunities. The USDA-NRCS staff will work closely with LDAF to ensure that RMS level conservation plans developed for this project meet NRCS planning standards. The field and area staff will assist in providing technical assistance for BMP plan designs, implementation, and certification. The NRCS staff will assist LDAF and LDEQ in developing semi-annual and annual reports for this project.

University of Louisiana at Lafayette monitored nine locations in the Bayou Chene watershed for field parameters and water chemistry on a weekly basis through July 2017, to track changes in water quality.

The Louisiana Department of Environmental Quality Water Surveys Section replaced UL beginning August 2017, and will continue water quality monitoring activity at the same nine locations, to track changes in water quality.

Jefferson Davis Soil & Water Conservation District contacts and works with project participants at the local level. The SWCD is responsible for contacting potential applicants, conducting sign up, and working with project participants to ensure all BMPs are installed according to schedule. They also conduct extensive outreach to the youth of the parish. Louisiana SWCDs operate under the administrative authority of

the LDAF OSWC. LDAF will only cost-share on the following BMPS: (410) Grade Stabilization Structures and (464) Irrigation Land Leveling. The remaining BMP's listed in Table 22 will be used for match.

The Environmental Quality Incentives Program (EQIP) provides a voluntary conservation program for farmers and ranchers who face serious threats to soil, water, and related natural resources. Nationally, it provides educational assistance primarily in designated priority areas. About half of the program is targeted towards livestock related natural resource concerns and the remainder goes to other significant conservation concerns. EQIP offers five contracts that provide incentive payments and cost-sharing for conservation practices in the conservation plan. All EQIP activities must be carried out according to a conservation plan that is site-specific for each farm or ranch. Producers can develop these plans with help from USDA-NRCS, SWCD, or other service providers. Cost-sharing may pay up to 75 percent of the costs of certain conservation practices important to improving and maintaining the health of natural resources in the area. Incentive payments may be made to encourage a producer to perform specific land management practices.

Louisiana Rural Water Association (LRWA) will initiate education and outreach workshops geared towards educating homeowners on the importance of inspecting and maintaining OSDS. Fecal coliform in a watershed is generally attributed to untreated wastewater discharge OSDS. Proper maintenance and operation of these systems is imperative to reducing FC bacteria in Louisiana's waterbodies. Homeowners will also be instructed on how their systems work, how to conduct a thorough inspection, and how to maintain their system (through repairs, upgrades and pump-outs as needed). LDEQ-NPS has provided the association with a list of the number of OSDS included in Louisiana Department of Health's (LDH's) database located in the nitrogen-limited urban areas in the coastal 6217 Management Area. The LRWA was also given a list of NPS projects to assist in scheduling workshops.

FFY Year	HUC(s)	Federal	Match	Total
2014	080802020205	$133,333.33	$166,666.67	$300,000
2015	080802020201, 080802020203	$133,333.33	$166,666.67	$300,000
2016	080802020201, 080802020203	$133,333.34	$166,666.66	$300,000
2017	To be determined	Funding not allocated	Funding not allocated	Funding not allocated
2018	To be determined	Funding not allocated	Funding not allocated	Funding not allocated
Total		**$400,000**	**$500,000**	**$900,000**

Table 20 LDAF's estimated budget for BMP implementation in Bayou Chene for FFY's 2014, 2015, 2016, 2017, and 2018.

Bayou Chene - 080802020205

NRCS Code	BMP Name	BMP Type	Targeted Pollutant	Unit	100% Unit Cost	Cost Share Percent	Cost Share Amt	Match Percent
328	Conservation Crop Rotation	Standard Rotation	sediment	Ac	$14.92	0%		100%
345	Residue & Tillage Mgmt, Reduced Tillage	Mulch-Till - Drill only	sediment	Ac	$18.51	0%		100%
410	Grade Stabilization Structures	Plastic Pipedrop, Riser 18" and larger	sediment	DialnFt	$1.78	60%	$1.07	40%
410	Grade Stabilization Structures	Plastic Pipedrop, Riser less than 18"	sediment	DialnFt	$1.51	60%	$0.91	40%
449	Irrigation Water Management	Basic IWM more than 30 Ac	sediment/adsorbed pesticide	Ac	$10.87	0%		100%
464	Irrigation Land Leveling	Land Leveling 125 to 205 cy per ac	Sediment	Ac	$333.57	50%	$166.79	50%
464	Irrigation Land Leveling	Land Leveling over 205 cy per ac	Sediment	Ac	$454.40	50%	$227.20	50%
590	Nutrient Management	Basic NM System	soluble nutrients/DO	Ac	$7.16	0%		100%
590PA	Nutrient Management - Precision Ag	Precision NM System	soluble nutrients/DO	Ac	$38.63	0%		100%
595	Integrated Pest Management	Basic IPM Field 1 RC	soluble/soluble/adsorbed pesticide	Ac	$16.46	0%		100%

Table 21 LDAF's Bayou Chene, HUC 080802020205, section 319 project utilizes the 2015 NRCS statewide average costs list

Bayou Grand Marais - 080802020201 & 080802020203

NRCS Code	BMP Name	BMP Type	Unit	Targeted Pollutant	100% Unit Cost	Cost Share Percent	Cost Share Amt	Match Percent
328	Conservation Crop Rotation	Standard Rotation	Ac	Sediment	$15.94	0%		100%
345	Residue & Tillage Mgmt., Reduced Tillage	Mulch-Till -Drill only	Ac	Sediment	$19.00	0%		100%
410	Grade Stabilization Structures	Plastic Pipedrop, Riser 18" and larger	Dialnft	Sediment	$1.91	60%	$1.15	40%
410	Grade Stabilization Structures	Plastic Pipedrop, Riser less than 18"	Dialnft	Sediment	$1.65	60%	$0.99	40%
449	Irrigation Water Management	Basic IWM more than 30 Ac	Ac	sediment/adsorbed pesticide	$11.61	0%		100%
464	Irrigation Land Leveling	Land Leveling 125 to 205 cy per ac	Ac	Sediment	$343.25	50%	$171.63	50%
464	Irrigation Land Leveling	Land Leveling over 205 cy per ac	Ac	Sediment	$467.71	50%	$233.86	50%
590	Nutrient Management	Basic NM System	Ac	soluble nutrients/DO	$7.22	0%		100%
590PA	Nutrient Management - Precision Ag	Precision NM System	Ac	soluble nutrients/DO	$37.18	0%		100%
595	Integrated Pest Management	Basic IPM Field 1 RC	Ac	soluble/soluble/adsorbed pesticide	$17.58	0%		100%

Table 22 LDAF's Bayou Grand Marais, HUCs 080802020201 and 080802020203, section 319 project utilzes the 2016 NRCS statewide average costs list for BMPs to be implemented.

E. AN INFORMATION AND EDUCATION COMPONENT USED TO ENHANCE PUBLIC UNDERSTANDING OF THE PROJECT AND ENCOURAGE THEIR EARLY AND CONTINUED PARTICIPATION IN SELECTING, DESIGNING, AND IMPLEMENTING THE NONPOINT SOURCE MANAGEMENT MEASURES THAT WILL BE IMPLEMENTED

Implementing BMPs and conservation measures that reduce NPS pollution in Bayou Chene relies on cooperation of watershed stakeholders and local governments. Involvement by watershed stakeholders is necessary to support watershed protection programs. Watershed stakeholders include LDAF, LDEQ-NPS, UL stakeholders group, LDEQ Water Surveys, USDA-NRCS, Jefferson Davis SWCD, and community members and leaders.

The Bayou Chene education and outreach is an important component of watershed restoration, as it is the initial step in understanding how to improve water quality in the bayou. When landowners/producers understand the objectives of watershed restoration and benefits to the community, they are more likely to implement and maintain BMPs. Understanding the problem often results in a greater concern and encourages the community to take actions without regulation. Educational program activities are crucial components of watershed protection and water quality improvement. These activities are initiated prior to BMP implementation and continue throughout the life of the project.

LDAF will be the lead in the education and outreach program in order to increase the awareness of NPS pollution problems and issues associated with agricultural activities within the Bayou Chene watershed. In cooperation with the LDAF, Jefferson Davis SWCD, USDA-NRCS, LSU Ag Center, and the LDEQ NPS section, the goal is to work together to conduct education and outreach through agricultural BMP workshops, field days within the watershed, the Soil and Water Stewardship Program, and through other related events and activities throughout communities. Project WET (Water Education for Teachers) education workshops will be conducted for formal and non-formal educators of students ages kindergarten through twelve. The outreach will also lead to a better community wide understanding of the effects and remediation of off-site NPS pollution impairments. One agricultural BMP field day will be held within the Bayou Chene watershed to demonstrate the potential for reducing stream loading from agriculture activities, through the implementation of BMPs. Education and outreach will be conducted by the SWCD and NRCS in conjunction with a farm tour or rice field day. A special effort will be made to encourage landowners, operators, and educators from within the watershed to participate in the field day. Citizens will also be encouraged to become certified Master Farmers through the LSU Ag Center. USDA-NRCS and SWCD staff will make every effort to address local commodity groups at their annual meetings.

