Bayous Maringouin (120111) and Grosse Tete (120104) Watershed Implementation Plan

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Introduction

This watershed implementation plan (WIP) is intended to address use impairments in Bayous Maringouin and Grosse Tete. These waterbodies lie in south-central Louisiana, in the northern part of the Terrebonne Basin, spanning portions of Point Coupee, West Baton Rouge, and Iberville parishes. In the past, Bayou Maringouin was a distributary of Bayou Grosse Tete. Due to hydromodification, now they are distinct and Bayou Maringouin functions primarily as a stormwater runoff collector. However, in flood conditions Grosse Tete will overtop and flow into Bayou Maringouin. The two subsegments share the same nonpoint source (NPS) pollution issues and stakeholder groups. In fact, the Upper Delta Soil and Water Conservation District through the Natural Resource Conservation Service (NRCS) has funded an engineering study evaluating hydrology in the area. Proposed flood control projects include alternatives that reconnect these two waterbodies.

Both areas are dominated by significant forested wetlands, and intensive agricultural land use. During flood events, the smaller Bayou Maringouin – 32,000-acre drainage area – intermittently serves as a distributary to the larger Bayou Grosse Tete – 150,000-acre drainage area. Otherwise, Bayou Maringouin is fed strictly by rainfall-runoff. This plan sets out to address water quality impairments to restore water quality and full use support.

Designated uses in Bayous Maringouin and Grosse Tete are primary contact recreation (PCR), secondary contact recreation (SCR), and fish and wildlife propagation (FWP). FWP is impaired in both waterbodies, and PCR is impaired in Bayou Maringouin. According to the 2020 LDEQ Integrated Report (IR), these subsegments are impaired due to low dissolved oxygen (DO), high nutrient concentrations, total dissolved solids (TDS), and fecal coliform bacteria. The IR lists runoff from agriculture, silviculture, and decentralized on-site treatment / disposal systems (OSDS) as suspected sources for impairments.

Land use data shows primary land uses are agricultural and developed. Agricultural activities in this region consist mainly of row crops – sugarcane and soybeans – and pasture. Cropland and timber harvesting are associated with nutrient and sediment runoff; pasture is associated with bacteria and sediment runoff, and both may impact DO. Developed areas that are served by OSDS are potential sources of nutrients and bacteria. The other significant land is forested wetlands, 39% land cover in this region by area. Hardwood harvesting is prevalent.

This watershed plan will identify and address sources and causes of pollutant loading, practices to address those loadings, and the restoration of use support. The plan will follow the Environmental Protection Agency (EPA) 9-element watershed plan format. It is intended to be a living document with adaptive management revisions reflecting new stakeholder input, additional partnerships and opportunities arising in coming years, monitoring results, changes in the watershed, and improved technical approaches as necessary. This plan is not meant to limit activity in the watershed but to serve as a framework for planning measures to address pollutant loadings and to inform strategies for watershed managers in the future.

Mission Statement

This watershed implementation plan will employ individual engagement and organizational commitment to address water quality issues identified by watershed assessment and stakeholders in Bayous Maringouin and Grosse Tete through promoting pollution reduction activities that will restore water quality.

Element A. Causes and Sources of Pollution

This section will describe the water quality impairments in Bayous Maringouin and Grosse Tete, summarize both baseline and ambient water quality monitoring data, describe the geography of the watersheds, and characterize the region in terms of known and potential sources of pollution.

Bacteria, sediment, nutrients, and low DO are primary causes of water quality-related use impairment identified by LDEQ sampling and assessment information and by stakeholders in the watershed. Bacteria can originate from human sources when sewage treatment systems fail, and from wildlife and livestock directly accessing streams and indirectly through runoff. Cropland and silviculture runoff can contribute nutrients, which affect DO, and contribute sediment.

Grosse Tete-Maringouin Water Quality Assessment

LDEQ uses ambient water quality data to determine use support for designated uses in Louisiana watersheds. Since 2002, the LDEQ assessment lists Bayou Maringouin and Bayou Grosse Tete as having designated use impairments along with suspected causes and sources. The 2020 assessment is shown in Table 1.

Table 1. 2020 IR Use Support Status and Suspected Sources and Causes

Subsegment Number	Description	Size (Miles)	Designated Uses			Impaired Use	Suspected Causes of Impairment	Suspected Sources of Impairment
			PCR	SCR	FWP			
LA120104	Bayou Grosse Tete-From headwaters to ICWW near Wilbert Canal	37.3	F	F	N	FWP	Dissolved Oxygen	Agriculture
LA120104	Bayou Grosse Tete-From headwaters to ICWW near Wilbert Canal	37.3	F	F	N	FWP	Dissolved Oxygen	Introduction Of Non-Native Organisms (Accidental Or Intentional)
LA120104	Bayou Grosse Tete-From headwaters to ICWW near Wilbert Canal	37.3	F	F	N	FWP	Nitrate/Nitrite (Nitrite + Nitrate As N)	Agriculture
LA120104	Bayou Grosse Tete-From headwaters to ICWW near Wilbert Canal	37.3	F	F	N	FWP	Nitrate/Nitrite (Nitrite + Nitrate As N)	Silviculture Harvesting
LA120104	Bayou Grosse Tete-From headwaters to ICWW near Wilbert Canal	37.3	F	F	N	FWP	Phosphorus, Total	Agriculture
LA120104	Bayou Grosse Tete-From headwaters to ICWW near Wilbert Canal	37.3	F	F	N	FWP	Phosphorus, Total	Introduction Of Non-Native Organisms (Accidental Or Intentional)

LA120104	Bayou Grosse Tete-From headwaters to ICWW near Wilbert Canal	37.3	F	F	N	FWP	Total Dissolved Solids (TDS)	Agriculture
LA120104	Bayou Grosse Tete-From headwaters to ICWW near Wilbert Canal	37.3	F	F	N	FWP	Total Dissolved Solids (TDS)	Silviculture Harvesting
LA120111	Bayou Maringouin-From headwaters to East Atchafalaya Basin Levee	20.5	N	F	N	FWP	Total Dissolved Solids (TDS)	Agriculture
LA120111	Bayou Maringouin-From headwaters to East Atchafalaya Basin Levee	20.5	N	F	N	FWP	Total Dissolved Solids (TDS)	Silviculture Harvesting
LA120111	Bayou Maringouin-From headwaters to East Atchafalaya Basin Levee	20.5	N	F	N	PCR	Fecal Coliform	Introduction Of Non-Native Organisms (Accidental Or Intentional)
LA120111	Bayou Maringouin-From headwaters to East Atchafalaya Basin Levee	20.5	N	F	N	PCR	Fecal Coliform	On-Site Treatment Systems (Septic Systems And Similar Decentralized Systems)

The IR identifies agriculture, silviculture, non-native organisms, and OSDS as suspected causes for water quality impairments. Land cover data shows that nearly 66% of the combined Grosse Tete – Maringouin watershed area is engaged in agricultural production with 21% as sugarcane, a known contributor to sediment and turbidity in the water column without proper management, and 16% as soybeans. Row crop runoff commonly contains nutrients and sediment. Grass / pasture areas comprise 11% area and can be a source of nutrient, sediment, and bacteria runoff. Developed land consists of small towns and rural residential areas, some with no community sewage treatment. The IR lists on-site treatment systems as a suspected source of bacteria in Bayou Maringouin.

The PCR criterion for fecal coliform is 400 colony forming units (cfu)/100 ml. No more than 25% samples may exceed that number for the PCR season, which is May-October. Ambient sampling data for Bayou Maringouin from 2019-20 show a 33% exceedance rate (see Table 2).

Table 2. Bayou Maringouin ambient fecal coliform data (PCR) 2019-20

Sampling Date	CFU/100ml
10/8/2019	125
5/5/2020	125
6/9/2020	1800
7/7/2020	560
8/4/2020	88
9/1/2020	125
Exceeds standard	

The criteria for DO to support FWP in this area applies to both Bayou Maringouin and Bayou Grosse Tete: 2.3 mg/L in the warm season (March - November), and 5 mg/L in the cool season (December - February), with no more than 10% samples falling below that value. Bayou Maringouin and Bayou Grosse Tete both violate this standard, with 42% and 50% excursion rates, respectively. Although the 2020 IR - based on 2015-16 ambient data - did not identify a FWP impairment due to low DO in Bayou Maringouin, it is expected that the 2022 IR – based on 2019-20 ambient data – will (See Table 3).

Table 3. Ambient DO data 2019-20

Date	Bayou Maringouin DO mg/L	Bayou Grosse Tete DO mg/L
10/8/2019	2.7	2.7
11/5/2019	3.15	2.03
12/3/2019	3.47	1.08
1/7/2020	3.53	4.12
2/4/2020	16.72	5.96
3/9/2020	5.8	3.3
4/7/2020	5.96	5.6
5/5/2020	8.14	7.22
6/9/2020	3.82	1.93
7/7/2020	0.96	3.04
8/4/2020	0.9	1.07
9/1/2020	1.05	0.68
Exceeds standard		

The TDS criterion required to support FWP: no more than 30% samples may exceed 200 mg/L. The 2019-20 ambient sampling data show Bayou Maringouin's excursion rate is 33% (Table 4). Bayou Grosse Tete's rate is 25%, suggesting the impairment status may change during the next assessment cycle (2022). The 2020 IR impairment is based on the 50% excursion rate during the 2015-16 ambient monitoring cycle.

Table 4 Ambient TDS data 2019-20

Date	Bayou Maringouin TDS mg/L	Bayou Grosse Tete TDS mg/L
10/8/2019	120	190
11/5/2019	140	160
12/3/2019	110	120
1/7/2020	120	170
2/4/2020	220	220
3/9/2020	330	190
4/7/2020	340	210
5/5/2020	150	130
6/9/2020	110	280
7/7/2020	100	150
8/4/2020	250	140
9/1/2020	92	120
Exceeds standard		

Although ambient data identifies overall use impairments listed in the IR, NPS-collected project data provides a finer spatial and temporal resolution that sometimes reveals problem areas within the watershed. This WIP will address overall use impairment identified in the IR as well as issues identified by baseline monitoring in subareas of the watershed, and these subareas will be prioritized for runoff mitigation activities for maintaining water quality.

Land Use

The drainage area is primarily agricultural – 51% land use is cropland and pastureland. The primary remaining land covers are forested wetland (42%), and developed (6%). Harvesting of forested wetland trees occurs on about 10,000 acres (NAIP imagery, DOQQs, and previous LDEQ studies). Table 5 lists the primary land use / land cover.

Table 5. Land Use / Land Cover Acreages

Land Use / Land Cover	Grosse Tete - Maringouin Acres	Grosse Tete - Maringouin Percent
Forested Wetland	78720	42%
Sugarcane	38430	21%
Soybeans	29780	16%
Grass/Pasture	20600	11%
Developed	10520	6%
Other Cropland	5010	3%
Other / Water	2760	1%

The dominant crop type in the watershed is sugarcane. Sugarcane is commonly produced in a five-year cycle. In the fifth year, the field is fallow and the ground is bare. Sugarcane production can contribute sediment runoff and nutrient loading.

Figure 1. Sediment-laden Bayou Grosse Tete upstream of weir.

Pastureland is also abundant in this region, with approximately 20,000 acres consisting of small pastures associated with residential areas. Pastureland areas can contribute sediment runoff, as well as nutrient and bacteria loading particularly where cattle can directly access streams. Developed areas where on-site sewage treatment systems are malfunctioning can cause nutrient and bacteria loading to streams.

Figure 2. Cattle, which use EABPL borrow canal as a source of water, can be a source of nutrient, sediment, and bacteria.

Figure 3. Typical sugarcane harvesting operation, this one along Bayou Barre in the northwestern region of the drainage area.

Figure 4. Unfenced cattle grazing along the bayou.

Spatial distribution of land use / land cover along can be seen in Figure 5.

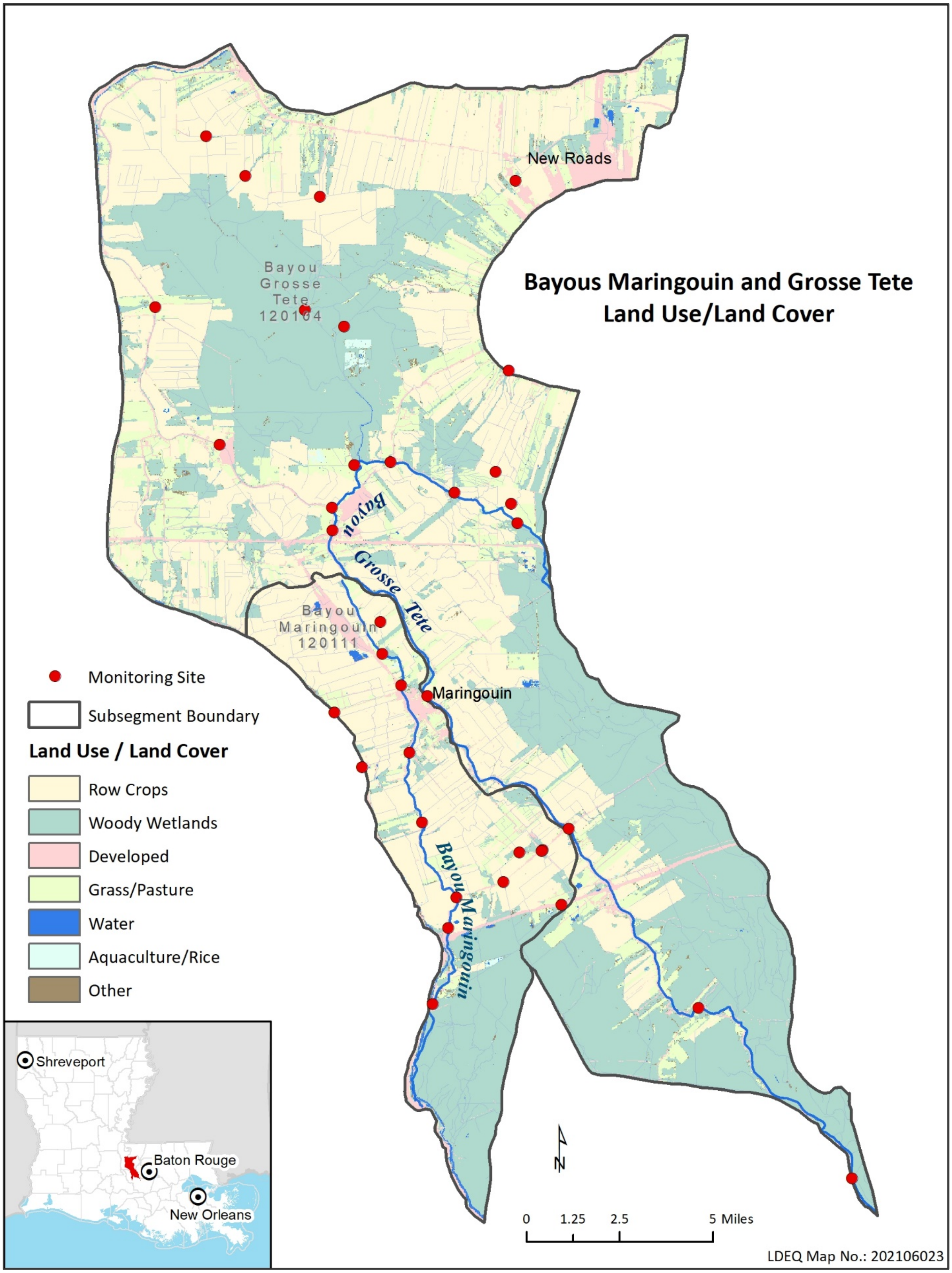


Figure 5. 2020 USDA CDL land use / land cover map

Soils

Soils in Terrebonne Basin in general have relatively high clay content and low permeability, typical of backswamp conditions. The wetland areas primarily contain hydrologic group A/D, and the agricultural and developed areas that contribute NPS runoff are primarily hydrologic groups C and D. Hydrologic soil type groupings are based on hydraulic conductivity data or on texture, compaction, clay and organic matter make up, and other factors (NRCS, 2007). These traits influence soil runoff potential from rainfall. Hydrologic group C soils have a slow infiltration rate, and a moderately high runoff potential; hydrologic group D soils have a high runoff potential, as water movement through the soil is very restricted (NRCS 2007). Thus, without conservation practices, high bacteria, nutrient, and sediment runoff is expected from pasture and cropland in this subsegment. Figure 6 shows hydrologic soil groups with cropland and pastureland overlain.