Additionally, to engage producers in the project areas, project fliers are distributed locally to notify landowners of CWA Section 319 funds being available for conservation assistance to correct surface water impairments. These impairments are made known to the community during the SWCD's locally-led conservation meetings, whereby all community stakeholders present are encouraged to voice, and prioritize their natural resource concerns. Beyond the locally led meeting is the project specific SWCD led BMP workshop and project orientation. These workshops often include presentations by technical specialists from all agencies involved in the watershed effort, and include presentations on the extent of impairments, environmental/agricultural impacts resulting from these impairments and methods of remediation. Maximizing public outreach and education is one of the annual goals of the Jefferson Davis SWCD.

In addition to field days and educational flyers/materials provided through the LSU Ag Center, LDEQ will partner with USDA and LDAF to host one to two meetings annually to discuss progress made in BMP implementation and water quality data collection. A summary of water quality data will be presented at these meetings to allow landowners and producers an opportunity to see how their participation in the programs is affecting water quality in Bayou Chene. The need to achieve PCR and FWP standards with continued implementation within the critical areas will be emphasized at each community meeting.

Additional outreach and education has been carried out by staff of UL, which included various educational activities, such as presentations in national conferences, speaking with and answering questions from citizens during water quality sampling, and engaging students in class projects whenever possible. Under grant C9-99610219, FFY 12, project#11, "Water Quality Sampling in Bayou Chene", the contractor hosted stakeholders' meetings, presentations of project findings at various regional and national level professional meetings, workshops, and conferences. These venues supported an environment for the interpretation of water quality data, data sharing, discussing the status of BMPs in Bayou Chene, and the overall coordination of project activities among various agencies. Three stakeholders' meetings were hosted in Jennings, LA, during the project period, September 2015, July 14, 2016, and June 29, 2017. Stakeholder members included university students, community leaders, interested citizens, university professors, government, and state employees.

In addition, The LRWA will be assisting LDEQ-NPS to promote public health, assist small water and wastewater systems through training, on-site technical assistance, and state operator certification necessary for promoting public health and environmental protection for the state of Louisiana. LRWA is partnering with LDEQ-NPS to help to improve water quality by 1) educating homeowners on the importance of routine inspections 2) how to properly maintain their home sewage treatment system, and 3) identifying repairs needed on their individual home sewage treatment system through OSDS inspections and to encourage and educate homeowners on the importance of denitrification systems. These elements combined will ultimately help to reduce FC bacteria in the Bayou Chene watershed.

F. SCHEDULE FOR IMPLEMENTING THE NONPOINT SOURCE MANAGEMENT MEASURES IDENTIFIED IN THIS PLAN THAT IS REASONABLY EXPEDITIOUS

LDEQ and LDAF have continued to work together to ensure BMP implementation coincides with water quality sampling. Implementation placement in the three 12-digit HUCs will be a concerted effort between LDAF, Jefferson Davis SWCD, USDA-NRCS, and LDEQ-NPS. LDAF and the SWCD have worked diligently with local producers to prepare Resource Management System (RMS) plans that address all resource concerns on each farm, and will meet the desired level of pollution abatement on each tract of land selected for implementation.

Implementation began in HUCs 080802020205, 080802020201, and 080802020203 in 2015, 2016, and 2017, respectively. Implementation in HUC 080802020205 was completed in 2018.The following has been completed in HUCS 080802020201 and 080802020203: development of ranking criteria, selection of BMPs and participants, meeting with participants, preparing individual comprehensive BMP plans, funding signups, education and outreach, and the work plan has been submitted. Within these HUCs, employees continue to work on technical and cost share assistance, the educational program, and BMP implementation. Implementation in HUCs 080802020201 and 080802020203 will continue through 2021. Tables 23 through 25 display implementation schedules and percent complete for each task, based on FFYs 2014 through 2016.

Each RMS plan will be developed under a three -year contract and tracked accordingly. The Jefferson Davis SWCD employees will determine if the BMPs are being implemented on schedule. The SWCD is also responsible for ensuring landowners are knowledgeable in proper maintenance and operation of BMPs implemented on their land.

Bayou Chene BMP Implementation in HUC 080802020205	Task	Timeframe	% Complete
	Develop Ranking Criteria	2/12/2015	100
	Selection of BMPs and Participants	3/2/2015 - 3/13/2015	100
	Meet with Potential Participants	3/13/2015 – 3/31/2015	100
	Prepare Individual Comprehensive BMP Plans	4/1/2015 – 5/19/15	100
	Technical Assistance	4/1/15 – 8/15/2018	100
	Cost Share Assistance	5/19/2015 – 8/15/2018	100
	Education Program	4/1/2015 – 8/1/2018	100
	BMP Implementation	4/1/2015 – 8/31/2018	100

Table 23 LDAF BMP Implementation schedule for FFY 2014 work plan, in HUC 080802020205

Bayou Chene BMP Implementation in HUCs 080802020201 and 080802020203	Task	Timeframe	% Complete
	Develop Ranking Criteria	12/16/2015	100
	Selection of BMPs and Participants	3/29/2016	100
	Meet with Potential Participants	3/29/16 – 4/19/16	100
	Prepare Individual Comprehensive BMP Plans	3/29/16 – 4/19/16	100
	Technical Assistance	3/29/16 – 8/15/2019	33
	Cost Share Assistance	4/19/16 – 8/15/19	17
	Education Program	4/19/15 – 8/15/19	20
	BMP Implementation	3/29/16 – 8/31/19	33

Table 24 LDAF BMP Implementation schedule for FFY 2015 work plan, in HUCs 080802020201 and 080802020203

Bayou Chene BMP Implementation in HUCs 080802020201 and 080802020203 FFY 2016	Task	Timeframe	% Complete
	Work Plan Submitted and Approved	03/01/16-08/01/16	100
	Funding and Sign Ups	10/01/16-02/01/17	100
	BMP Implementation	03/01/17-04/01/21	20
	Education and Outreach	10/01/16-04/01/16	100
	Wrap Up	04/01/21-10/31/21	0

Table 25 LDAF BMP Implementation for FFY 2016 work plan, in HUCS 080802020201 and 08080808020203

G. DESCRIPTION OF INTERIM MEASURABLE MILESTONES FOR DETERMINING WHETHER NONPOINT SOURCE MANAGEMENT MEASURES OR OTHER CONTROL ACTIONS ARE BEING IMPLEMENTED

The short-term goal of this WIP is to implement BMPs in the three 12-digit HUCs in Bayou Chene and to monitor water quality to evaluate changes in the watershed. LDAF began implementing BMPs in Bayou Chene in 2015, and plans to continue through 2021. The long-term goal is to improve water quality in the bayou, by reducing the concentration of FC bacteria and increasing DO concentrations; thereby, meeting the state's water quality standards and/or restoring beneficial uses in Bayou Chene.

Project milestones for LDEQ and LDAF are listed in Table 26. The initial sampling plan was approved, and baseline monitoring conducted by UL, under the MRBI project began June 2012 and was collected through May 2013. Long-term monitoring began in June 2013 under the MRBI project and continued under the "Water Quality Sampling in Bayou Chene", project. Sampling by UL was completed in July 2017, and continued to be sampled by LDEQ Water Surveys. Ambient water quality sampling began in October 2018 and will be completed by September 2019. Long-term water quality monitoring under the "Water Quality Sampling in Bayou Chene" is set to continue through 2021. Post BMP monitoring will be conducted from 2021 through 2022. Ambient water quality monitoring will resume in 2022 and continue through 2023.

Project information will be updated in the Grants Reporting and Tracking System (GRTS) semi-annually throughout the project period. Water quality data will be entered into LDEQ's and EPA's water quality database. Annual progress made in implementing BMPs and activities associated with projects by LDAF will be utilized as interim indicators of success toward restoring water quality in the watershed. It is estimated Bayou Chene could be restored for FWP (DO) and PCR (FC) in 2027.

Project Milestones	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Sampling Plan approved																	
Baseline Monitoring under MRBI project																	
Long-term monitoring under MRBI project																	
LDAF BMP implementation HUC 080802020205																	
Long-term monitoring under "Water Quality Sampling in Bayou Chene", conducted by UL																	
LDAF BMP implementation HUC 080802020205 50% complete																	
LDAF BMP implementation HUCs 080802020201 and 080802020203																	
LDAF BMP implementation HUC 080802020205 75% complete																	
LDAF BMP implementation HUCs 080802020201 and 080802020203 34% complete																	
Long-term monitoring under "Water Quality Sampling in Bayou Chene", conducted by LDEQ Water Surveys																	
LDAF BMP implementation HUC 080802020205 100% complete																	
LDAF BMP implementation HUCs 080802020201 and 080802020203 51% complete																	
LDEQ Ambient Water Quality Monitoring																	
LDAF BMP implementation HUCs 080802020201 and 080802020203 68% complete																	
LDAF BMP implementation HUCs 080802020201 and 080802020203 85% complete																	
LDAF BMP implementation HUCs 080802020201 and 080802020203 100% complete																	
Post-BMP Monitoring																	
LDEQ Ambient Water Quality Monitoring																	
GRTS reporting																	
LDEQ Ambient Water Quality Monitoring																	
Waterbody possibly restored for FWP (DO)																	
Waterbody possibly restored for PCR (FC)																	
Waterbody possibly removed from The Louisiana Department of Environmental Quality's 2028 305(b) report																	

Table 26 Bayou Chene Milestones

H. A SET OF CRITERIA THAT CAN BE USED TO DETERMINE WHETHER LOADING REDUCTIONS ARE BEING ACHIEVED OVER TIME AND SUBSTANTIAL PROGRESS IS BEING MADE TOWARD ATTAINING WATER QUALITY STANDARDS

According to the article *Lag Time in Water Quality Response to Best Management Practices*, "NPS watershed projects often fail to meet expectations for water quality improvement because of lag time, the time elapsed between adoption of management changes [BMP implementation] and the detection of measurable improvement in water quality in the target waterbody. Even when management changes are well designed and fully implemented, water quality monitoring efforts may not show definitive results if the monitoring period, program design, and sampling frequency are not sufficient to address the lag between treatment and response, which may be years after implementation has been completed. The main components of lag time include the time required for an installed practice to produce an effect, the time required for the effect to be delivered to the water resource, the time required for the waterbody to respond to the effect, and the effectiveness of the monitoring program to measure the response" (Donald 2009). Important processes influencing lag time include hydrology, vegetation growth, transport rate and path, hydraulic residence time, pollutant sorption properties, and ecosystem linkages. The magnitude of lag time is highly site and pollutant specific, but may range from months to years for relatively short-lived contaminants such as indicator bacteria, years to decades for excessive phosphorus (P) levels in agricultural soils, and decades or more for sediment accumulated in river systems. Groundwater travel time is also an important contributor to lag time and may introduce a lag of decades between changes in agricultural practices and improvement in water quality. Approaches to deal with the inevitable lag between implementation of management practices and water quality response lie in appropriately characterizing the watershed, considering lag time in selection, siting, and monitoring of management measures, selection of appropriate indicators, and designing effective monitoring programs to detect water quality response (Donald 2009).

Criteria utilized to determine whether NPS loads are being achieved over time and progress is being made toward meeting water quality standards will include data from water quality sampling measured against the state's water quality standards. Table 27 includes the water quality standards and designated uses for Bayou Chene.

Waterbody	NPS related parameters for which numerical standards have been developed	Standard LDEQ Environmental Regulatory Code	Does waterbody meet standard? 2016 IR
Bayou Chene 050603 -From headwaters to Lacassine Bayou; includes Bayou Grand Marais	Primary Contact Recreation (Fecal coliform)	[1]	Not
	Secondary Contact Recreation (Fecal coliform)	[2]	Fully
	Fish and Wildlife Propagation (Dissolved Oxygen)	3.0 mg/L, March-November, 5.0 mg/L December-February	Not
	TDS	400	Fully
	SO_4	10	N/A
	Chloride	90	N/A

[1] Based on a minimum of not less than five samples taken over not more than a 30-day period. Fecal coliform count should be less than 200 /100ml over a 30-day period, and less than 10 % of samples during any 30-day period or 25 % of total samples collected annually can exceed 400/100ml. Applies only May 1 – Oct. 31, otherwise, criteria for secondary contact recreation applies.

[2] Based on a minimum of not less than five samples taken over not more than a 30-day period Fecal coliform count should be less than 1000 /100ml in at least 5 samples taken over a 30-day period, and less than 10 % of samples during any 30-day period or 25 % of total samples collected annually can exceed 2000/100ml.

Table 27 Bayou Chene numerical standards and LDEQ's 2016 Integrated Report data

For the 2014/2015 ambient sampling cycle, an average DO concentration of 2.01 and 3.88 mg/L was calculated at WQN site 0658, for March through November and December through February, respectively. Assuming an average yearly improvement of 0.0825 mg/L (March-November) and 0.0933 mg/L (December-February), as result of implementation, the DO standard of 3.0 mg/L from March-November, and 5.0 mg/L December-February, can be attained. It is expected that the bayou will attain the respective DO standards by 2027; thereby restoring the waterbody to fully support its FWP use. LDEQ expects this attainment to be reflected in LDEQ's 2028 IR. Figure 13 shows estimated DO improvements, March through November through 2028. Figure 14 shows estimated DO improvements, December through February, through 2028.

Fecal coliform concentrations were exceeded on three occasions during the 2014/2015 PCR period. On October 14, 2014, concentrations measured 450 cfu/100mL, and on July 14, 2015 and September 8, 2015, fecal coliform levels hit a peak of 620 cfu/100 mL. Peak concentrations of 620 cfu/100mL would need to be reduced by 36 percent to meet the PCR standard, of 400 cfu/100mL. To calculate the yearly percent reduction needed each year to reach the fecal coliform PCR standard, divide 36 percent by the estimated 12 years it may take to restore the FWP use. It is predicted that implementing FC related BMPs in the bayou, FC concentrations will be reduced by three percent each year. Figure 15 illustrates estimated FC reductions from 2016 through 2027. It is expected that the bayou will fall below the FC PCR standard by 2027; thereby restoring the waterbody to fully support its PCR use. It is predicted that Bayou Chene should not be listed on the 2028 IR for not supporting its PCR use due to high FC concentrations stemming from runoff from forest/grassland/parkland, drought related impacts, and rural (residential areas).

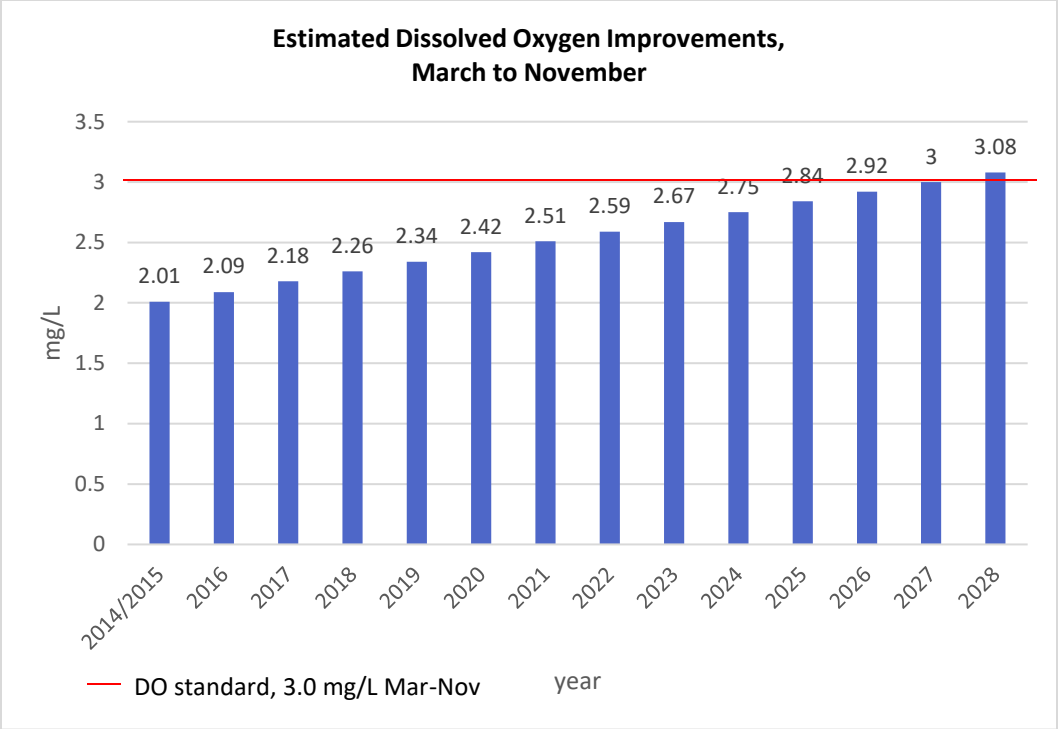

Figure 13 Bayou Chene's estimated dissolved oxygen improvements due to BMP implementation. March to November. It is expected that Bayou Chene will be restored to fully support its FWP designated use by 2027.

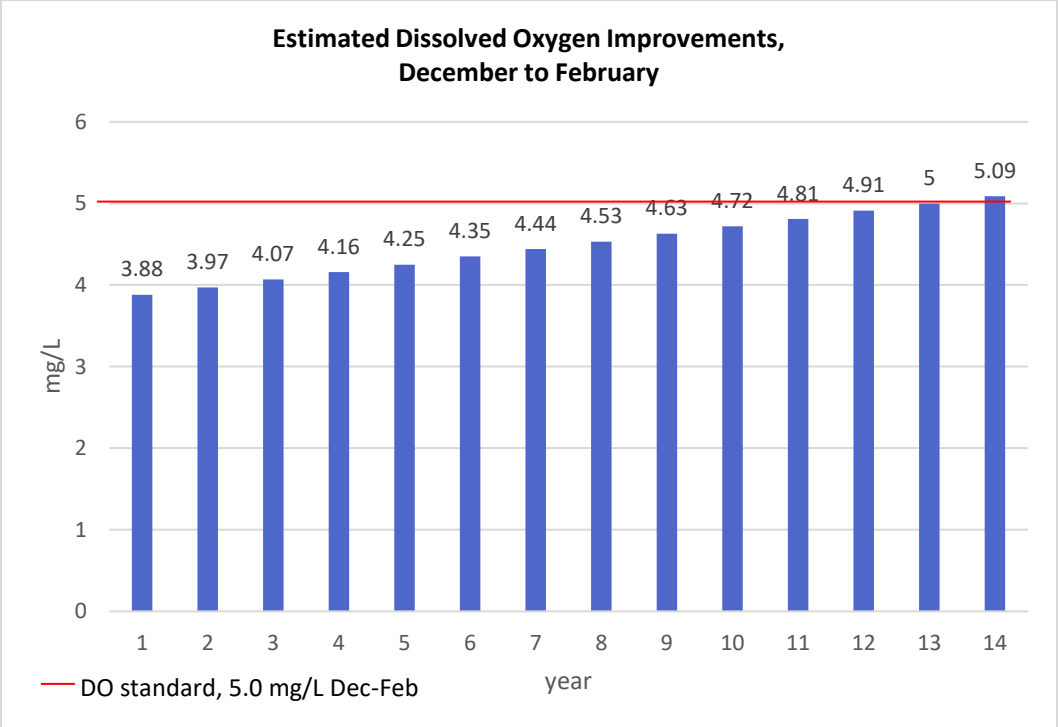

Figure 14 Bayou Chene's estimated dissolved oxygen improvements due to BMP implementation, December to February. It is expected that Bayou Chene will be restored to fully support its FWP designated use by 2027.