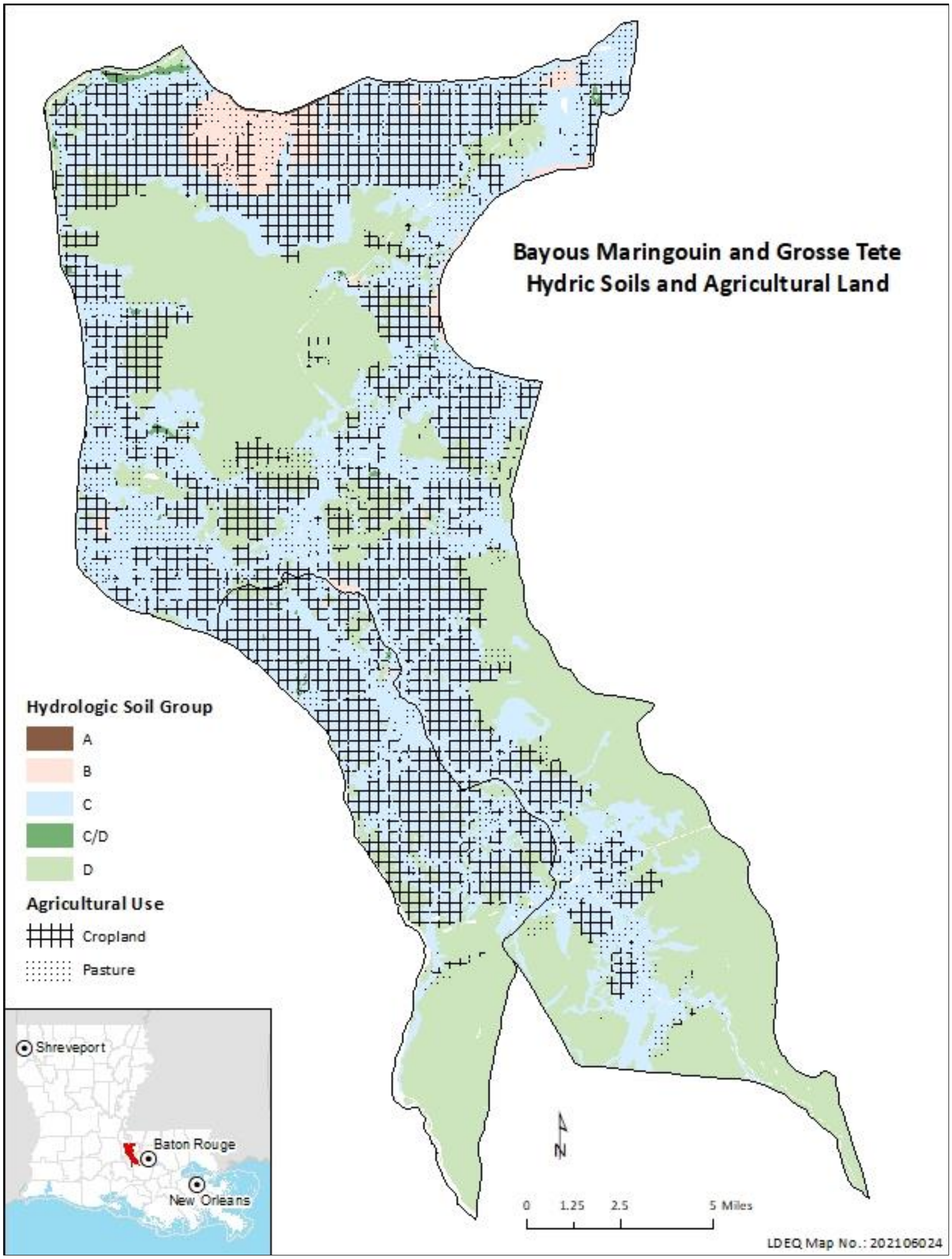
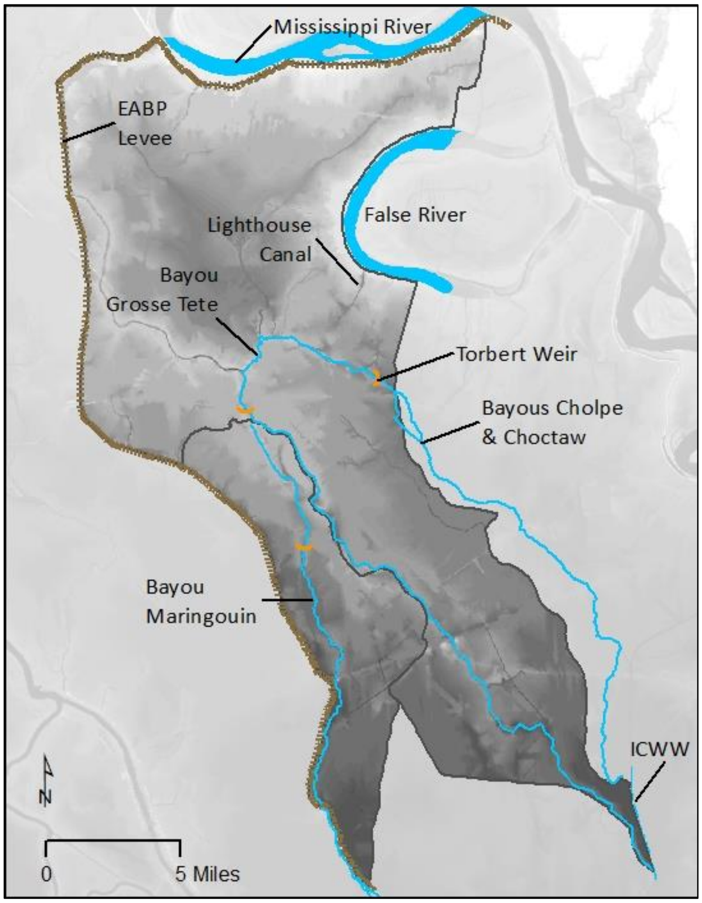
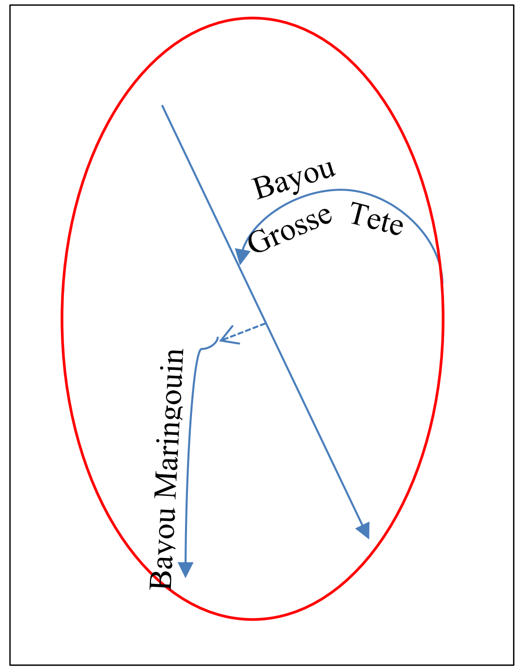


Figure 6. Hydrologic Soils and Crop Type

Elevation and Hydrology

The watersheds are bounded to the north by the Mississippi River, to the east by False River and Bayous Cholpe and Choctaw drainage areas, to the south by the Grosse Tete confluence with the Intracoastal Waterway (ICWW), and to the west by the East Atchafalaya Basin Protection Levee (EABPL). Figure 7 shows usual direction of flow, and Figure 8 shows bounding features.





^ **Figure 7. Drainage schematic**

< **Figure 8. Drainage area geographic boundaries**

Bayou Grosse watershed begins where the False River's overflow canal, Lighthouse Canal, flows into the bayou near Torbert Weir. When False River reaches a certain elevation, gates are opened to allow flow through the outfall canal to Bayou Grosse Tete. Some of this headwater flows east toward Bayou Cholpe and leaves the watershed, and some flows west into the mainstem of Bayou Grosse Tete. Flow from Lighthouse Canal as well as Bayou Sere, which also drains False River when high, and runoff via drainage canals enter Grosse Tete, which ultimately flows to the Intracoastal Waterway, the adjacent subsegment to the south.

Bayou Maringouin headwaters are located nearly adjacent to Bayou Grosse Tete near the town of Livonia. Bayou Maringouin, typical of many Louisiana streams, has a natural levee, and land slopes away from the bayou. However, manmade channels direct runoff from the surrounding lands into Bayou Maringouin. During flood conditions, some flow from Grosse Tete enters Bayou Maringouin. Bayou Maringouin flows south toward I-10. The Ramah Canal, just north of the town of Ramah and I-10, diverts a portion of flow from Bayou Maringouin west toward the EABPL borrow canal, while the remainder continues south past King Ditch to a downstream convergence with the EABPL borrow canal.

Water levels in upper Bayou Maringouin are typically higher due to a weir, and backflow from the EABPL canal to the west. The lower portion of Bayou Maringouin, sees very low flows due to the redirected flow to the west, the weir to the north, and dam-like driveways to the south.

The two waterways were once connected. However, due to hydromodification for road construction, they now are distinct during dry conditions and hydrologically connected only during flood conditions when Bayou Maringouin becomes a distributary for Bayou Grosse Tete.

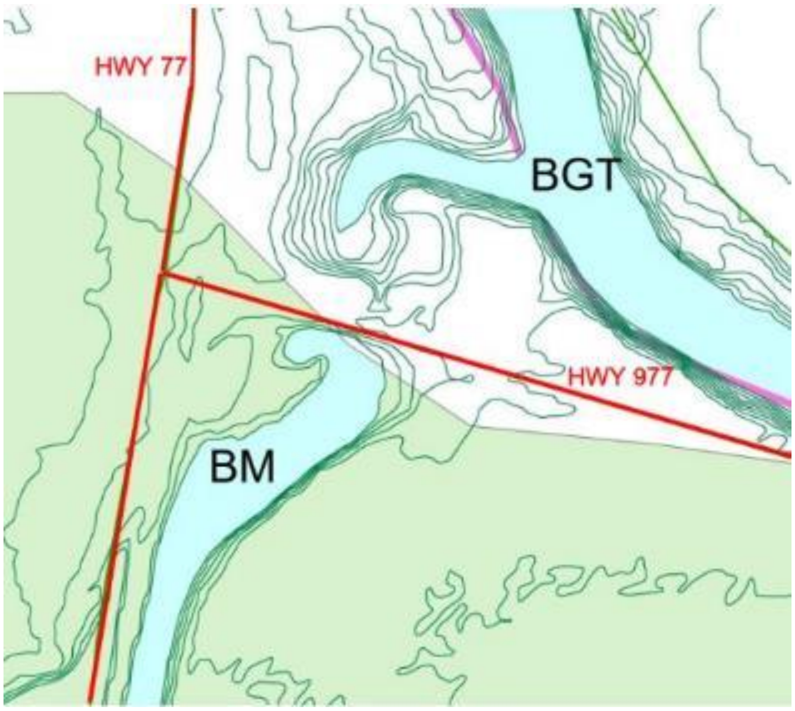


Figure 9. Location of former junction of Bayou Maringouin and Bayou Grosse Tete

Eight 12-digit National Hydrography Dataset Hydrologic Unit Codes (HUCs) comprise the drainage area (see Table 6).

Table 6. USGS HUC-12s

HUC-12 Number	HUC-12 Name
80703000102	Portage Canal No 1-Portage Canal No 2
80703000104	Bayou Fordoche-Bayou Grosse Tete
80703000303	Caney Bayou-Bayou Grosse Tete
80703000304	Bear Bayou-Catfish Canal
80703000301	Bayou Maringouin
80703000302	Bayou Grosse Tete-Grand Bayou
80703000103	Portage Canal No 2
80703000201	Bayou Grosse Tete-Bayou Cholpe

Elevation in these watersheds ranges from -1 to 63 feet (+/- 1 foot). Higher elevations follow manmade or natural levees along northern boundaries of the watershed as well as natural ridges in the interior. Lower elevations are primarily forested wetland areas. Agriculture and populated areas are located on the higher ground in the watershed and along natural levees, generally avoiding low-lying wetland areas. Manmade canals channel runoff from croplands and populated areas into the bayous. Figure 10 shows elevation and HUCs.

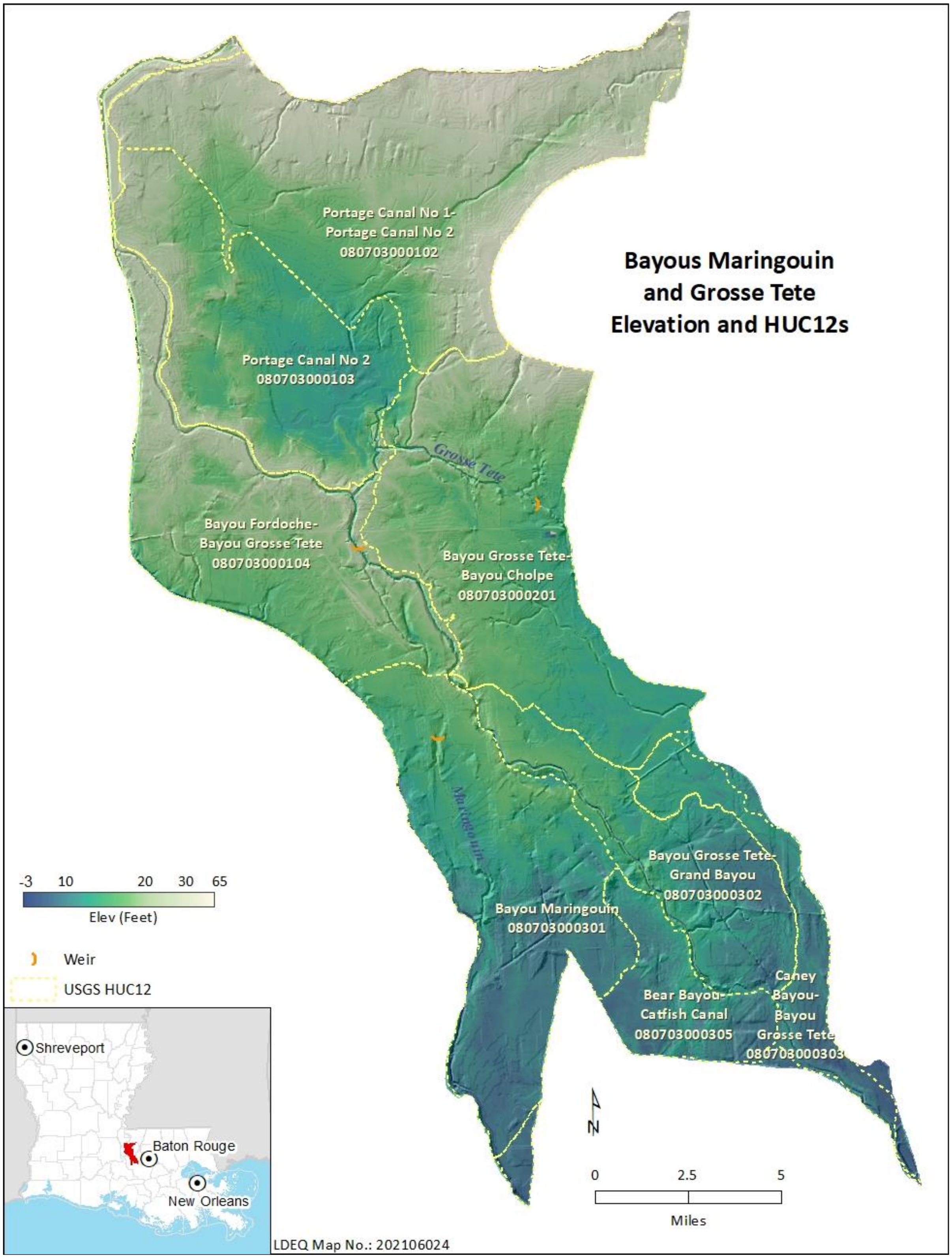


Figure 10. Elevation and HUCs

Urban Area Characteristics

Approximately 18,000 people inhabit the two subsegments according to the 2010 US Census and US Census American Community Survey ACS 2019 5-year estimates. Most of the population is concentrated in the city of New Roads to the north on False River. The three most populated towns are New Roads, about 5,000, and Livonia and Maringouin – each with about 1,300. Other incorporated towns in the drainage area are Morganza, Fordoche, Rosedale, and Grosse Tete. Rural farmland and forested wetland dominate the remainder of the landscape.