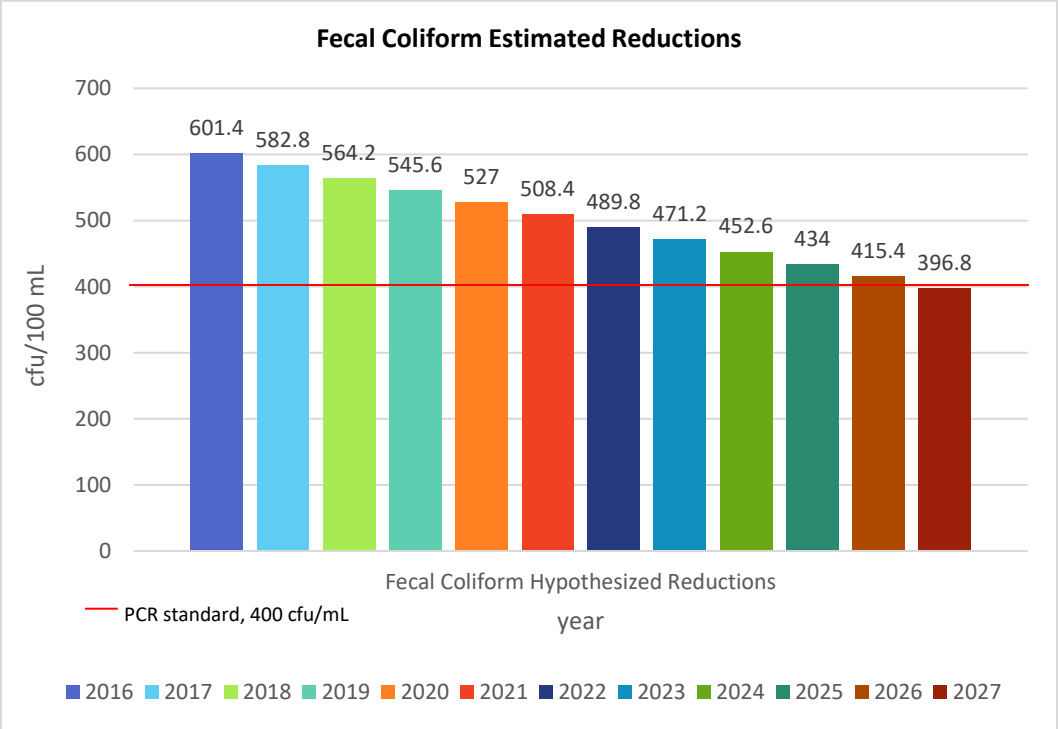

Figure 15 Estimated fecal coliform reductions due to fecal coliform related BMP implementation in Bayou Chene. It is expected that the bayou will be restored to fully support its PCR designated use by 2027.

I. A MONITORING COMPONENT TO EVALUATE THE EFFECTIVENESS OF THE IMPLEMENTATION EFFORTS OVER TIME, MEASURED AGAINST THE CRITERIA ESTABLISHED UNDER ITEM H IMMEDIATELY ABOVE

LDEQ's Ambient Water Quality Monitoring

LDEQ's ambient water quality monitoring is one source of data to evaluate changes in water quality following the implementation of BMPs in the Bayou Chene watershed. Statewide DO values represent the minimum criterion designed to protect indigenous wildlife and aquatic life species associated with the aquatic environment. Louisiana's ambient water quality monitoring and assessment program follows a four-year rotating subsegment approach through which approximately one fourth of the state's subsegments are monitored during each one-year period of the rotation. LDEQ has one ambient water quality network site (WQN), located at the Highway 99 Bridge station in Bayou Chene where water quality data has been collected since 1998. LDEQ sampled the Bayou Chene subsegment in 1998, 2003, 2007, and 2010/2011, and 2014/2015, and 2018/2019.

A second avenue to gauge changes in water quality is through targeted watershed monitoring. The goal of targeted watershed monitoring is to determine where NPS pollutants occur and to evaluate water quality changes where LDAF or NRCS have implemented BMPs. Since 2012, there have been three water quality sampling projects conducted in Bayou Chene. Figure 16 displays the water quality sampling timeline for Bayou Chene from 2012 through 2022. Figure 17 illustrates the Bayou Chene water quality sampling sites in the water quality monitoring projects. Criteria for the designated uses will be used to determine whether NPS loads are being reduced and progress is being made towards meeting water quality standards and restoring the uses in the Bayou Chene watershed. This will be determined by the WQN site.

2012
Develop draft sampling plan for approval. Upon approval, baseline assessment begins under MRBI project.

2013
Baseline sampling ends and long-term sampling begins under MRBI project. Annual review of sampling plan and revise as needed.

2014
Long-term sampling continues. Annual review of sampling plan and revise as needed.

2015
Long-term sampling continues under MRBI project, through June 14, 2015. Long-term sampling continues under "Water Quality Monitoirng in Bayou Chene" project., beginning June 15, 2015. Annual review of sampling plan and revise as needed

2016
Long-term sampling continues. Annual review of sampling plan and revise as needed

2017
Long-term sampling continues. UL stops sampling July 2017 and LDEQ Water Surveys begins August 2017. Annual reivew of sampling plan adn revise as needed.

2018
Long-term sampling continues. Annual review of sampling plan and revise as needed. LDEQ Ambient Water Qualtiy Monitoring begins.

2019
Long-term sampling continues. Annual review of sampling plan and revise as needed. LDEQ Ambient Water Qualtiy Monitoring ends.

2020
Long-term sampling continues. Annual review of sampling plan and revise as needed

2021
Long-term sampling ends and post BMP monitoring begins. Annual review of sampling plan and revise as needed

2022
Post BMP monitoring ends. A revision of the sampling plan will be resubmitted to EPA if sampling will be continued. A report will be prepared, summarizing data and all activities from the project. LDEQ Ambient Water Qualtiy Monitoring resumes.

2023
LDEQ Ambient Water Quality Monitoring ends.

2026
LDEQ Ambient Water Quality Monitoring resumes.

2027
LDEQ Ambient Water Quality Monitoring ends.

Figure 16 Water quality sampling timeline for Bayou Chene

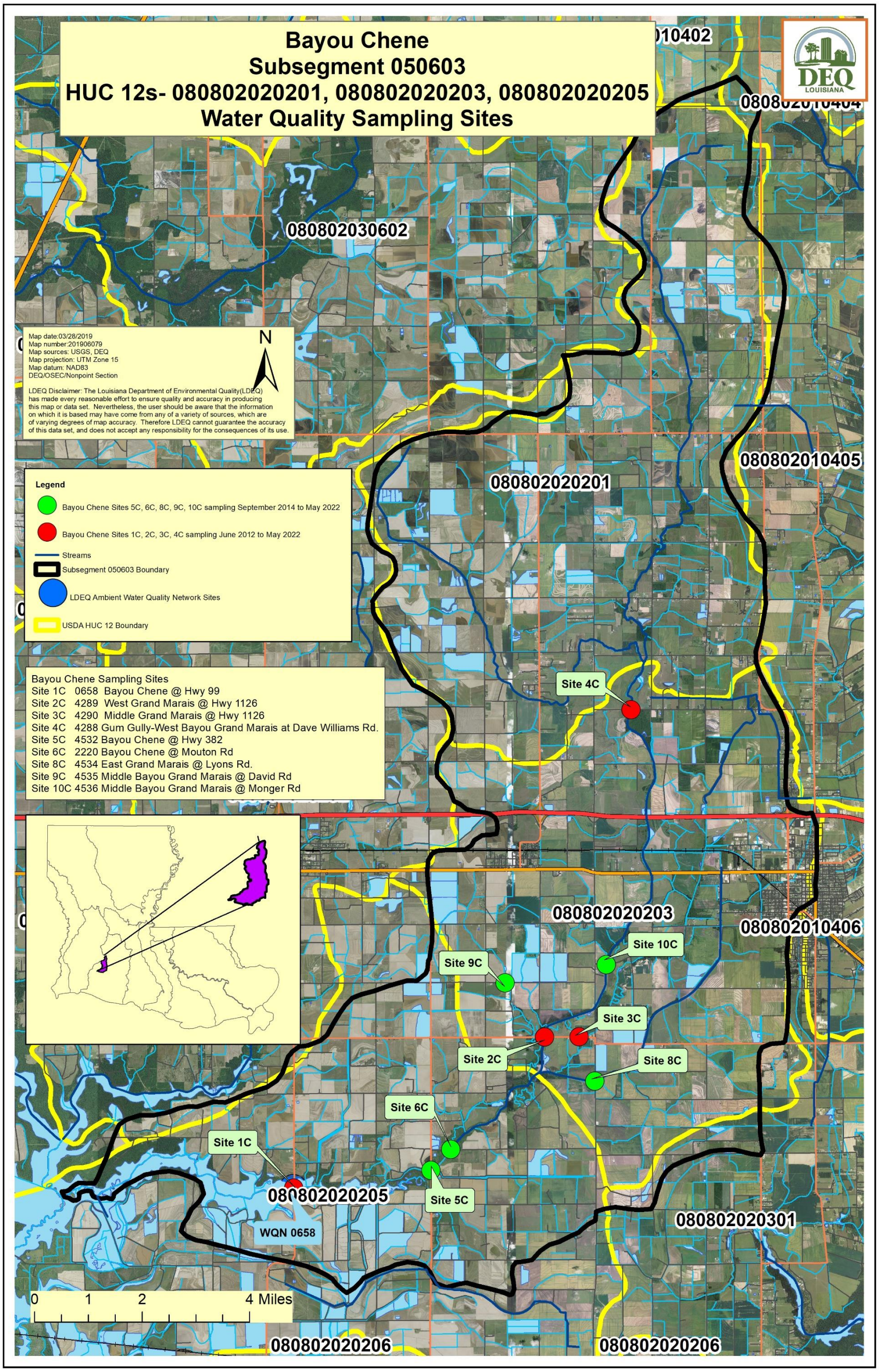

Figure 17 Bayou Chene water quality sampling site map

"The Mississippi River Basin Initiative (MRBI) Watershed Water Quality Monitoring in Bayou Chene and Lacassine Bayou Project"

To determine water quality changes following the introduction of agricultural BMPs in reducing nutrients (phosphorus and nitrogen), sediment (solids and turbidity), BOD_5, sulfate, chloride, and fluoride entering the bayou, weekly monitoring of surface water quality was collected at four sites (1C, 2C, 3C, and 4C) beginning in June of 2012. To gather additional data, sites 5C, 6C, 7C, 8C, 9C, and 10C were added in September 2014. Subsequently, site 7C was removed in April 2015 due to inaccessibility and safety issues. The LDEQ surveys team collected the flow data for select monitoring locations in Bayou Chene. During the Bayou Chene MRBI project, forty two BMPs were implemented in HUC 080802020205, and monitoring data collected displayed small improvements in turbidity, total suspended solids (TSS), total dissolved solids (TDS), total solids (TS), NO_3-N, NO_2-N, fluoride (FL), sulfate (SO_4), Soluble reactive phosphorus (SRP), and total phosphorus (TP); however, DO concentrations did not attain the state's standard of 3.0 mg/L, March to November, and 5.0 mg/L December to February. DO data collected at the AWQN site, from June 2012 through May 2013, showed 23 of 37 samples were below 3.0 mg/L March to November (62 percent exceedance) and 5 of 12 samples were below 5.0 mg/L December to February (42 percent exceedance). DO data collected from June 2013 through May 2014, showed 34 of 39 samples were below 3.0 mg/L March to November (87 percent exceedance) and 2 of 11 samples were below 5.0 mg/L December to February (18 percent exceedance). DO data collected from June 2014 through May 2015, showed 31 of 38 samples were below 3.0 mg/L March to November (82 percent exceedance) and 3 of 11 samples were below 5.0 mg/L December to February (27 percent exceedance), (Figures 18 and 19). At the conclusion of the project, Bayou Chene, remained listed on LDEQ's 2016 IR for not supporting its use of FWP, due to low concentrations of DO attributed to agriculture.

Although water quality analysis results, from the project, made it evident that additional BMP implementation was needed, LDEQ and LDAF remained dedicated to improving the water quality in the Bayou Chene watershed. After the closing of the MRBI project, LDEQ-NPS and UL personnel entered into a new contract in which UL continued to collect weekly water quality data to pinpoint additional critical areas where BMPS were necessary.

For additional information, the project's final report can be found on LDEQ's NPS website: https://deq.louisiana.gov/assets/docs/BayouCheneMRBIProjectFinalReport063016.pdf

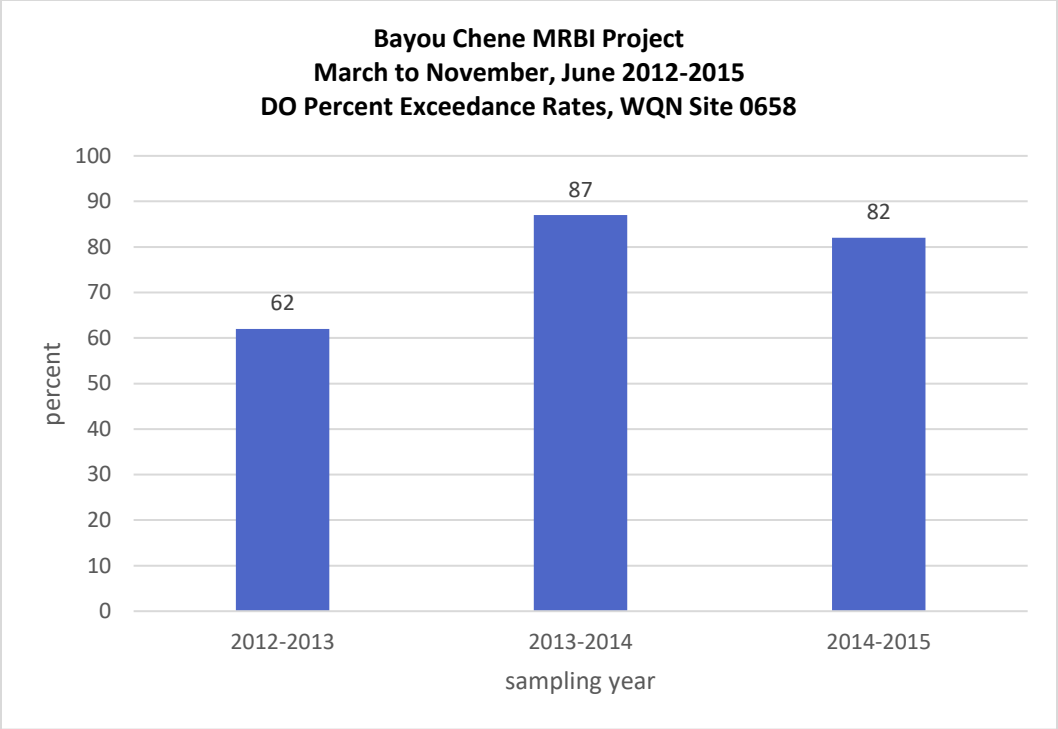

Figure 18 Bayou Chene, MRBI Project, WQN 0658/site 1C dissolved oxygen exceedance rates, March to November, 2012-2015

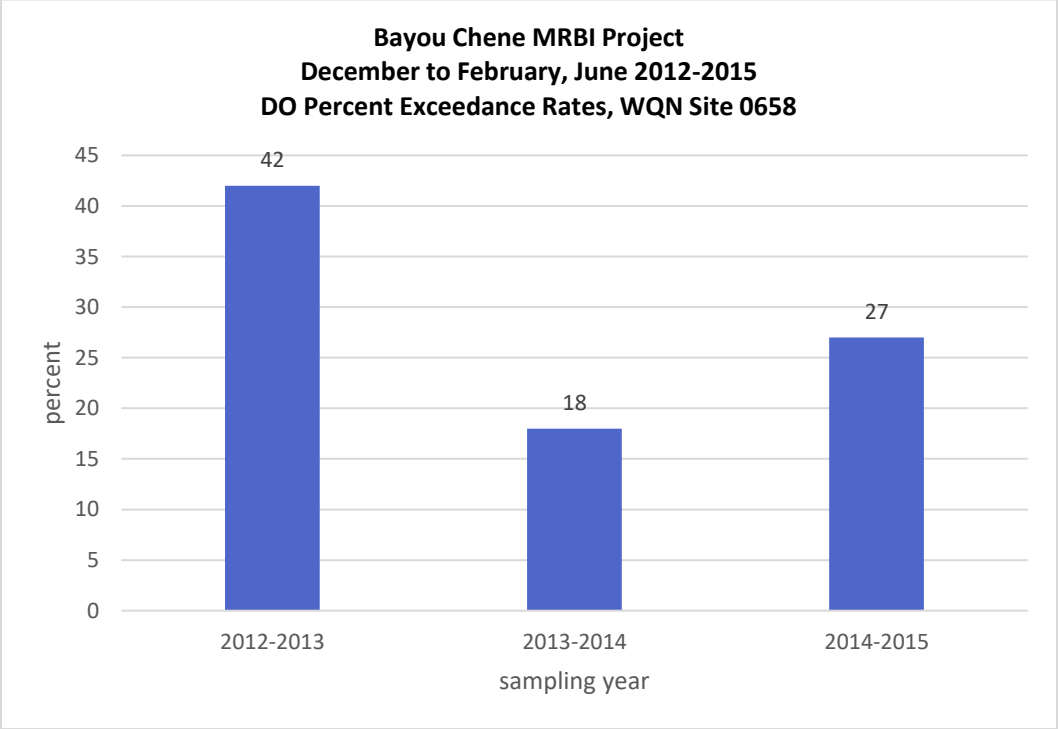

Figure 19 Bayou Chene, MRBI Project, WQN 0658/site 1C dissolved oxygen exceedance rates, December to February, 2012-2015

"Water Quality Sampling in Bayou Chene", conducted by UL

From June 15, 2015 through July 2017, UL continued to monitor nine locations in the Bayou Chene watershed on a weekly basis. Sampling sites were selected based on critical areas of highest sediment loadings determined by the SWAT Model, LDAF 12-digit BMP implementation areas, land use data, accessibility, and safety of sampling locations. The data collected during this project will be used to determine water quality changes in the watershed. Sampling site exceedance rates were used to rank critical areas for future LDAF BMP implementation.