Figure 11 Fresh grave site on bank of Bayou Maringouin – a potential source of sediment.

Residences and agricultural fields have been established on the side of the bayou opposite from Ramah Road, therefore the owners have constructed driveways to cross over the bayou in order to get to their homes and fields. Several of these driveways are simply an earthen dam with no culvert underneath to allow the bayou to continue flowing (Figure 12).

Figure 12. One of many driveways acting as dams on Bayou Maringouin south of I-10, completely blocking the flow of water.

Figure 13. Resulting stagnant water trapped between two dam-like driveways on Bayou Maringouin.

Sewage treatment in the watershed is a combination of wastewater treatment plants (New Roads), individual home systems and small package plants. The IR lists both OSDS sites and similar decentralized systems as sources of fecal coliform bacteria in Bayou Maringouin.

There is one major treatment plant, New Roads Wastewater Treatment Plan, seven Class III, IV, and minor sanitary treatment sites, and the remainder are small Class I or individual package plants. Of approximately 50 permitted dischargers in the subsegments, 15 show at least one recent permit violation in their discharge monitoring reports (DMRs) for either total suspended solids, biologic oxygen demand, or (and primarily) fecal coliform bacteria. See Table 7.

Table 7. Permitted Discharger Types

Permit Type	Count of Permittees	Count of Permittees With Recent Exceedance Reported
Gen-LAG53-Sanitary Class I	16	3
Gen-LAG54-Sanitary Class II	8	3
Gen-LAG56-Sanitary Class III	1	1
Gen-LAG57-Sanitary Class IV	2	2
Gen-LAG75-Exterior Vehicle Wash	8	1
Gen-LAG47-Auto Repair/Dealers	2	0
Gen-LAG48-Light Commercial	1	1
Gen-LAR05-Multi-Sector	5	0
Indiv-Major-Sanitary	1	1
Indiv-Minor-Sanitary	4	4

About 1,300 individual home systems lie in the drainage area, about 1,100 in Grosse Tete and about 200 in the Bayou Maringouin subsegment. Maintenance of home treatment systems has an associated cost, as well as the requirement of homeowner diligence. Poverty as well as absentee ownership often play a role in maintenance issues. Individual home systems along with permitted dischargers reporting at least one recent permit exceedance are shown in Figure 14. When targeting bacteria reduction activities, prevalence of OSDS as well as pastureland can help determine potential sources of bacteria and what types of reduction activities would be most beneficial in different watershed subareas (see *Element B. Estimated Load Reductions*).

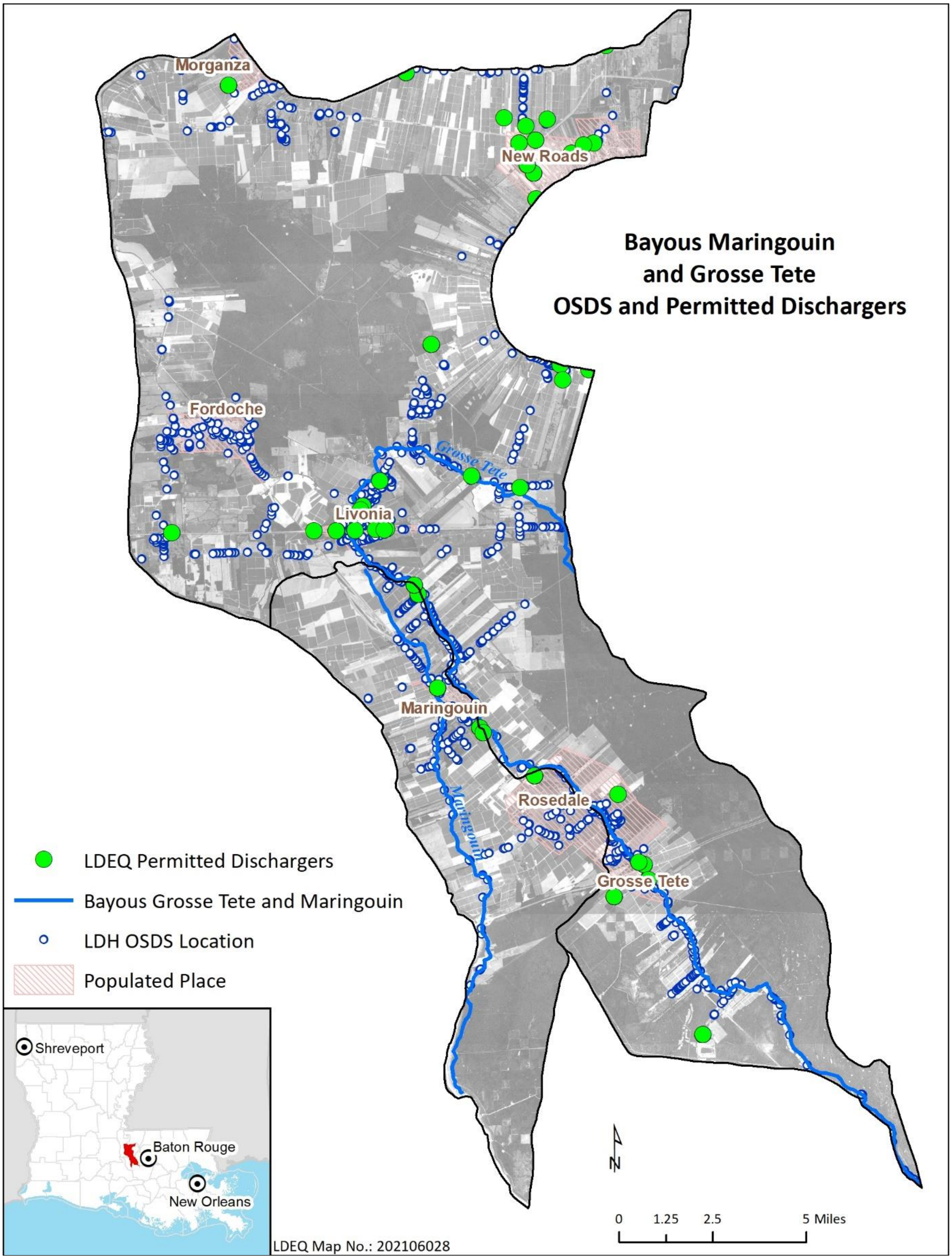


Figure 14. OSDS Locations and Selected Wastewater Dischargers

Baseline Monitoring Data

Baseline monitoring for water quality throughout the subsegment (sites depicted in Figure 5) was analyzed to help determine areas contributing the greatest loading. This analysis is useful for selecting areas to prioritize for education, outreach, and best management practice (BMP) implementation. Baseline monitoring results were examined to identify potential sources and priority areas for each parameter of concern. In cases of fecal coliform, data may show runoff loading spikes during intermittent events such as rainfall or continual loading such as from malfunctioning home treatment systems. Continually high values suggest both processes may be occurring. TDS can be caused by runoff, although after the first flush during a rain event, concentrations may decrease if sustained increased flow provides sufficient dilution. DO is subject to complex cycling and distribution of results may not point to a distinct loading process. The next section provides graphs and maps of the baseline data with a summary for each parameter.

Fecal Coliform Bacteria Data and Priority Areas:

In cases of fecal coliform, data may show runoff loading spikes during intermittent events such as rainfall or continual loading such as from malfunctioning home treatment systems. Continually high values suggest both processes may be occurring.

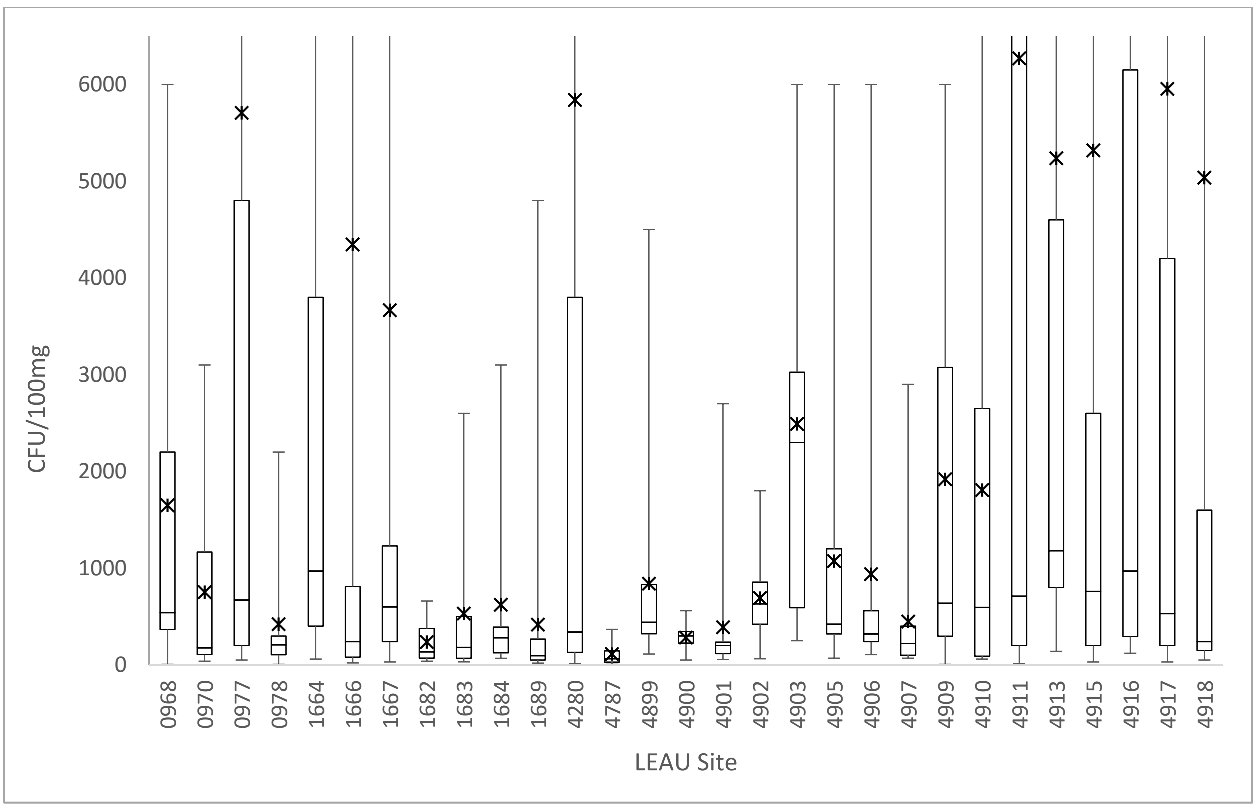


Figure 15. Boxplot of Fecal Coliform Bacteria Data

The box-and-whiskers plot above (Figure 15) shows the range, inter-quartile range, median, and mean of the May 2019 - July 2020 PCR baseline sampling data. The y-axis is truncated at 6,500 cfu/100ml for legibility.

Data from sites 4903, 4913, and 4916 show consistently high bacteria concentrations that indicate a continual significant input source as would be found with a malfunctioning facility or a cluster of malfunctioning home systems regularly discharging into the waterbody. The median suggests typical values. The high and closely grouped median and mean of Site 4903 are particularly noteworthy. Data from the remainder of the sites show either lower medians overall, and/or a divergence between the mean and median. The mean is influenced by the extreme high values, but the median is lower due to a large number of low values. This type of variability with numerous low values and occasional spikes suggests a rainfall/runoff input mechanism. These sources are likely to be pasture bacteria or smaller home system bacteria that may collect in nearby small ditches but are not flushed into the sampled waterbodies until a rainfall event.

Figure 16. Raw sewage with toilet paper discharge from home onto bank of waterbody

Bayou Maringouin suffers from significant bacteria impairment to its PCR use, and Bayou Grosse Tete project data shows high bacteria throughout the subsegment. Sites exceeding the PCR criteria based on NPS project baseline data are shown below in Table 8.

Table 8. Baseline Fecal Coliform Data for 2018 PCR Season

Site	% FC > PCR Standard	Mean CFU/100ml (PCR months)	Median CFUs/100ml (PCR Months)
Bayou Grosse Tete Sites			
0968	65%	1,651	540
0970	35%	753	175
0978	14%	421	208
1682	30%	237	135
1683	41%	530	181
1684	24%	621	280
1685	18%	537	113
1686	19%	304	116
1689	6%	416	94
4787	0%	111	63
4899	63%	840	440
4900	13%	282	300
4901	20%	388	200
4902	75%	690	630
4903	86%	2,491	2,300
4905	59%	1,074	420
4906	35%	938	320
4907	24%	448	220
4909	70%	1,918	637
4934	11%	812	150

Site	% FC > PCR Standard	Mean CFU/100ml (PCR months)	Median CFUs/100ml (PCR Months)
Bayou Maringouin Sites			
0977	65%	5,705	670
1664	71%	7,195	970
1666	41%	4,346	240
1667	65%	3,666	600
4280	41%	5,841	340
4910	50%	1,808	595
4911	65%	6,269	710
4913	82%	5,238	1,180
4914	81%	8,686	1,050
4915	53%	5,319	760
4916	69%	8,131	970
4917	53%	5,955	530
4918	41%	5,036	240
4924	85%	4,643	1,200

In addition to baseline monitoring data, several additional datasets augmented the identification of subareas and their ranking for BMP implementation. A combination of USGS National Hydrography Dataset (NHD) HUC boundaries, EPA catchment data, NHD flowlines, and LDEQ NPS baseline monitoring site locations were used to generate sub-drainage areas (subareas) for bacteria BMP implementation. These subareas were prioritized based on high fecal coliform concentrations seen in baseline monitoring relative to the water quality standard for primary contact recreation. Baseline monitoring results were examined to identify potential sources and priority areas for each parameter of concern. Due to accessibility, certain subareas were unmonitored. These areas were assessed for prioritization by analyzing geospatial data including grass/pasture areas abutting streams, OSDS locations, land use, aerial photography, and elevation data. Data used to prioritize subareas for bacteria reduction activities include:

- Cropland Data Layer (Grass/Pasture; CDL, USDA) – % pasture area within 250 feet of stream
- OSDS location (LDH) – density (count per catchment area within 250 feet of stream)
- NHD (USGS) – stream/flowlines
- Distance to stream (USGS NHD) –250-foot buffer
- National Agricultural Imagery Program imagery (USDA)

For OSDS locations, density (count per square mile) was examined using spatial analysis. OSDS density in proximity to streams was compared to drainage subareas showing higher bacteria concentrations, and subareas were ranked for OSDS activities and mapped. The same process was used for pastureland. Using raster landuse data (USDA 2016 CDL), pastureland locations were compared to areas of high bacteria concentrations, and areas were ranked for implementation. Subareas with more pasture acreage or higher OSDS density in close proximity to streams were given consideration. Some subjective judgment was used on ranking based on watershed knowledge and local hydrology. Figure 17 shows sub-watershed areas ranked for OSDS-related bacteria-reduction activities. Figure 18 shows priority areas for pasture BMPs.