Figures 20 and 21 illustrate DO exceedance rates at each sampling site for project sampling year, June 2015 to May 2016. Critical areas for 2017 BMP implementation were based on project DO exceedance rates calculated during March to November, 2015/2016. The highest priority ranking for implementation, for March to November, was assigned to the sites with the highest exceedance rate, 76 percent (sites 3C, 6C, and 8C) followed by sites 1C (WQN 0658), 5C, 10C, 2C, 9C, and 4C, with a 73, 73, 59, 54, 22, and 19 percent exceedance, respectively (Figure 20). The DO exceedance rates for December to February, were 55 percent (site 6C) followed by sites 5C, 1C (WQN 0658), 8C, 2C, 3C, 9C, 10C, and 4C, with a 45, 36, 36, 27, 9, 9, 9, and 0 percent exceedance, respectively (Figure 21).

Figures 22 and 23 illustrate DO exceedance rates at each sampling site for project sampling year, June 2016 to May 2017. Critical areas for 2018 BMP implementation were based on project DO exceedance rates calculated during March to November, 2016/2017. The highest priority ranking for implementation, for March to November, was assigned to the site with the highest exceedance rate, 84 percent (site 6C), followed by sites 1C (WQN 0658), 5C, 2C, 3C, 8C, 10C, 9C, and 4C, with a 74, 74, 66, 63, 63, 58, 18, and 3 percent exceedance, respectively (Figure 22). The DO exceedance rates for December to February, were 55 percent (site 1C/WQN 0658) followed by sites 5C, 6C, 3C, 8C, 9C, 2C, and 10C, with a 36, 36, 27, 27, 18, 9, and 0 percent exceedance, respectively (Figure 23).

For additional information, the project's final report and appendix can be found on LDEQ's NPS website:
https://deq.louisiana.gov/assets/docs/ULLBayouCheneFinalReport.pdf

https://deq.louisiana.gov/assets/docs/BayouCheneFinalReportAppendix.pdf

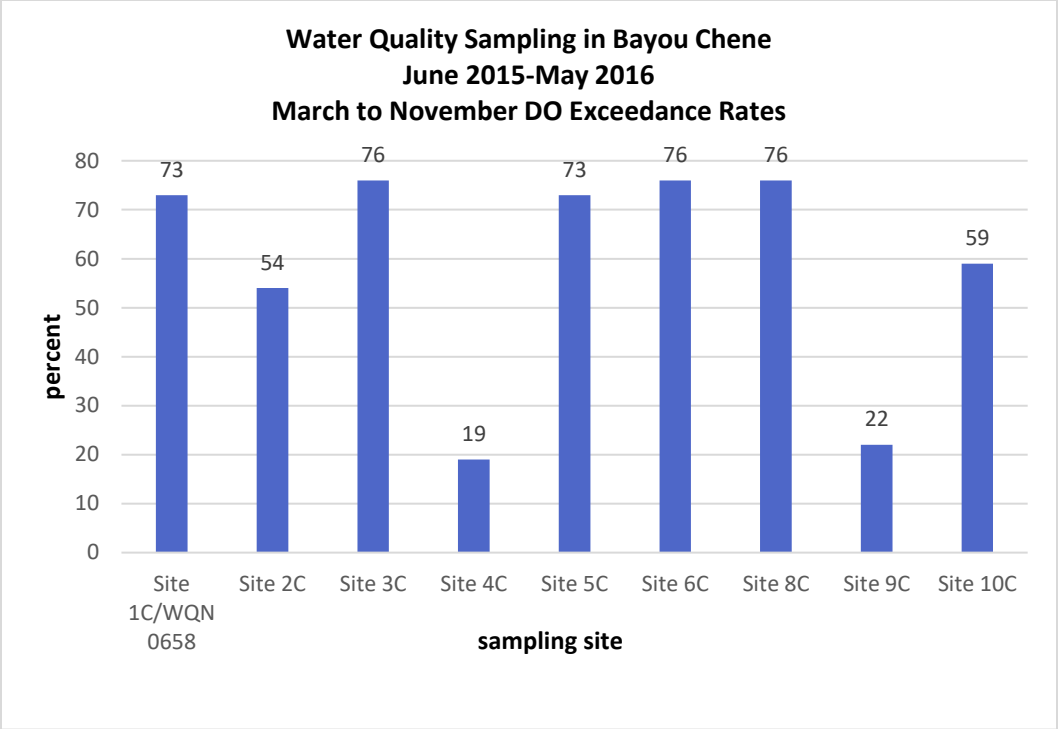

Figure 20 Water Quality Sampling in Bayou Chene, dissolved oxygen exceedance rates by site, Mach to November, June 2015 through May 2016

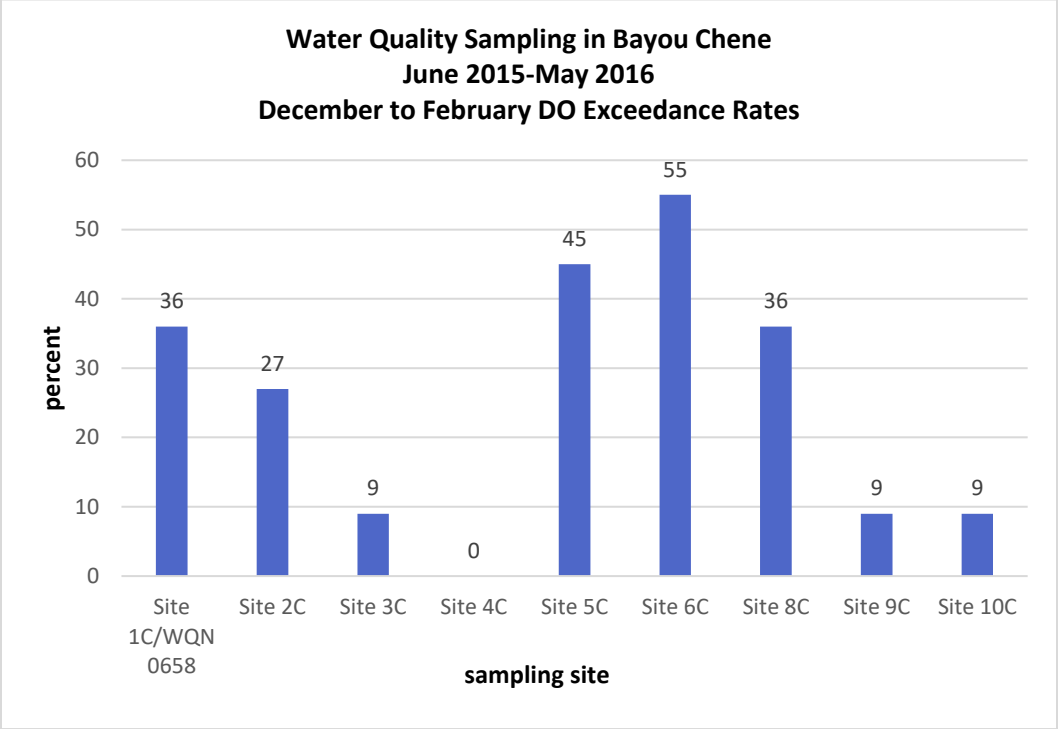

Figure 21 Water Quality Sampling in Bayou Chene, dissolved oxygen exceedance rates by site, December to February, June 2015 through May 2016

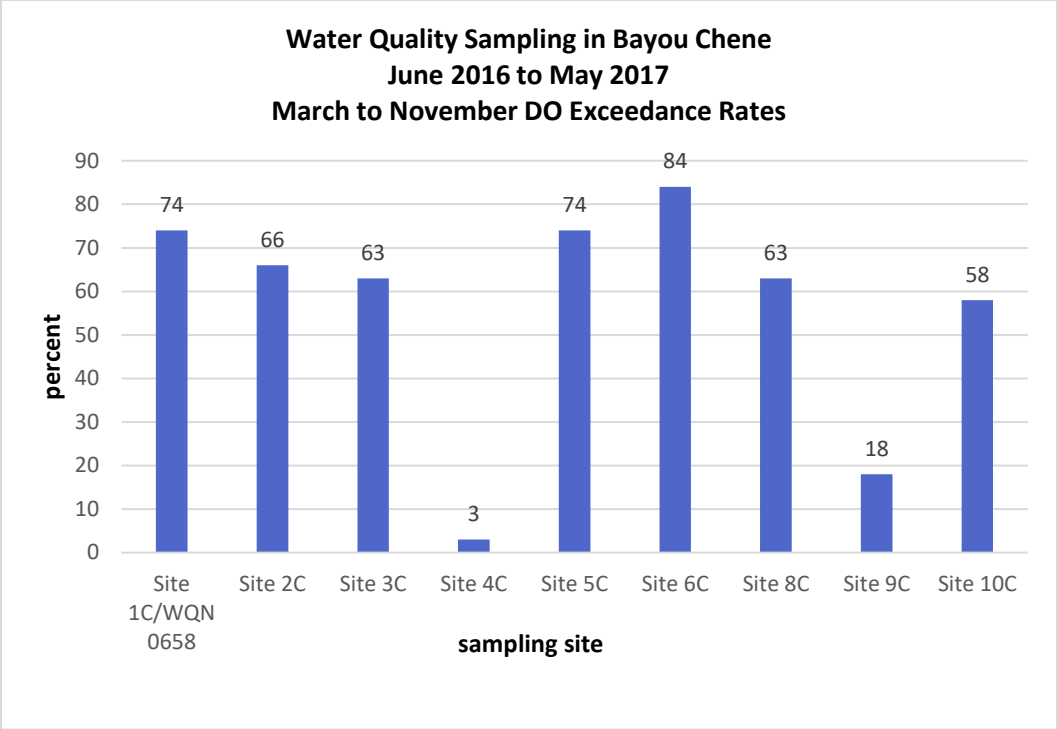

Figure 22 Water Quality Sampling in Bayou Chene, dissolved oxygen exceedance rates by site, Mach to November, June 2016 through May 2017

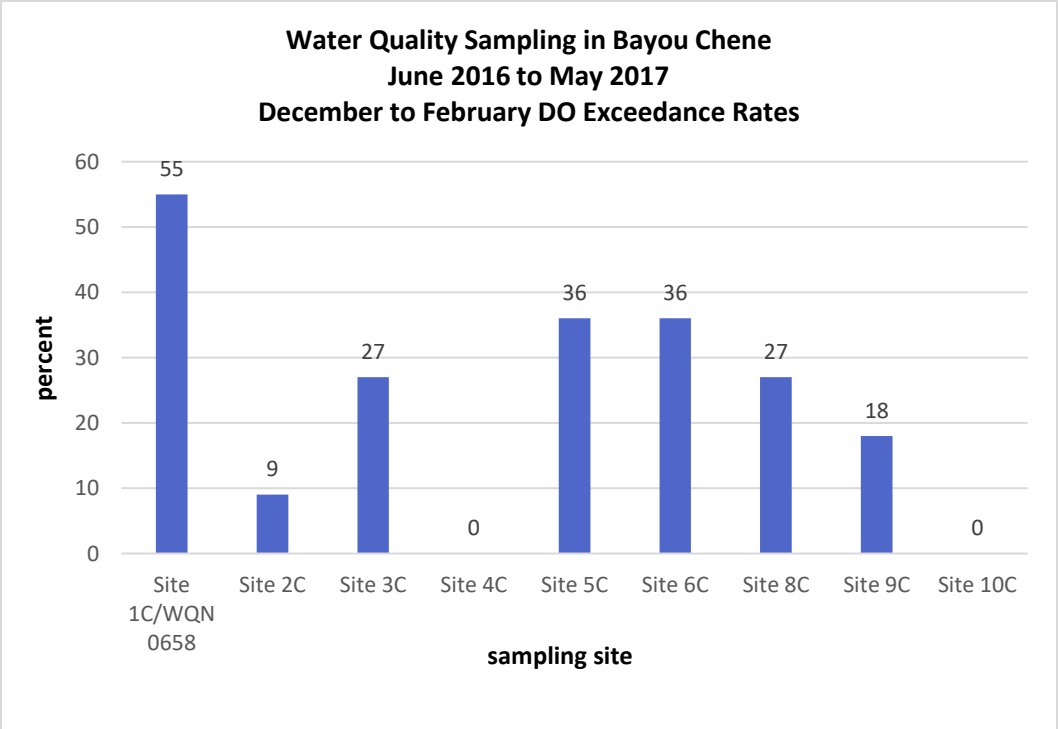

Figure 23 Water Quality Sampling in Bayou Chene, dissolved oxygen exceedance rates by site, December to February, June 2016 through May 2017

Water Quality Sampling in Bayou Chene, conducted by LDEQ Water Surveys

Beginning August 2017 LDEQ Water Surveys replaced UL and continues to monitor water quality at the same nine locations. Water quality monitoring was conducted twice a month and flow was collected once a month. In addition to in situ parameters, the following was sampled: nitrate-nitrite, TKN, TP, TS, TSS, TDS, and turbidity. Figures 24 and 25 illustrate DO exceedance rates at each sampling site for project sampling year, June 2017 to May 2018. Beginning April 2018, the sampling frequency was changed to once per month, FC was added as a parameter, and TS, TSS, and TDS are no longer being sampled. Critical areas for 2019 BMP implementation were based on project DO exceedance rates calculated during March to November 2017/2018. The highest priority ranking for implementation, for March to November, was assigned to the site with the highest exceedance rate, 76 percent (site 6C), followed by sites 5C, 3C, 2C, 1C (WQN 0658), 8c, 10c, 9c, and 4C, with a 67, 65, 63, 62, 60, 59, 24, and 14 percent exceedance, respectively. The DO exceedance rates for December to February, were 40 percent (site 1C/WQN 0658) followed by sites 5C, 6C, 2C, 3C, 4C, 8C, 9C, and 10C, with a 17, 17, 0, 0, 0, 0, 0, and 0 percent exceedance, respectively.

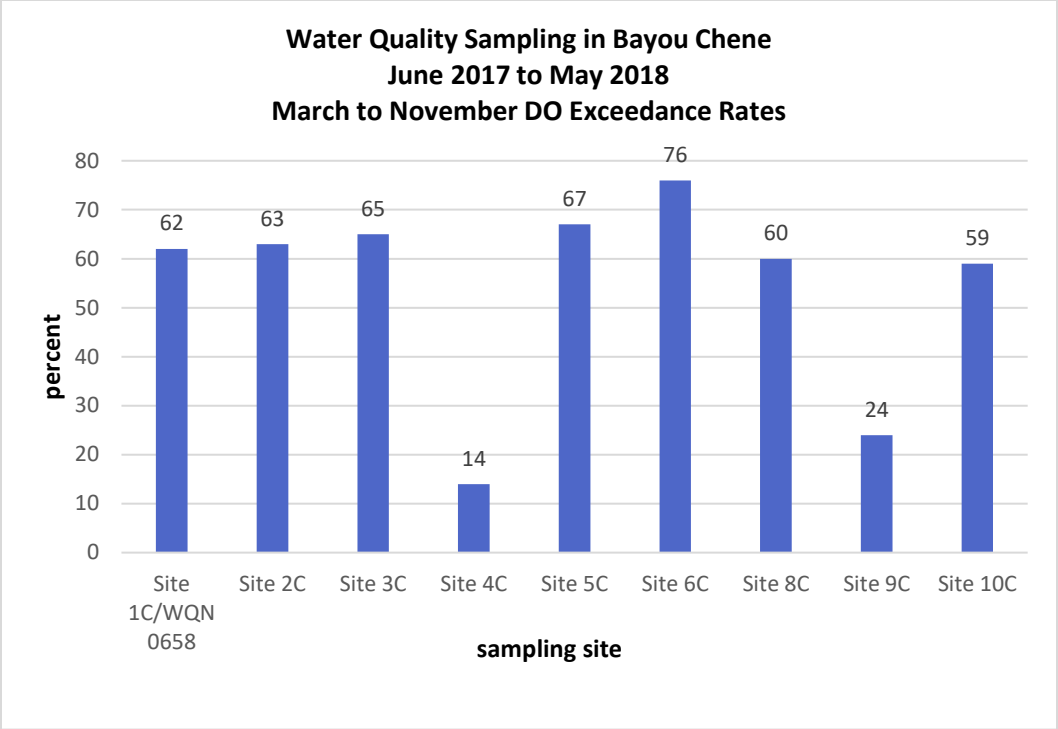

Figure 24 Water Quality Sampling in Bayou Chene, dissolved oxygen exceedance rates by site, Mach to November, June 2017 through May 2018

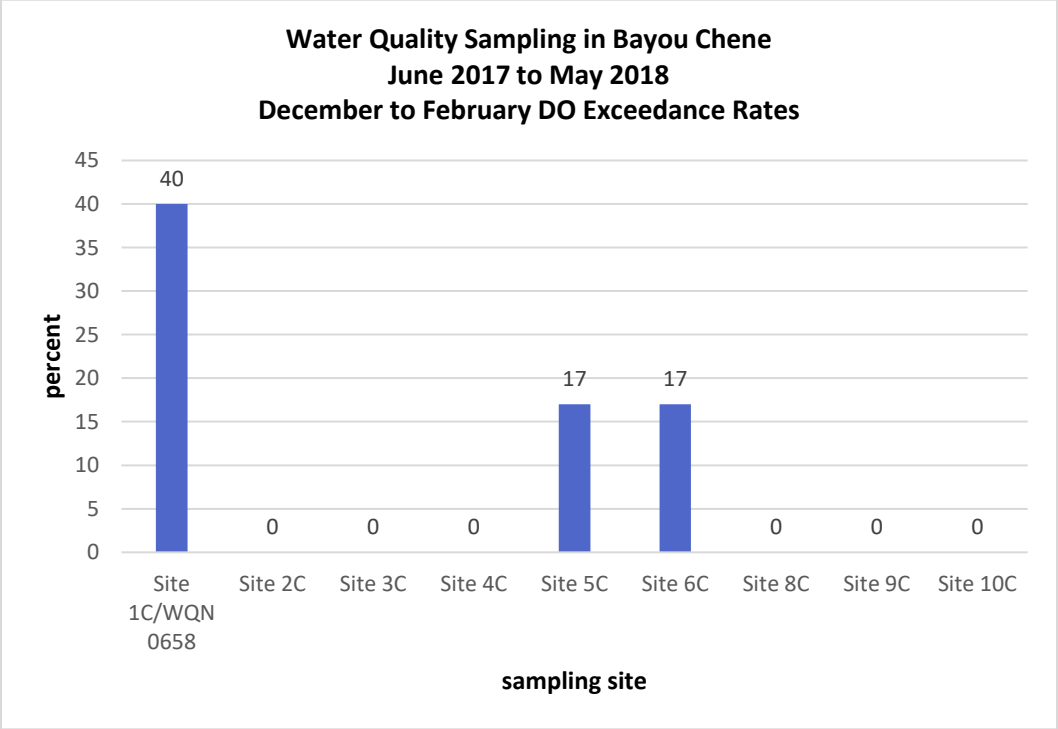

Figure 25 Water Quality Sampling in Bayou Chene, dissolved oxygen exceedance rates by site, December to February, June 2017 through May 2018