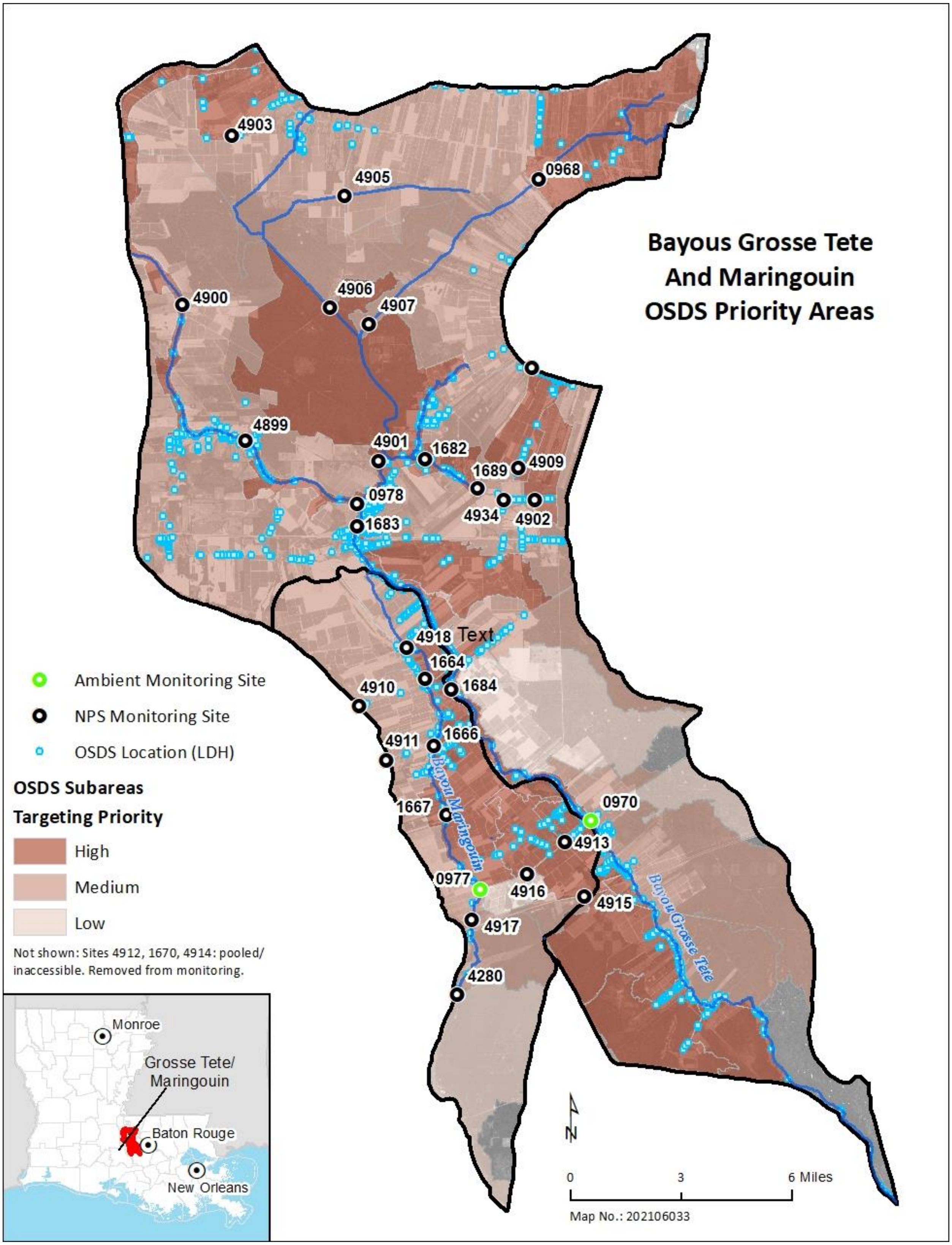


Figure 17. Priority Areas for OSDS-Related Bacteria Reduction Activities

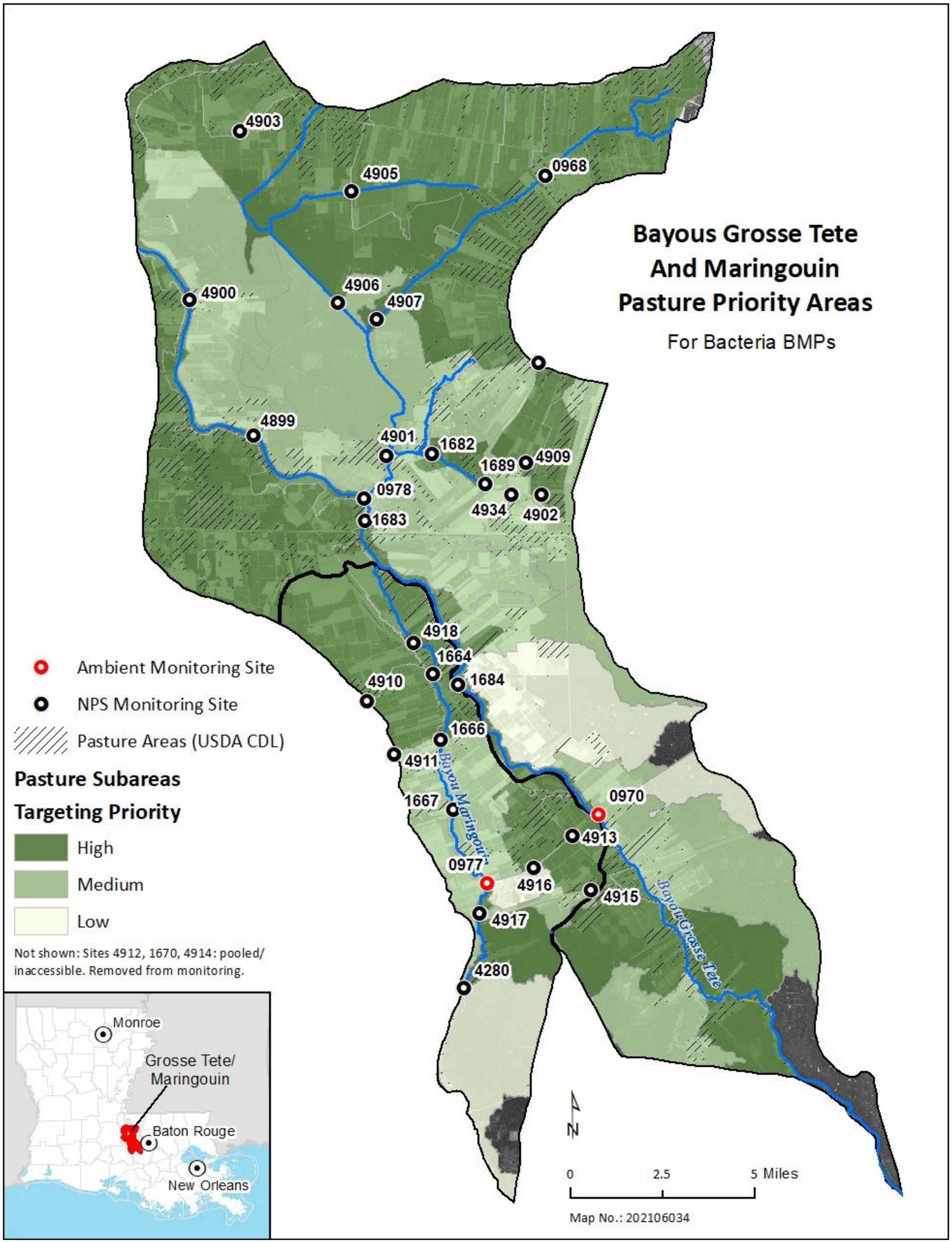


Figure 18. Priority Areas for Pasture BMPs to Reduce Bacteria

TDS:

Water quality standards for Bayous Maringouin and Grosse Tete allow for no more than 30% samples to exceed 200 mg/L during the ambient water quality monitoring cycle. Ambient monitoring for the 2020 IR (2015-16 water year) showed a 50% excursion rate for Grosse Tete and a 58% excursion rate for Maringouin.

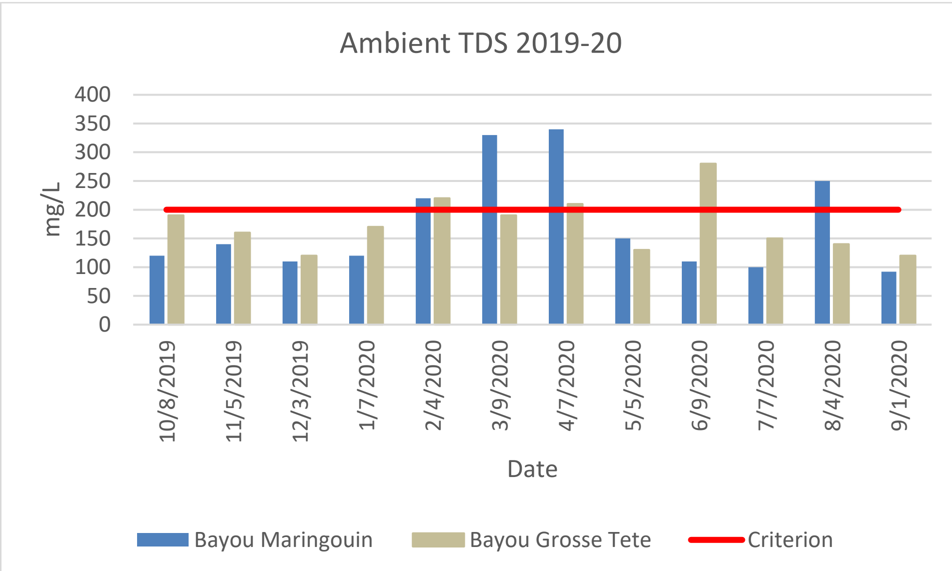


Figure 19. Ambient TDS Data

Baseline project data from sites sampled throughout the subsegment show TDS values vary greatly (from 0% at some sites to 100% at others). Sites 0968, 4903, 4909, and 4915 show both the highest excursion rates and the highest median TDS concentrations. Table 9 shows the exceedance rate and average for each project site. Sub-drainage areas were ranked for TDS reduction BMPs using baseline sampling results, and mapped (see Figure 21).

Table 9. Summary of NPS Project Data: TDS Dec 2018 – Mar 2021

Site	% > 200 mg/L	Mean TDS mg/L	Median TDS mg/L
Bayou Grosse Tete Sites			
0968	91%	288	286
0970	27%	199	167
0978	50%	233	211
1682	27%	212	198
1683	36%	182	173
1684	36%	187	180
1689	18%	181	177
4787	9%	178	177
4899	73%	273	283
4900	0%	160	153
4901	50%	205	193
4902	50%	199	194
4903	100%	377	351
4905	64%	279	248
4906	64%	269	205
4907	82%	280	283
4909	83%	278	296
Bayou Maringouin Sites			
0977	41%	193	190
1664	49%	200	200
1666	47%	201	198
1667	63%	216	211
4280	37%	185	178
4910	49%	202	193
4911	52%	204	202
4913	61%	236	218
4915	87%	301	301
4916	42%	207	175
4917	33%	184	174

Figure 20. Tributary to Bayou Grosse Tete showing high sediment content

The Total Maximum Daily Loads (TMDLs) for Bayous Maringouin and Grosse Tete call for NPS-based TDS reductions of 40% and 32% respectively.

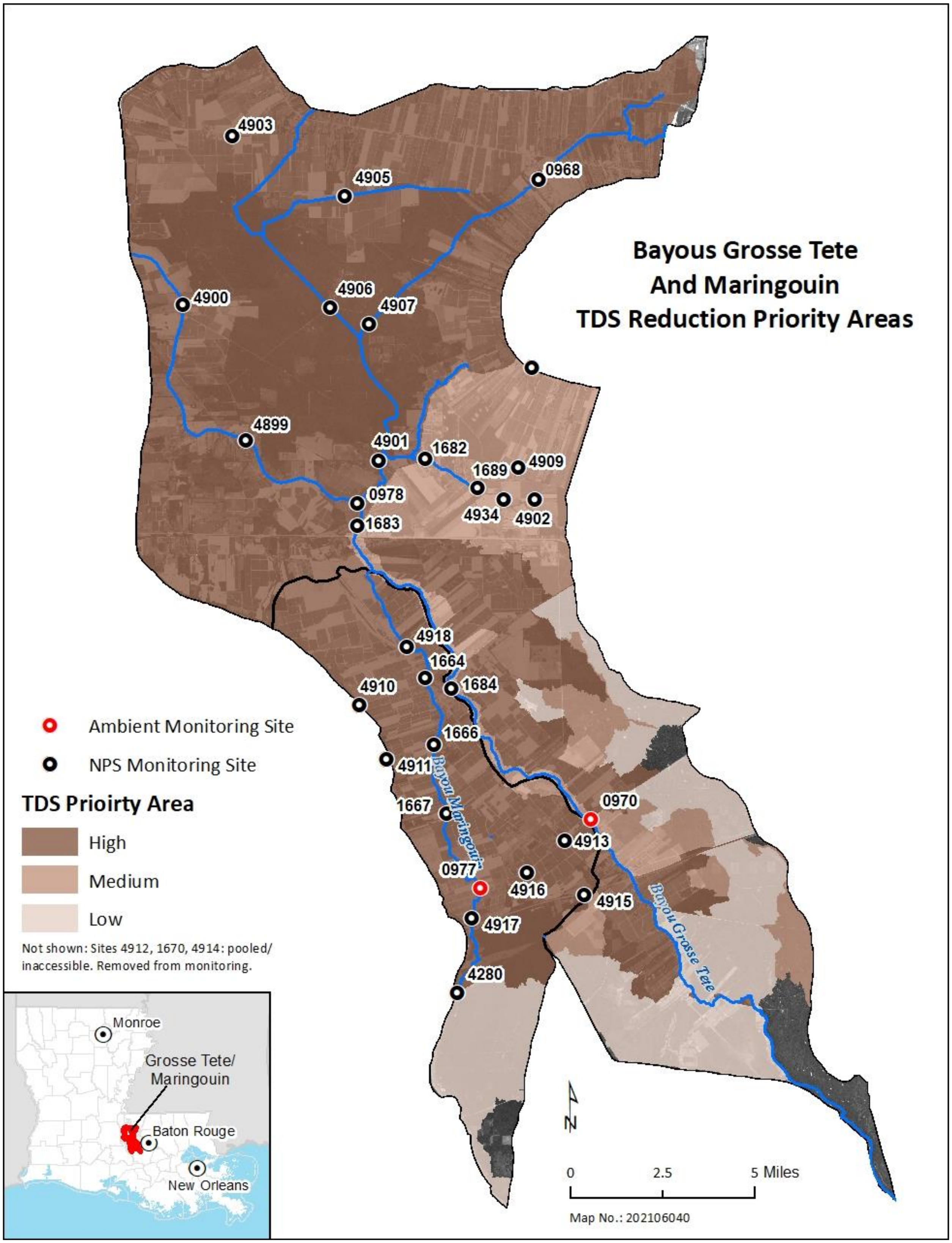


Figure 21. TDS Reduction Priority Areas

Dissolved Oxygen:

DO is subject to complex cycling and distribution of results may not point to a distinct loading process. Nutrient and sediment inputs are the presumed drivers of FWP use impairment.

DO frequently falls below the minimum criteria in Bayous Maringouin and Grosse Tete. The criteria for DO to support FWP in this area applies to both waterbodies: 2.3 mg/L in the warm season (March - November), and 5 mg/L in the cool season (December - February). If more than 10% samples fall below that value, the waterbody is deemed to have impaired support of fish and wildlife propagation. Because of the high excursion rates, LDEQ has determined Bayou Grosse Tete does not support its FWP designated use, and Bayou Maringouin is expected to receive the same designation in the 2022 IR. Both watersheds exceeded the threshold during the 2019-20 ambient monitoring cycle (see Figure 22). The excursion rates are 42% for Bayou Maringouin, and 50% for Bayou Grosse Tete.

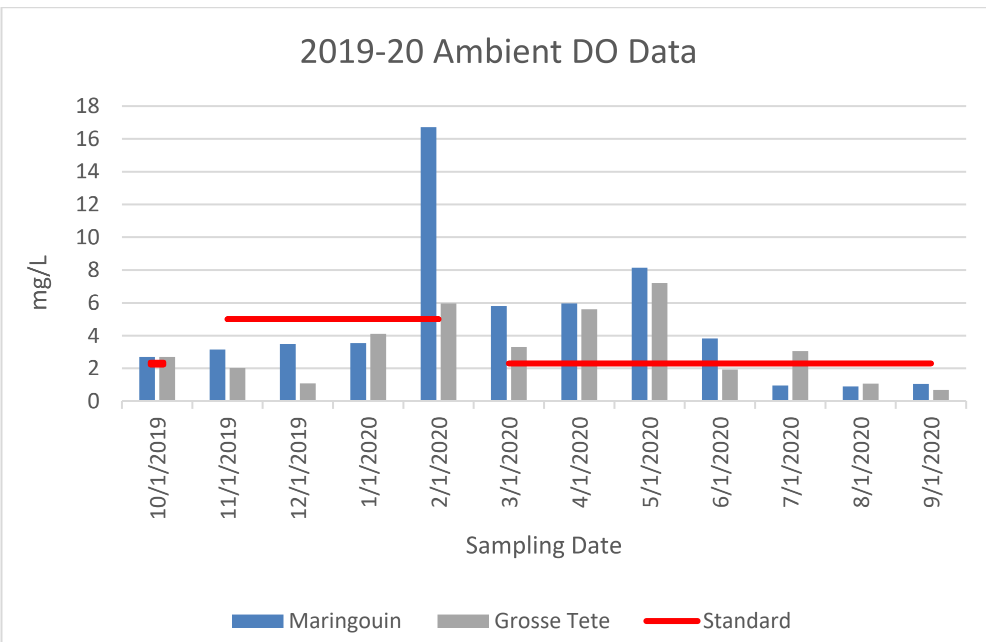


Figure 22. Ambient DO Data

Figure 23. Low flow conditions in Bayou Grosse Tete can exacerbate low DO and fish kills.

The 2020 IR attributes low DO in Bayou Grosse Tete to agricultural suspected sources. The revised TMDL for Bayou Maringouin calls for a reduction in NPS runoff of 88% in winter and 98% in summer (LDEQ, 2005/2010). The revised TMDL for Bayou Grosse Tete calls for an NPS runoff reduction of 60% in winter months and 65% in summer months (LDEQ, 2007/2010). NPS sources include nutrients from cropland, nutrients from human and animal waste (grazing animals, the absence of community sewage treatment, wildlife), and potentially undisturbed organic bedload.

Baseline data shows that minimal geographic variation exists in DO levels throughout the watersheds. All areas show low average DO, and no location exhibits values that would meet the water quality standard. See Table 10 for summarized NPS project data. See *Element B. Estimated Load Reductions* for more information on oxygen-demanding loads.

Table 10. Summary of NPS Project Data: DO Dec 2018-May 2021

Site	% DO < Standard	Median DO
Bayou Grosse Tete Sites		
0968	13%	5.0
0970	33%	3.2
0978	24%	4.5
1678	10%	6.2
1682	15%	5.2
1683	37%	3.3
1684	30%	3.9
1685	58%	2.4
1686	22%	3.7
1689	26%	5.0
4787	15%	6.3
4899	74%	2.2
4900	84%	1.1
4901	25%	3.6
4902	11%	5.0
4903	30%	6.4
4905	52%	4.8
4906	59%	4.4
4907	61%	4.4
4909	52%	4.9
4934	56%	4.4

Site	% DO < Standard	Median DO
Bayou Maringouin Sites		
0977	50%	3.0
1664	57%	2.7
1666	18%	4.7
1667	29%	4.1
1670	27%	5.2
4280	31%	3.3
4910	62%	3.7
4911	66%	3.9
4913	74%	2.3
4914	83%	1.9
4915	90%	1.9
4916	63%	4.4
4917	77%	3.2
4918	83%	2.7
4924	82%	2.9

Using baseline sampling data for DO, priority areas were identified to implement BMPs for nutrient reduction. Areas with lower DO and higher nutrient concentrations were given higher priority. However, because the entire watershed areas show low DO values, implementation is appropriate throughout.

Agricultural BMP Priority Areas   Agricultural subareas were prioritized for implementation of agricultural BMPs to address sediments, nutrients, and DO using the approach described below:

Sub-watersheds were identified using the Texas A&M University Soil and Water Assessment Tool (SWAT) model. These were prioritized for crop-related BMPs according to highest runoff potential as derived from row crop areas with higher slope, soil erodibility, and proximity to stream using these spatial datasets:

- Cropland Data Layer (row crop classes; CDL 2018; USDA)
- National Hydrography Dataset (NHD 2021; USGS)

- Distance to stream (derived > or <= 250 meters from NHD flowlines; USGS)
- Soil erodibility (k-factor; SSURGO; USDA)
- LiDAR elevation (USGS 2007)
- National Agricultural Imagery Program imagery (NAIP 2018; USDA)
- Digital orthophoto quarter quads (DOQQs 2010-2021; USGS)

Some areas were manually adjusted based on additional information including monitoring data. Final pasture subareas were prioritized in the same way, but using the CDL grass/pasture land use class rather than row crop areas. Silviculture areas were identified using USDA NAIP and USGS DOQQ aerial photography from 2010 to the present, which helped identify wetland forest harvesting locations. Baseline monitoring data helped ascertain priority areas were assigned correctly and in some cases led to reassignment of priority. Priority areas were ranked as “high,” “medium,” “low” based on the above information (see Figure 24, Figure 25, and Figure 26).

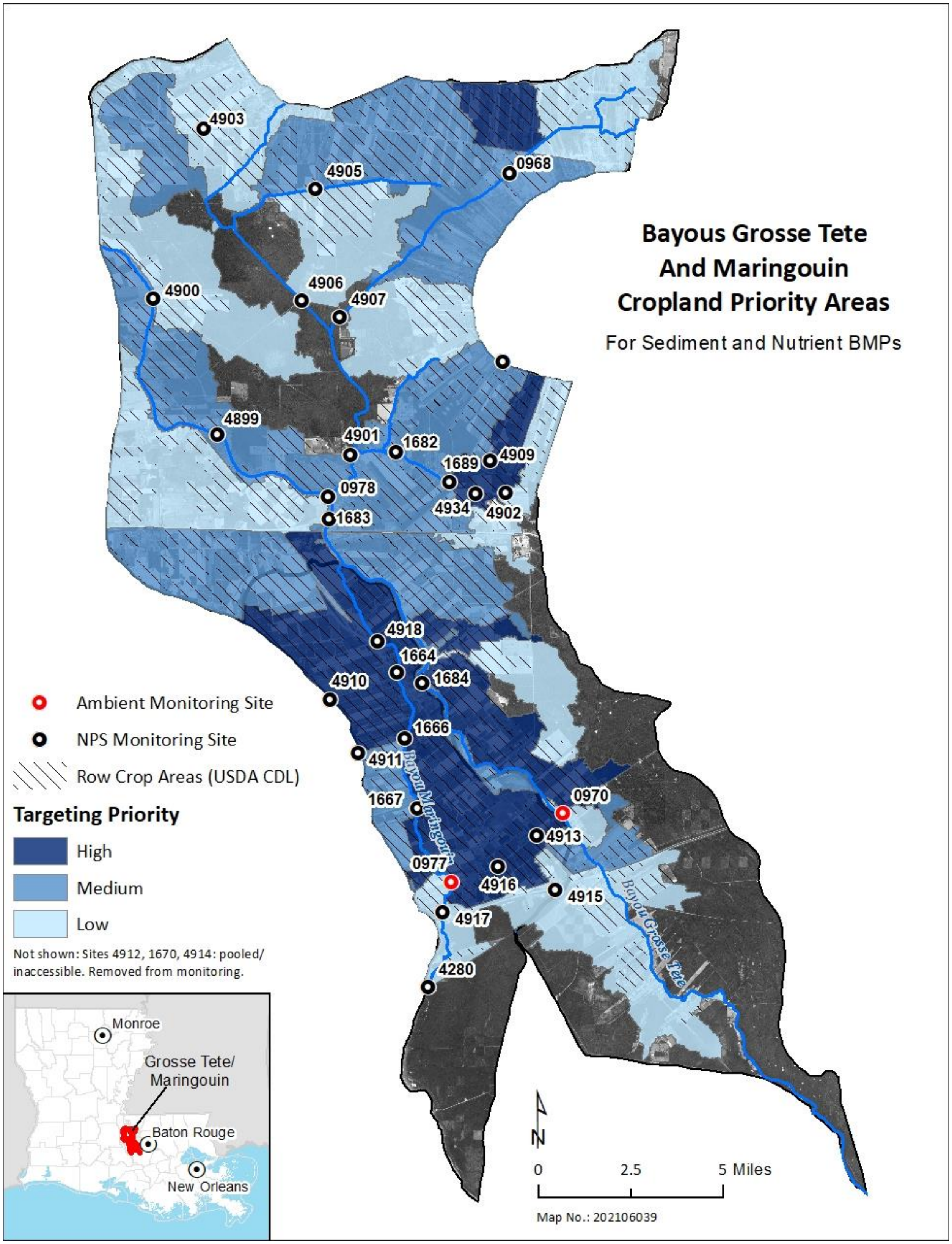


Figure 24. Cropland Priority Areas (DO, Nutrients, and Sediment)

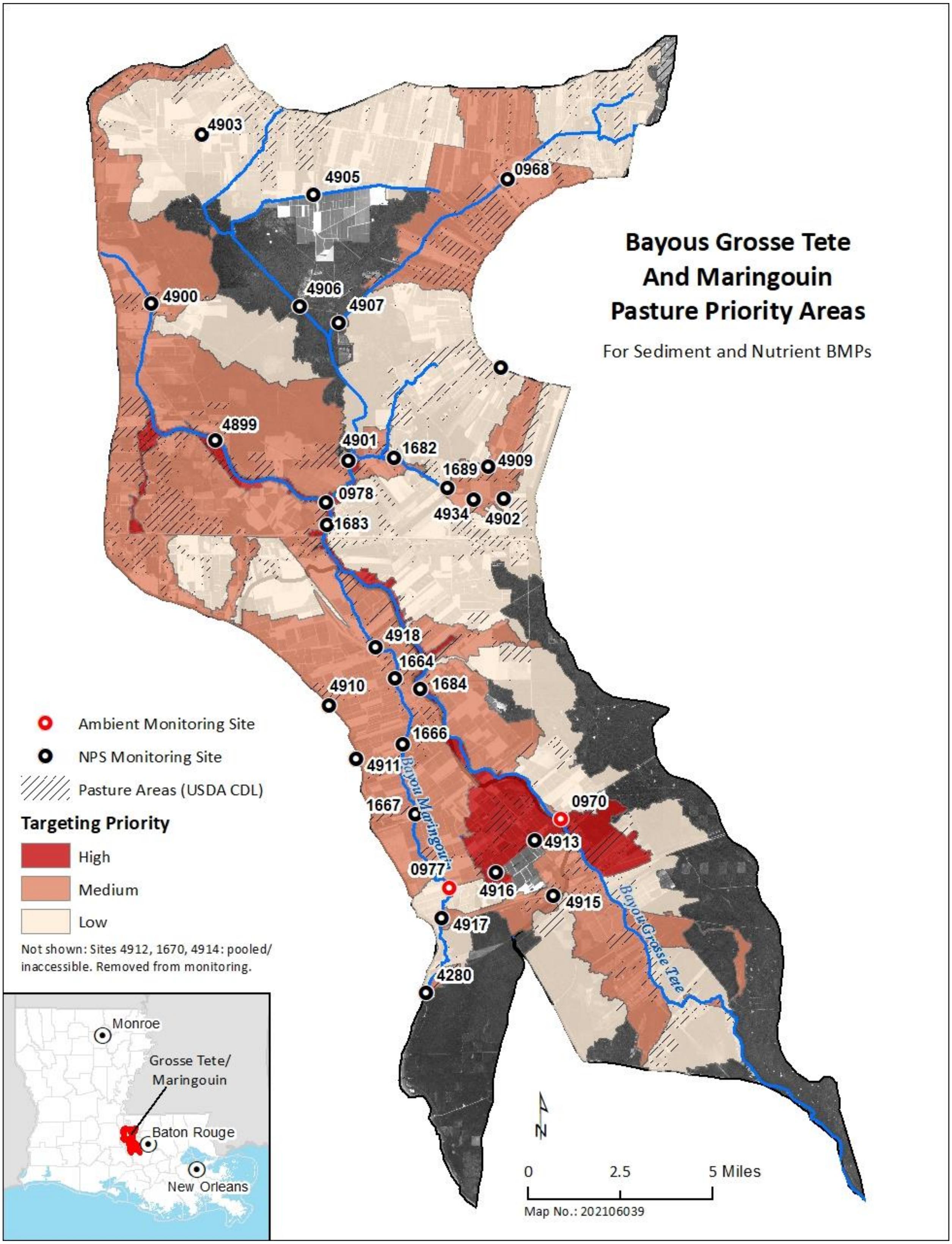


Figure 25. Pasture Priority Areas (DO, Nutrients, and Sediment)

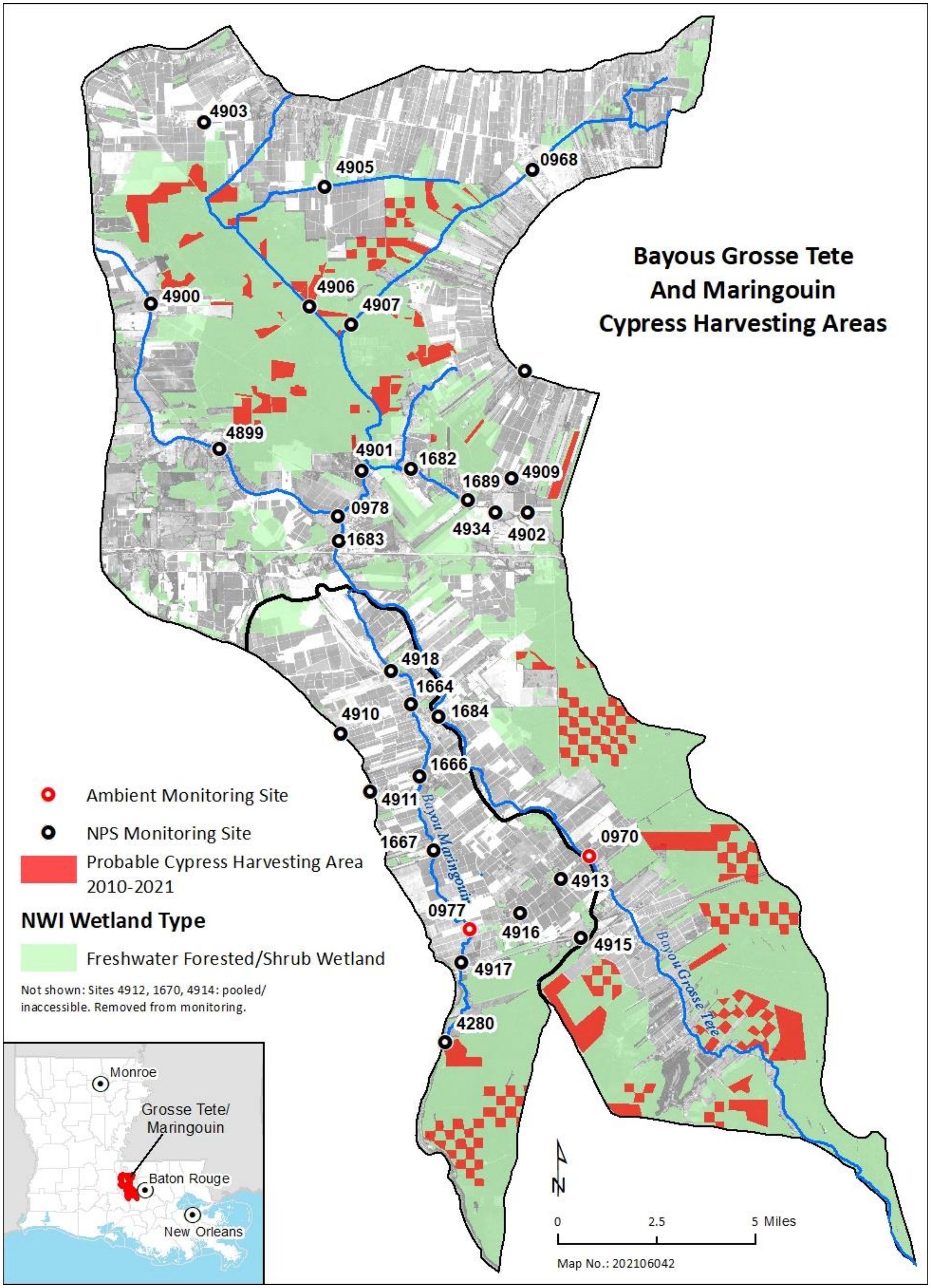


Figure 26. Silviculture Areas

Point Sources
The TMDLs called for 0% reduction in point source discharges. This figure is based on the assumption of adherence to permit allowances. However, as stated previously, DMRs show a couple of point sources have exceeded their allowed bacteria, biological oxygen demand (BOD) and other discharges. As LDEQ enforcement brings these facilities into compliance, BOD and bacteria levels should improve.