Dissolved oxygen exceedances calculated from NPS project data from June 2012 to May 2018, at WQN site 0658, range from 62 to 87 percent, March to November. Project data shows a DO exceedance rate of 62 percent, March to November, in 2012/2013 and in 2017/2018 (Figure 26). Figure 27 shows a range of 18 to 55 percent, December to February, between June 2012 and May 2018. Critical areas for LDAF's 2020 BMP implementation will be based on project DO exceedance rates calculated from June 2018 to May 2019 water quality data. Long-term sampling will end in 2021 and post BMP monitoring will be collected from 2021 through 2022.

Since FC has not been collected for an entire year, available ambient data may be utilized to pinpoint critical areas for FC related implementation. All data collected during this project will be used to evaluate water quality changes in the watershed. It is expected that as BMPs continue to be implemented, fecal coliform and nutrients, TP, TKN, nitrate-nitrite, and turbidity concentrations will decrease, while DO concentrations will increase. Water quality data will be analyzed and a draft final report will be submitted to EPA for approval. LDEQ will share all data with its stakeholders on a semi-annual basis. Current water quality results have been stored in LDEQs water quality database, Environmental Quality Information System (EQUIS), and also EPA's water quality database, Storage and Retrieval Data Warehouse (STORET)/ Water Quality eXchange (WQX). NPS staff will continue to coordinate with LDAF and LDEQ Water Surveys, to gauge changes in water quality during watershed implementation.

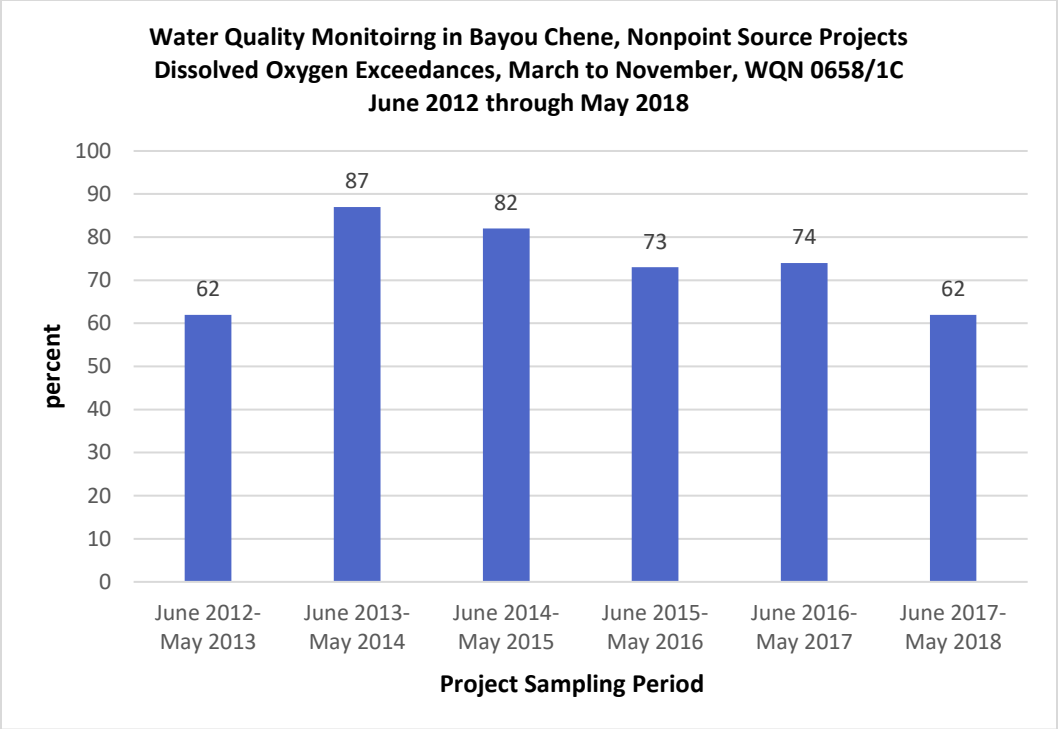

Figure 26 Dissolved oxygen exceedances calculated from NPS project data from June 2012 to May 2018, March to November

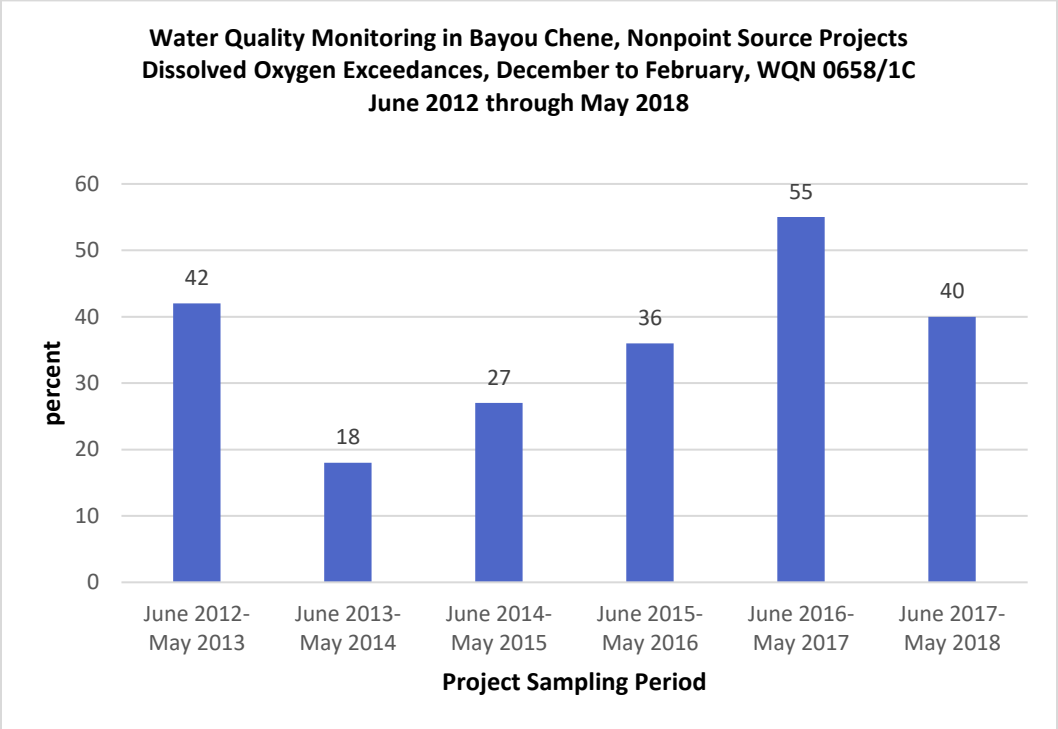

Figure 27 Dissolved oxygen exceedances calculated from NPS project data from June 2012 to May 2018, December to February

3. Tracking and Evaluation: Pathway to Improvement

LDEQ-NPS staff partners with LDAF through quarterly meetings to discuss progress made in watershed implementation. These quarterly meetings include progress made on BMP implementation in the Bayou Chene watershed as well as current status of water quality data collected at the subwatershed scale. If water quality data indicates improvement in DO and FC concentrations, due to implementation, LDEQ and LDAF will continue their current approach with respect to watershed implementation. If water quality data does not indicate improvement, LDEQ and LDAF will determine adaptive management strategies to be applied to the watershed implementation approach. If water quality data indicate water quality standards have been met, the waterbody will be listed as restored and a NPS success story will be developed and submitted to USEPA Region 6.

Future recommendations for implementation in the Bayou Chene watershed include:

1) Continue implementation of BMPs to improve DO concentrations;
2) Integrate proposed FC BMPs into the WIP, as deemed necessary;
3) Begin implementation of proposed FC BMPs;
4) Continue monitoring surface water quality in Bayou Chene, focusing on high priority areas;
5) Integrate efforts currently being implemented by project partners;
6) Increase implementation within the critical areas in the watershed;
7) Maintain agricultural productivity and the local economy by providing financial incentives; and
8) Develop a more aggressive outreach component for Bayou Chene, reaching all stakeholders in the watershed.

More information on NPS can be found at LDEQ's NPS website at http://deq.louisiana.gov/page/nonpoint-source.

4. REFERENCES

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