Summary of Sources
The following summarizes the NPS sources for the causes identified in this section.
Bacteria

- OSDS
- Cattle
- Wildlife (especially feral hogs)
- Point Sources

Nutrients

- OSDS
- Cattle
- Row Crops
- Point Sources
- Benthic Load

Sediment

- Row Crops
- Cattle
- Benthic Load

Element B. Estimated Load Reductions

Baseline monitoring for water quality throughout the subsegment (sites depicted in Figure 5) was analyzed to help determine areas contributing the greatest loading. TMDLs establish load limitations for pollutant loading and targets for reduction of those pollutants. This section will attempt to quantify pollutant loading to Bayous Maringouin and Grosse Tete and load reductions necessary to restore water quality. Load calculations and load reductions for each parameter of concern are delineated below. Load reduction requirements were determined by TMDL analysis and reduction estimates were derived from baseline monitoring data.

The TMDL is the total amount of pollutant that can be assimilated by the receiving waterbody while still achieving water quality standards. In TMDL development, allowable loadings from all pollutant sources that cumulatively amount to no more than the TMDL must be established and thereby provide the basis to establish water quality-based controls. A TMDL for a given pollutant and waterbody is composed of the sum of individual wasteload allocations (WLAs) for point sources, and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL includes an implicit or explicit margin of safety (MOS) to account for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody (USEPA, 2007).

Estimates of load reductions required to meet restoration goals are based on loading seen during baseline monitoring. Discussion on yearly load reductions tied to specific BMP acreages and counts can be found in *Element G. Interim Milestones*. Those reductions are based on STEP-L modeling, and source-specific bacteria loading from literature and watershed characterization.

TDS Reduction Estimates

Baseline monitoring data was used to determine TDS load reductions necessary to meet the water quality standards for TDS. Concentration and flow data were used to calculate loading, and criteria concentration and flow data were used to calculate criteria loading.

Recent ambient and baseline monitoring data show that Bayou Grosse Tete meets the TDS water quality standard. However, due to the on-again/off-again TDS impairment of FWP in this watershed, and to add a margin of safety, this WIP will target TDS for reductions in Bayou Grosse Tete. In-stream loads seen in baseline monitoring support this effort.

Baseline load calculations using current project concentration and flow data, compared to criteria concentration and flow data, indicate a daily average exceedance of 23 tons per day in Bayou Grosse Tete, and 2 tons per day in Bayou Maringouin. These will be the TDS reduction targets for this WIP (Table 11).

Table 11. Watershed Plan Target TDS Load Reductions

Watershed	TDS Load Reduction Targets (tons/day)
Grosse Tete	23
Maringouin	2

Nutrient (for DO) Reduction Estimates

Louisiana currently does not have numeric nutrient criteria, but rather narrative criteria which has existed since the late 1970's. LDEQ is developing numeric translators of the narrative criteria for assessment of possible nutrient impairment by waterbody types and based on ecoregions. This is in accordance with USEPA guidance for development of numeric translators.https://www.deq.louisiana.gov/page/nutrient-management-strategy .

For nutrient reductions in this watershed plan, the TMDLs guide load reduction targets. Reductions in bedload contributions are expected to follow a significant lag period after inputs are reduced. See the Bayou Maringouin TMDL excerpt below (LDEQ, 2005/2010):

> LDEQ has collected and measured the CBOD and NBOD oxygen demand loading components for a number of years. These loads have been found in all streams including the non-impacted reference streams. It is LDEQ's opinion that much of this loading is attributable to run-off loads which are flushed into the stream during run-off events, and subsequently settle to the bottom in our slow moving streams. These benthic loads decay and breakdown during the year, becoming easily resuspended into the water column during the low flow/high temperature season. This season has historically been identified as the critical dissolved oxygen season. LDEQ simulates part of the non-point source oxygen demand loading as resuspended benthic load and SOD. The calibrated non-point loads, UCBOD, UNBOD and SOD, are summed to produce the total calibrated benthic load. The total calibrated benthic load is then reduced by the total background benthic load … to determine the total manmade benthic loading. The manmade portion is then reduced incrementally on a percentage basis to determine the necessary percentage reduction of manmade loading required to meet the water body's dissolved oxygen criteria. These reductions are applied uniformly to all reaches sharing similar hydrology and land uses.

The results of projection modeling for Bayou Maringouin show that the water quality standard for dissolved oxygen of 5.0 mg/L from December through February and 2.3 mg/L from March through November will require a maximum load allocation of 62 lbs/day in the winter and 18 lbs/day in the summer. See Table 12 (LDEQ, 2005/2010).

Table 12 Bayou Maringouin Reduction Targets for Oxygen-Demanding Substances

Season	TMDL Load Allocation (LA) Manmade NPS (lbs/day)	Baseline Data Average Nutrient Load (lbs/day)*	Reduction Target (lbs/day)	Reduction Target (lbs/year)
Mar - Nov	18	190	172	63,022
Dec - Feb	62	80	18	6,570

* Sum of TKN, NO3-NO2 and Total P average daily loads.

The TMDL load allocation for Bayou Grosse Tete was not used for this load reduction estimate due to issues with the load allocations for this watershed. Instead, percent reduction from the TMDL was applied to baseline loads to determine reduction targets. TMDL modeling in Bayou Grosse Tete shows that the water quality standard for dissolved oxygen of 5.0 mg/L from December through February and 2.3 mg/L from March through November will require a reduction of 60% NPS loading in winter and 65% in summer to meet criteria (Table 13).

Table 13. Bayou Grosse Tete Reduction Targets for Oxygen-Demanding Substances

Season	TMDL % Reduction Required	Baseline Data Average Nutrient Load (lbs/day)*	Reduction Target (lbs/day)	Reduction Target (lbs/year)
Mar-Nov	65%	4,051	2,633	961,200
Dec - Feb	60%	2,801	1,681	613,414

* Sum of TKN, NO3-NO2 and Total P average daily loads.

STEP-L modeling was used to determine BMPs necessary to achieve reduction targets. While reduction targets are seasonal, this plan will use the higher target, as a single year-round conservative estimate for load reductions in each subsegment using STEP-L. Monitoring data will be used to track progress toward meeting this target (See Element H. Progress Determination Criteria). Baseline loads CDL land use data, SSURGO soils data, and local weather information were used as inputs into STEP-L to estimate acreages of BMPs needed to meet the prescribed reductions. Note that STEP-L provides different load estimates than the TMDL and baseline data. Reasons for this could include: assumptions of the STEP-L model may not apply to this watershed; the model does not take into account geographic variability in location of contributing sources; baseline data may not be representative of long-term dynamics; the TMDLs are not specific to nutrients. To be conservative, this plan will use STEP-L to determine acreages needed to reduce prescribed loads.

Using load calculated with STEP-L, and the reduction targets derived from TMDLs, the following load reductions and BMP acreages are required to reach the DO standard.

Bayou Maringouin target reduction of 63,022 lbs/year nutrients:

- Repair 100% malfunctioning OSDS home systems
- Multiple BMP implementation on approximately 11,000 acres cropland

- Multiple BMP implementation on approximately 1,500 acres pasture

Bayou Grosse Tete target reduction of 961,200 lbs/year:

- Repair 100% malfunctioning OSDS home systems
- Multiple BMP implementation on 64,000 acres cropland
- Multiple BMP implementation on 12,000 acres pasture

Due to the intermittent connection between the two waterbodies, reducing the load in Bayou Grosse Tete is expected also to reduce its sediment and nutrient input into Bayou Maringouin. Sources of uncertainty are: 1.) STEP-L is a yearly model, but the TMDL specified seasonal load reduction targets; 2.) Baseline monitoring includes NO^3-NO^2, TKN, and TP. Other sources of oxygen demand may be present but are not monitored; and 3.) STEP-L doesn't account for geographic variability within the watershed or complex interactions in the water body over time. No point source wastewater dischargers were identified in the Bayou Maringouin TMDL. However, several point sources exist in the watershed and their DMRs show permit exceedances. Bringing permittees into compliance will be critical to meeting water quality standards.

Figure 27 and Figure 28 show projected cumulative reductions of yearly nutrient loads.

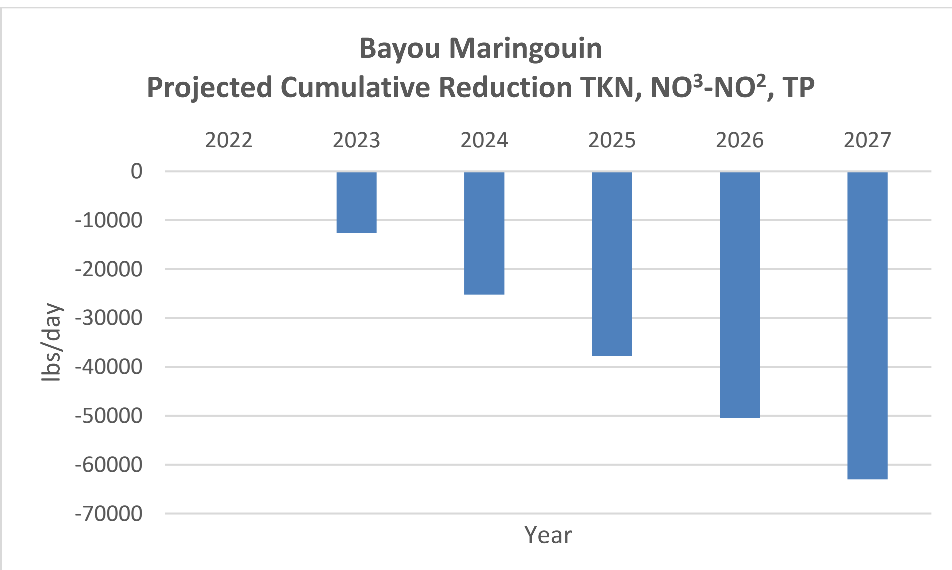


Figure 27. Bayou Maringouin Projected Cumulative Nutrient Reduction 2022-2027

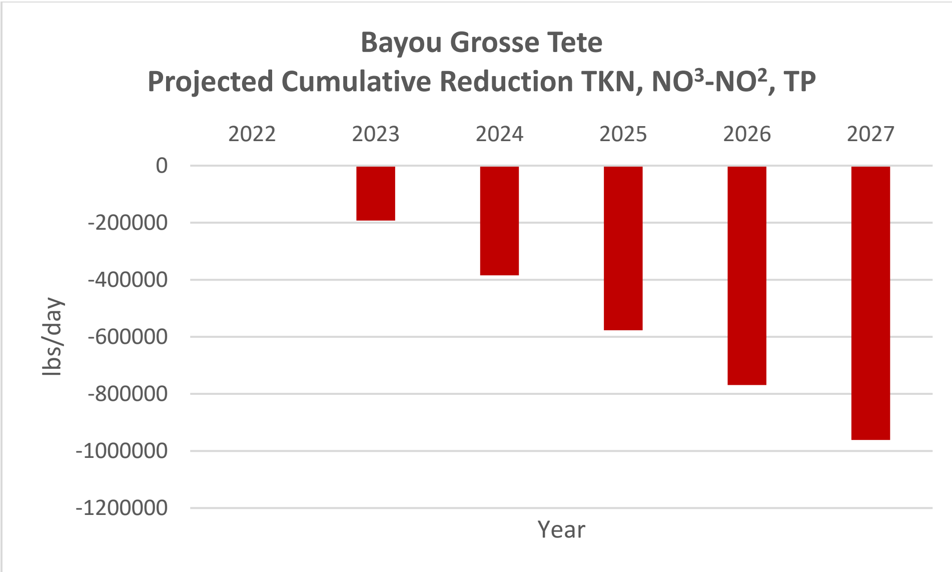


Figure 28. Bayou Grosse Tete Projected Cumulative Nutrient Reductions 2022-2027

Bacteria Load Reduction Estimates

The two seasons for bacteria loading and criteria are the warm season (PCR: May 1 – Oct 31) and year-round (SCR). Baseline data was evaluated for both PCR and SCR seasons. The PCR standard states that no more than 25% samples taken May-Oct may exceed 400 cfu/100ml. The SCR standard states that no more than 25% samples taken Jan-Dec may exceed 2,000 cfu/100ml. Comparing baseline bacteria data to criteria, neither subsegment supports its PCR designated use and Bayou Maringouin does not support its SCR use, although the current (2020) IR identifies PCR use impairment in Bayou Maringouin. In order to meet the water quality standard, reduced bacteria loading to both subsegments is required. Based on baseline load calculations and water quality criteria, load reductions were estimated (Table 14).

Table 14. Bayous Grosse Tete and Maringouin Estimated Bacteria Load Reductions to Meet PCR and SCR Use Support

Watershed and Season	Reduction Required (CFUs/day)
Grosse Tete / May - Oct	1.45E+12
Grosse Tete / Jan - Dec	0.00E+00
Maringouin / May - Oct	1.37E+13
Maringouin / Jan - Dec	5.21E+12

To use a conservative approach, the largest seasonal reduction will be used as the overall target for purposes of this plan.

In Bayou Maringouin there are 2,240 acres of pasture within 1,000 feet of a stream. In Bayou Grosse Tete there are 13,890 acres. Assuming cows on these pastures have access to and spend time in streams, there is a significant bacteria loading potential. There are 200 home systems in

Bayou Maringouin and 1,100 in Bayou Grosse Tete according to 2016 Louisiana Department of Health (LDH) data. At an estimated failure rate of 50% (based on inspections in other watersheds and field), human waste from 650 home systems also contributes a significant bacteria load. In addition, the feral hog population and wetland waterfowl and wildlife both contribute bacteria to the system. Potential sources and estimated loads are seen in Table 15 and Table 16 below.

Table 15. Bayou Grosse Tete Bacteria Load Estimates for Specific Sources

Source	Population / Units	CFU/Day	Potential Land Load: CFU/Day	% Potential Loading to Stream[2]	Potential Stream Load CFU/Day	Relative Contribution
Cattle on Land	4,937	3.30E+10	1.63E+14	3%	4.89E+12	29%
Cattle in Stream[1]	324	3.30E+10	1.07E+13	100%	1.07E+13	64%
Feral Pigs/Other Wildlife	Data Gap	1.10E+10	Data Gap	Data Gap	Data Gap	Data Gap
Malfunctioning OSDS	550	2.00E+09	1.10E+12	100%	1.10E+12	7%

1 Based on proportion of Bayou Grosse Tete pasture within 1000ft of stream, density .1 cow/acre, 8.3% time in stream.
2 Assumed rate based on California Regional Water Quality Control Board (2012)
Sources: USAA National Agricultural Statistical Service, US Census, field observations, LDH, USDA CDL

Using the relative contributions rates in the table above, the 1.45E+12 cfu/day load reduction target in Bayou Grosse Tete can be reached by addressing:

- 5% runoff load from cattle using pasture BMPs,
- 15% load from cattle directly accessing streams using pasture BMPs,
- 15% repair of malfunctioning OSDS using inspections, education, and other methods. Note that nutrient reduction targets call for addressing 100% malfunctioning OSDSs.

Table 16. Bayou Maringouin Bacteria Load Estimates for Specific Sources

Source	Population / Units	CFU/Day	Potential Land Load: CFU/Day	% Potential Loading to Stream[2]	Potential Stream Load CFU/Day	Relative Contribution
Cattle on Land	489	3.30E+10	1.61E+13	3%	4.84E+11	26%
Cattle in Stream[1]	35	3.30E+10	1.17E+12	100%	1.17E+12	63%
Feral Pigs/Other Wildlife	Data Gap	1.10E+10	Data Gap	Data Gap	Data Gap	Data Gap
Malfunctioning OSDS	100	2.00E+09	2.00E+11	100%	2.00E+11	11%

1 Based on proportion of Bayou Maringouin pasture within 1000ft of stream, density .1 cow/acre, 8.3% time in stream.
2 Assumed rate based on California Regional Water Quality Control Board (2012)
Sources: USAA National Agricultural Statistical Service, US Census, field observations, LDH, USDA CDL

Using the relative contribution rates in the table above, the 1.37E+13 cfu/day load reduction target in Bayou Maringouin may be reached by addressing:

- 100% runoff load from cattle using pasture BMPs,
- 100% load from cattle directly accessing streams using pasture BMPs,
- 100% repair of malfunctioning OSDS using inspections, education, and other methods,
- Any permit non-compliance by point source dischargers,
- Potential flow increases to Bayou Maringouin via reconnection to Bayou Grosse Tete,
- Feral hog/wildlife bacteria inputs using stream buffers, hog removal, and other measures.

Data gaps exist as wildlife bacteria inputs are unknown and noncompliance of point source dischargers does occur. Assumptions such as hours per day cows spend in streams may be incorrect. Estimates of malfunctioning OSDS may be inaccurate.

Figure 29 shows projected cumulative total load reductions required to meet target reductions for PCR and SCR use support.

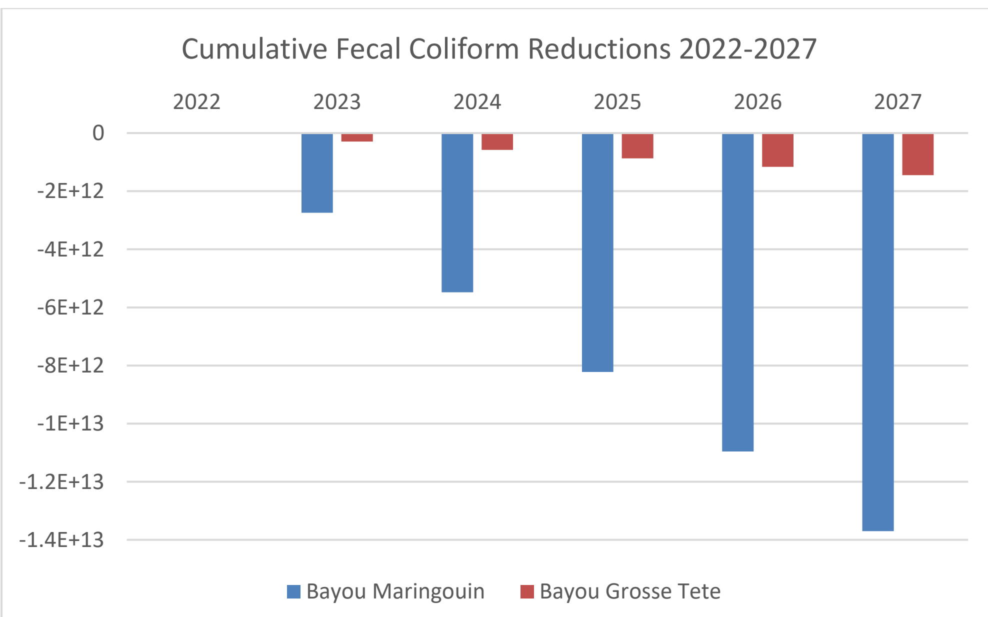


Figure 29. Projected Cumulative Bacteria Load Reductions 2022-2027

Element C. Best Management Practices

This section will describe pollution reduction measures identified by key stakeholders, including LDEQ, that are selected to reduce runoff causing water quality impairments. It is understood that baseline monitoring data collected throughout the watershed will help guide geographic targeting of those measures.

For purposes of categorizing strategies to reduce NPS in Bayous Maringouin and Grosse Tete, LDEQ identified the following implementation program goals and strategies. Responsible parties for implementation are shown below.

Strategy I – Reduce nutrient and sediment loading through implementation of conservation practices to stem cropland and pastureland runoff (Louisiana Department of Agriculture and Forestry, or LDAF).

Strategy II – Reduce bacteria loading through pastureland BMPs, inspections of home sewage treatment systems (LDEQ), pumpouts (LDAF), and education-outreach activities (LDEQ Source Water Protection Program (SWPP) and Louisiana Rural Water Association (LRWA)).

Strategy III – Work with LDEQ's Office of Environmental Compliance to bring all permitted dischargers into compliance with permit limits. Implement additional activities as needed.

Strategy I – Measures to Reduce Nutrients and Sediment

The Clean Water Act Section 319(h) Program allows LDAF, in partnership with other state and federal agencies, to provide technical and financial assistance to farmers for implementation of conservation systems. Under the 319 Program, LDAF will implement BMPs to reduce bacteria loading from cattle that access waterbodies directly, and to reduce runoff from pastureland. LDAF also will implement practices to reduce runoff from cropland. Nutrient loading from cropland will be addressed by conservation practices. These are listed in Table 17 with their respective water quality physical impacts, which form the rationale for implementing these BMPs. Associated costs also are listed in Table 17.

To optimize water quality benefits of plan development and implementation, management practices which most effectively control bacteria and nutrient losses will be promoted and given top priority. Based on site-specific characteristics and water quality effects (USDA NRCS, 2022), plans may include practices in the table below, but all plans should include one or more of the *preferred* management practices, indicated with an * in Table 17. Some practices stand alone and some are components of a larger system.

Table 17. BMPs, Surface Water Quality Effects, and Costs

NRCS Code	Practice	Selected Impacts	BMP Cost	Total Water Quality Score
314	Brush Management	Invasive/Noxious woody plant species control, reduce erosion, improve water quality, enhance hydrology	$46.37/ac	1
328*	Conservation Crop Rotation	Reduce erosion, reduce water quality degradation due to excess nutrients, maintain or improve soil health	$9.65/ac	14
329*	Residue and Tillage Management, No-Till /Strip Till /Direct Seed	Reduce erosion	$14.47/ac	12
340*	Cover Crop	Reduce erosion, capture and recycle nutrients	$49.74/ac	14
342*	Critical Area Planting	Stabilize streambanks and reduce erosion	$198.17/ac	7
345*	Residue and Tillage Management, Reduced Till	Reduce erosion, improve soil health	$10.76/ac	11
382	Fence	Reduce erosion and nutrient runoff, support other BMPs	$1.18/ft	2
386*	Field Border	Reduce erosion, compaction, and excess nutrients	$61.83/ac	12
393*	Filter Strip	Reduce transport of nutrients, sediment, pathogens, metals, and other pollutants	$183.61/ac	32
410	Grade Stabilization Structure	Reduce runoff and erosion	$1.24DiaInFt	2
430	Irrigation Pipeline	Reduce energy use and erosion as part of a complete irrigation system	$14.87/ft	8
449*	Irrigation Water Management	Minimize irrigation-induced soil erosion	$9.35/ac	22
462*	Precision Land Forming	Erosion control	$179.45/ac	10
464*	Irrigation Land Leveling	Reduce excess irrigation-induced runoff	$237.73/ac	17
472*	Access Control	Reduce erosion and nutrient loading	$447.62/each	13
512	Pasture and Hay Planting	Reduce erosion	$262.86/ac	5
516	(Livestock) Pipeline	Reduce energy use, reduce sedimentation in surface water, provide clean drinking water for livestock	$3.69/ft	3

(continued)				
Code	Practice	Selected Impacts	BMP Cost	WQ Score
528*	Prescribed Grazing	Reduce erosion and maintain soil condition	$31.71/ac	13
533	Pumping Plant	Reduce energy use, increase efficiency of water use, improve air quality	$807.48/bhp	0
561	Heavy Use Area Protection	Reduce erosion	$3.64/sq ft	5
576	Livestock Shelter Structure	Provide protection for livestock from heat/cold. Reduce erosion and nutrient loading into surface waters	$3.4/sq ft	0
578	Stream Crossing	Reduce sediment and nutrient loading, reduce streambank and streambed erosion	$12.29/sq ft	-2
587	Structure for Water Control	Reduce erosion and sedimentation in surface water	$2.83/DiaInFt	2
590*	Nutrient Management	Reduce nutrient runoff, maintain/improve soil condition	$6.72/ac	18
595*	Pest Management Conservation System	Prevent and mitigate pest suppression impacts	$16.77/ac	10
614*	Watering Facility	Meet water requirements, improve animal distribution	$2.49/gal	5
642	Water Well	Meet water needs, enable proper use of range, pasture, and wildlife areas	$26.65/ft	-1
644	Wetland Wildlife Habitat Management	Maintain or develop habitat for wetland flora/fauna and wildlife, provide water cover to reduce erosion/runoff	$9.30/ac	4
646	Shallow Water Development and Management	Maintain or develop habitat for wetland flora/fauna and wildlife, provide water cover to reduce erosion/runoff	$18.02/ac	7

Sources: LDAF personal communication, Louisiana Conservation Practice Physical Effects (2015). Most recent posted here:
https://efotg.sc.egov.usda.gov/#/state/LA/documents/section=5&folder=5959
https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/econ/tools/?cid=nrcs143_009740.
Scores reflect water quality impacts to ground and surface water (NRCS), including pathogens, nutrients, sediment, metals, temperature, etc.
*Plans should include one or more of the management practices indicated with an *

Forestry BMPs are routinely practiced in Louisiana. Every three years, LDAF conducts a random site survey of silviculture areas throughout the state, examining whether best practices were used. The survey includes multiple components in 10 categories, each with a set of BMPs. According to the most recent survey of 204 tracts statewide (LDAF, 2018), 95-97% of areas surveyed employed best practices to reduce NPS runoff. BMPs used can be found in the state forestry BMP manual. The 2018 survey and results can be seen in Appendix A, and the manual and the latest survey can be found here: https://www.ldaf.state.la.us/forestry/management/best-management-practices-and-statistics/. The BMP manual is being updated (release expected 2022) by the Louisiana Forestry Association (LFA). The extensive list of BMPs addresses all aspects of logging operations (LFA, LDEQ, and LDAF, 2000). Some selected BMPs specific to wetland harvest operations include:

- Harvest during dry periods to minimize rutting,
- Use low pressure/high floatation tires or wide tracks to minimize damage to residual stand,
- Keep skidder loads light when rutting is evident,
- Fell trees away from watercourses,
- Remove obstructions in channels resulting from harvesting, and
- Limit operations on sensitive sites and in streamside management zones during periods of wet weather.

The Sustainable Forestry Initiative Master Logger Program administered by the LFA entails BMP training. Most major mills in the state accept wood only from Master Logger cardholders. The Louisiana Forestry Association investigates complaints against loggers, and will pull a Master Logger card where it finds valid and serious issues.

Strategy II – Measures to Reduce Bacteria

Human sources:

A number of residents in these subsegments are served by individual home systems that rely on aeration units and settling compartments to treat wastewater. Soils in the area are generally poorly drained and do not support a passive septic system. These mechanical units require maintenance and upkeep, and often fall into disrepair.

Louisiana’s statewide NPS strategy includes OSDS inspections, where local governments work with inspectors to evaluate the function of home systems, educate homeowners on repair and maintenance, and re-inspect malfunctioning systems to make sure they are functioning properly. Using Clean Water Act 319 funding, LDEQ works with partners to inspect home systems in the watershed(s). This activity is also part of LDEQ’s statewide OSDS inspection program as outlined in the NPS Management Plan. Priority area maps will help guide inspection activity. As funding becomes available, LDAF will initiate home system pump-outs. Pump-out costs vary, but $450/each is an average cost (using data from other Louisiana watersheds). Through informational packets and potentially with face-to-face interactions, LDAF or district staff will relay to homeowners the importance of system maintenance. Pump-outs and related education activities can be conducted to further address bacteria and loading from home systems. Additionally, the repair/replacement of malfunctioning or nonfunctioning OSDS may occur with assistance from LDAF and the CWSRF should funding become available.

Starting in 2020, LDEQ's Source Water Protection Program initiated a water quality education campaign, meeting with and presenting to residents and stakeholders on NPS threats to wells and surface water intakes and ways to mitigate those impacts. Part of this effort includes educating homeowners on the importance of proper home system maintenance. In addition, SWPP staff work with LRWA to conduct formal classes that provide classroom instruction followed by a field demonstration of malfunctioning and functioning home systems. Participants who complete the training are eligible to receive a home system maintenance certificate from LDH.

Animal sources:
Pastureland BMPs (see Table 17) help prevent cattle from directly accessing streams and may also help prevent bacteria runoff from pasture into waterways. Fencing, access control, prescribed grazing, and watering facilities are examples of practices that are known to reduce bacteria in streams.

Finally, the Louisiana Department of Wildlife and Fisheries (LDWF) indicates feral hogs contribute to erosion and fecal bacteria loading into waterways (Kaller, et al., 2016). LDWF estimates that 700,000 feral hogs reside in the state of Louisiana. The agency provides information and resources for residents to address feral hog populations. This includes information on hog populations and impacts, trapping technologies, current research, and information and permitting for helicopter/shooting control. LDWF and LDAF can provide information on animal transport regulations passed by the Louisiana Legislature in 2018. (https://www.wlf.louisiana.gov/page/feral-hogs and https://www.ldaf.state.la.us/faqs/what-are-louisianas-feral-swine-rules-and-regulations/). LDWF's private lands biologists can provide technical assistance for managing feral hogs on private lands.

Because the resulting load impact of these activities can be unpredictable, sampling results will determine efficacy toward reducing bacteria load.

Strategy III – Regulatory and Other Additional Measures
LDEQ NPS will collaborate with LDEQ's Office of Environmental Compliance to bring all permitted dischargers into compliance with permit limits. LDEQ NPS and LDEQ Enforcement have established a process by which to share information on enforcement issues identified in a watershed and activities to address those issues. Additionally, the Source Water Protection

Program works to prevent contamination of drinking water sources through measures such as increasing public awareness, identifying potential sources of contamination, visiting those businesses to promote risk mitigation, and promoting drinking water protection ordinance adoption. The Town of Maringouin has adopted a drinking water protection ordinance.

Element D. Technical and Financial Assistance

This section will describe assistance roles provided by those partners that have committed to working in the watershed, and funding information (where available) for that assistance.

Technical assistance is provided to agricultural producers by LDAF. Additional assistance is provided to the Soil and Water Conservation District (SWCD) by LDAF, working with the Natural Resources Conservation Service (NRCS). LDEQ will initiate the home system inspections effort and LDEQ Source Water Protection Program will provide some water quality protection education and outreach. LDAF will lead home system pump-outs. Table 18 shows funding for specific components of water quality restoration projected out through 2027. If work continues beyond that, the plan will be revised and funding sources identified at that time (as per the schedule in Element F).

Previously through a pilot approach in Bayou du Portage, LDAF structured assistance contracts on a five-year basis rather than a three-year basis. This entailed a smaller contract amount over an extended period of time to assure a longer period of implementation. Other states have reported that with certain management practices, a longer period will enable producers to see a longer-term result in yield. While up to 80% of producers may drop some management practices after a three-year commitment, that many will continue following a five-year commitment (USEPA, 2018). The same 5-year contract structure will be employed in Bayous Maringouin and Grosse Tete.

Table 18. Financial Assistance for Water Quality Restoration

Activity / Year / Cost	2021	2022	2023	2024	2025	2026	2027	Total
LDEQ 319(h) WQ planning, sampling, analysis/source water protection education/ outreach	$243,056	$193,142	$130,548	$130,548	$130,548	$130,548	$130,548	$1,088,938
LDAF 319 Agricultural technical assistance	TBD	$498,625	$498,625	$498,625	$498,625	TBD	TBD	$1,994,500
LDEQ 319(h) OSDS Education and outreach (inspections, classes)*	$0	$5,000	$22,000	$22,000	$20,000	$20,000	$20,000	$89,000
LDAF OSDS pump-outs*	$0	$0	$29,250	$29,250	$29,250	$29,250	$29,250	$146,250
LDAF OSDS repair/replace*	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
TOTAL	$243,056	$696,767	$680,423	$680,423	$678,423	$179,798	$159,798	**$3,318,688**

Sources: LDAF, LDEQ, NRCS

*As funding becomes available; other funding also may be used for this activity if available.

Previous funding

A search through NRCS' ProTract database shows BMPs implemented in HUCs falling in these subsegments were implemented from 2009-2016 totaling $615,000 for certified practices, and $455,000 for planned practices. A previous Upper Terrebonne Basin watershed project funding includes $190,000 from LDEQ/EPA 319(h) for a tri-parish stakeholder outreach, debris removal, and data collection effort; $90,000 from the Upper Terrebonne Basin Tri-Parish Partnership (TPP); $15,000 from LDNR; $204,000 from the TPP for in-kind services. More recently, LDEQ outlay for Bayous Maringouin and Grosse Tete was $191,541 in 2019 and $243,056 in 2019. This covered reconnaissance, sampling plan development, sampling, and analysis.

Element E. Education and Outreach

This section will describe key stakeholders in the watershed and partnerships that are essential to establishing goals and local implementation. In addition, this section outlines current and planned education and outreach activities that will occur on a local level in the two watersheds.

Partners and Stakeholder Involvement

Stakeholders in the upper Terrebonne Basin include residents, local and state government, non-governmental organizations, and businesses – primarily agricultural producers – among others. There are two SWCDs – Upper Delta SWCD in New Roads, covering Pointe Coupee and West Baton Rouge parishes, and Lower Delta SWCD in Donaldsonville, covering Iberville Parish.

Upper Terrebonne Basin Tri-Parish Partnership

From 2009-2013, Iberville, West Baton Rouge, and Pointe Coupee Parish governments formed the Upper Terrebonne Basin Tri-Parish Partnership (TPP). In 2009 LDEQ, using EPA CWA Section 319 funds, sponsored the Partnership's "Water Quality Improvements for the Upper Terrebonne Basin Project" (UTB Project). The purpose was to address NPS issues by developing stakeholder support, removing waterbody debris, and collecting data and technical information to identify and target "hot spots" of NPS loading in the upper basin. "The long-term vision for this watershed restoration effort is to combine the nine-step EPA Watershed Planning Process and the six-step Corps of Engineers Planning Process, coupled with extensive stakeholder coordination for a long-term planning/restoration process." (USEPA, 2016). The TPP developed relationships with 29 partner organizations through 30 stakeholder meetings, removed more than 180 tons of debris from waterbodies, and participated in multiple outreach and education events.

The draft Final Report states that stakeholders within the UTB identified problems with water quality, increased erosion and deposition, and flooding. Water quality concerns included sedimentation/erosion, low DO, and pesticides. Conclusions in the final report stated intensive BMP use alone would not be practical to solve water quality issues in the basin, particularly low DO. The report identified hydromodification as both a source of water quality impairment and a potential solution. Constraining lateral flow between two levee systems, while providing flood protection, served to cut off historic overflows that were significant freshwater inputs. Restricting flushing from river overflow into the upper basin during high flow conditions may contribute lower DO in months with critically low flow. To counter that effect, the report called for a study of potential freshwater re-introduction into the UTB as an alternative approach for mitigating dissolved oxygen problems. Other TPP concerns listed included pesticides. This plan includes the Pest Management Conservation System BMP, and does not preclude any future monitoring or efforts to address pesticide concerns in these watersheds.

Upper Delta Soil and Water Conservation District
Recently the Upper Delta Soil and Water Conservation District received NRCS funding to investigate flooding issues in the district. Due to the constrained lateral flow, and intermittent closure of floodgates to the south, flooding is a significant concern in the region during high flow periods, tropical systems, and high rainfall events. The NRCS funding supported an engineering study to evaluate scenarios for mitigating damage from flooding, erosion, and sediment accretion. The resulting preferred scenario involves increasing capacity of a number of waterbodies in the watershed through clearing, snagging, mucking, and other methods, restoring the Torbert Weir, and reconnecting Bayous Grosse Tete and Maringouin. Accordingly, the District is seeking funding for regional drainage improvements that will impact the three parishes through the Louisiana Watershed Initiative, and potentially other sources. LDEQ commented on this proposal (see Appendix B).

Louisiana Department of Agriculture and Forestry Through the Upper and Lower Delta SWCDs, LDAF will be a lead agency for BMP implementation. Using baseline monitoring results and additional data, LDAF will target areas for implementation, provide project management on a day-to-day basis, assist in developing and implementing BMPs, and provide reimbursement to project participants for cost-share. LDAF/Office of Soil and Water Conservation will track the rate and extent of BMP implementation within the subsegment. LDAF staff will share information and conduct education and outreach about water quality issues through locally led meetings, conservation practice sign-ups, and follow-up technical assistance and reporting.

In addition to BMP implementation, as funding becomes available LDAF will coordinate OSDS pumpouts in the watersheds. Home system pump-outs include distribution of informational packets containing applications. These face-to-face interactions provide an effective means of education and communication on the importance of home system maintenance when they occur.

Louisiana Department of Environmental Quality conducted baseline water quality monitoring and watershed planning in these subsegments. LDEQ Water Surveys is sampling throughout the watersheds. LDEQ NPS is conducting watershed planning, including watershed characterization, modeling, data analysis and mapping, and sampling plan design. LDEQ NPS analyzes monitoring results for sharing with partners. As the project progresses, LDEQ will provide updated data and maps to stakeholders quarterly and as requested, to assist with communicating issues and trends. LDEQ staff will assist in prioritizing areas for implementation. LDEQ Source Water Protection staff will conduct educational activities in the watershed with cooperation from LRWA. This education will focus on home treatment system maintenance, preventing runoff, and communicating pollution risk and prevention to local residents and businesses. LDEQ NPS may also coordinate with partners such as DOTD for watershed signage, as well as “no dumping” signs at known dumping sites, such as Site 1664.

LDEQ and LDAF will continue to share data and information, and to solicit concerns, comments, and suggestions from stakeholders in the region, participate in local SWCD meetings, and in public education opportunities when appropriate.

USDA NRCS NRCS continues Environmental Quality Incentives Program (EQIP) in the state. In addition to EQIP, NRCS assists LDAF and the local SWCDs in developing project-ranking criteria and with outreach and educational activities to ensure landowners and operators are aware of program opportunities. NRCS staff work closely with LDAF to ensure that resource management system conservation plans developed for this project meet NRCS planning standards. The field and area staff assist in providing technical assistance for BMP plan designs, implementation, and certification. The NRCS staff will assist LDAF and the local SWCDs in collecting data and assembling semi-annual and annual reports for this project.

Element F. Implementation Schedule

This section provides a schedule of tasks and activities required for plan implementation (see Figure 30). If progress is slower than planned, and/or uses are not restored by 2027, the plan may be updated or extended as necessary. Implementation strategies described in Element C may occur simultaneously and consist of:

Strategy I – Reduce nutrient and sediment loading through BMP implementation (LDAF)

Strategy II – Reduce bacteria loading through pastureland BMPs (LDAF), education-outreach activities (LDEQ), home system pump-outs (LDAF), and OSDS inspections (LDEQ).

Strategy III – Bring all permitted dischargers into compliance with permit limits and perform additional actions as needed (LDEQ).

	Restoration Timeline										
		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
GOALS	Project Term										
	Ambient Monitoring										
	IR Assessment										
	Uses Restored with Approved IR									or	
LDEQ	Assessment, Recon, Site Selection										
	QAPP/Sampling Plan Development										
	Baseline Sampling & Assessment										
	General NPS Outreach/Education										
	Stakeholder Meetings										
	WIP Development										
	Long-term Monitoring / Data Analysis										
	Home System Education Class										
	Home System Inspections (pending funding)										
	Plan Revision (if required)										
LDAF / Partners	Planning Phase										
	Develop Ranking Criteria/Select BMPs										
	Meet with Participants/Sign-Ups										
	Prepare Individual BMP Plans										
	Ag BMP Implementation (LDAF)										
	Ag BMP Implementation (NRCS)										
	Home System Pump-outs/Education										

Figure 30. Project Timeline

Element G. Interim Milestones

This section lists quantitative and qualitative indicators that will be used to gauge progress of implementing the plan and its effectiveness. Feedback on achieving these milestones will come in the form of water quality data, participation rates, and stakeholder input. This information will inform any adjustments to the plan elements: schedule, locating practices, adding or removing specific practices, and education/outreach approach.

The short-term goals of this plan are to:

- Identify areas contributing pollutant loading within the watershed,
- Reduce cropland and pastureland runoff in eight 12-digit HUCs,
- Reduce home sewage pollution loading through pastureland BMPs, education, OSDS pump-outs and inspections,
- Monitor water quality to track changes in the watershed.

The long-term goal of this plan is to restore use support in Bayou Grosse Tete and Bayou Maringouin.

Progress toward achieving these goals will be determined using interim indicators and milestones as depicted in Table 19. Quantitative milestones are based on baseline monitoring data, water quality criteria, and STEP-L modeling. Specifically, BMP implementation milestones are based on STEP-L estimates; OSDS milestones are based on Louisiana Department of Health permitted system counts and an estimated failure rate based on previous inspection work; bacteria loading milestones are based on potential loading from sources identified in the watershed and baseline monitoring; and nutrient and exceedance milestones are based on observed baseline loads at the ambient site and water quality criteria. Limitations of this approach include:

- STEP-L does not represent geographic variability within the watershed,
- An additive approach to load reductions does not reflect complexities of bacteria and nutrient cycling in the natural environment,
- Response of DO to nutrient loading and nutrient ratios in Bayous Maringouin and Grosse Tete is unknown,
- Existing benthic load is not represented.

In light of these limitations, monitoring and implementation tracking will be key to measuring progress. In addition, because implementing BMPs on cropland and pastureland relies on volunteers, acreages under implementation during a given year are difficult to predict. As implementation of this plan progresses, new information will be used to adjust activities as required. This adaptive management strategy will occur in the context of these milestones and plan adjustments will occur with continued stakeholder involvement.

Table 19. Incremental Restoration Milestones

Bayou Maringouin Milestones						
	2022	2023	2024	2025	2026	2027
Implementation-Based Milestones						
Acres in Cropland BMPs*	100	2480	4960	7440	9920	11,000
Stream-Adjacent Acres in Pastureland BMPs*	50	540	1080	1620	2160	1,500
OSDS Addressed (cumulative)	0	10	30	50	75	100
Water Quality-Based Milestones (Ambient Monitoring Site)						
Bacteria Load (cfu/day) May-Oct	1.4E+13	1.1E+13	8.4E+12	5.7E+12	2.9E+12	1.8E+11
Bacteria Load (cfu/day) Jan-Dec	8.7E+11	7.8E+11	7.0E+11	6.1E+11	5.3E+11	4.4E+11
Nutrient Load (tons/day TKN + NO3-NO2 + TP)	191	156	122	88	53	18
Bacteria PCR Exceedances	33%	31%	30%	28%	27%	25%
TDS Exceedances	33%	32%	32%	31%	31%	30%
DO Excursions	42%	36%	29%	23%	16%	10%
Bayou Grosse Tete Milestones						
	2022	2023	2024	2025	2026	2027
Implementation-Based Milestones						
Acres in Cropland BMPs*	0	5000	10000	25000	50000	64,000
Stream-Adjacent Acres in Pastureland BMPs*	0	1000	2500	5000	7500	12,000
OSDS Addressed (cumulative)	0	100	200	300	400	550
Water Quality-Based Milestones (Ambient Monitoring Site)						
Bacteria Load (cfu/day) May-Oct	3.8E+12	3.5E+12	3.2E+12	2.9E+12	2.6E+12	2.3E+12
Nutrient Load (tons/day TKN + NO3-NO2 + TP)	4051	3524.4	2998	2471	1945	1418
Bacteria PCR Exceedances	31%**	30%	29%	27%	26%	25%
TDS Exceedances	50%	46%	42%	38%	34%	30%
DO Excursions	50%	42%	34%	26%	18%	10%

* Based on Step-L estimates; ** Excursion rate derived from baseline project data

Qualitative milestones include:

- Communicating water quality issues to stakeholders and compiling a team of interested and invested local individuals and organizations (build on previous work),
- Identifying and overcoming obstacles to agricultural BMP implementation, including enlisting assistance from Master Farmers in the watershed,
- Cooperating with stakeholders and partners for sharing research and monitoring data, and information on updates on activities in the watershed,
- Plan adjustments as indicated by monitoring data.

Element H. Progress Determination Criteria

This section summarizes benchmarks used to determine progress and long-term success.

Data collected from water quality monitoring will be used to determine whether NPS loads are improving over time and progress is being made toward meeting water quality standards. Progress will be determined by comparing implementation and monitoring data to milestones in *Element G. Interim Milestones*. Monitoring locations, parameters to be analyzed, and monitoring frequency are specified in the following section, *Element I. Monitoring*. Success will be determined using water quality data sampled at the ambient monitoring location measured against Louisiana's water quality criteria to assess the watershed's use support restoration. LDEQ formally assesses use support every two years and publishes this assessment in its biannual Integrated Report.

LDEQ water quality standards used to assess use support in this subsegment are:

- DO – for both subsegments 2.3 mg/L in the warm season (March - November), and 5 mg/L in the cool season (December - February) (maximum 10% excursion rate),
- Fecal coliform limits for primary contact recreation – 400 cfu/100ml May-Oct (maximum 25% exceedance rate),
- TDS – no numeric criteria, target of 200 mg/L (maximum 30% exceedance rate)

Continued sampling throughout the watershed will serve as a feedback mechanism and provide information needed for any plan adjustments in the future. Specifically, following each PCR season, bacteria loading estimates and concentration data will be analyzed and compared to milestones in the previous section to assess progress. TDS excursion rates will be compared to reduced excursion milestones. Annual assessment of progress in reduced nutrient loading will be determined through annual analysis of monitoring data and of acres participating in BMPs. Reductions may be examined using baseline or estimated using STEP-L. Acreages and modeled reductions will be compared against milestones in the previous section to determine progress. Corrective action will be taken with partner and stakeholder input to adjust planned activities as indicated.

Element I. Monitoring

This section describes the purpose, method, sites, parameters, and schedule of water quality monitoring that will support this plan.

The purpose of water quality monitoring in Bayou Maringouin and Bayou Grosse Tete is to characterize water quality issues throughout the watershed, to help identify geographic areas contributing high NPS runoff, to inform any strategy adjustments, and to provide a quantitative tracking of water quality before, during, and after BMP implementation.

Water Quality Monitoring

Ambient water quality monitoring at Bayou Maringouin (Site 0977) and Bayou Grosse Tete (Site 0970) occurs on a four-year rotation and determines use support. NPS water quality monitoring occurs in addition to ambient monitoring, at more sites and more frequently. Through CWA Section 319(h) funding, LDEQ Water Surveys collects water quality samples for LDEQ NPS at the ambient and additional locations throughout the watersheds. Table 20 on the following page provides further detail. On each site visit, survey staff record site conditions observed during monitoring. NPS water quality data is used to identify priority areas for BMP implementation and track changes over time before, during, and after BMP implementation. NPS water quality data may be used for assessment. Data collection and analysis occur under EPA-approved QAPP #3050 and the current EPA-approved sampling plans (LDEQ NPS, 2021a, LDEQ NPS, 2021b)

Measured and Estimated Parameters

Water quality parameters are listed in Table 20. Survey staff collect in situ measurements and samples are analyzed in a certified laboratory for bacteria, sediment, and nutrients. Flow is measured at the ambient location once monthly. Flow and pollutant concentrations are used to calculate load at the ambient site location. Data and project progress toward reaching interim milestones are shared with stakeholders throughout the project term through stakeholder meetings, and presentations.

Table 20. NPS Project Monitoring Sites and Parameters

Site ID	Waterbody Name	Site Description	Latitude	Longitude	Parish	Water Quality[1,2]		NPS Site Characterization With Photos[3]	Sample Frequency Per Month[6]
						Lab	In Situ	Initially and As Needed	
Subsegment 120111									
0977[5]	Bayou Maringouin	Southwest of Rosedale, Louisiana	30.41597	-91.50306	Iberville	X	X	X	1-2x
1664	Bayou Maringouin	At Sparks, Louisiana	30.49883	-91.52656	Pointe Coupee	X	X	X	1-2x
1666	Bayou Maringouin	West-Northwest of Rosedale, Louisiana	30.47259	-91.52331	Iberville	X	X	X	1-2x
1667	Bayou Maringouin	North of Musson, Louisiana	30.44529	-91.51807	Iberville	X	X	X	1-2x
4280	King Ditch	South of Ramah, Louisiana	30.37472	-91.51425	Iberville	X	X	X	1-2x
4910	East Atchafalaya Protection Levee Borrow Canal	Southwest of Kenmore, Louisiana	30.48850	-91.55677	Iberville	X	X	X	removed[4]
4911	East Atchafalaya Protection Levee Borrow Canal	Northwest of Musson, Louisiana	30.46714	-91.54468	Iberville	X	X	X	1-2x
4913	Unnamed Stream	Southwest of Rosedale, Louisiana	30.43407	-91.46409	Iberville	X	X	X	1-2x
4914	Unnamed Canal	Northwest of Grosse Tete, Louisiana	30.43367	-91.46450	Iberville	X	X	X	removed[4]
4915	Unnamed Canal	West of Grosse Tete, Louisiana	30.41253	-91.45591	Iberville	X	X	X	removed[4]
4916	Unnamed Canal	East-Northeast of Ramah, Louisiana	30.42180	-91.48180	Iberville	X	X	X	1-2x
4917	Unnamed Canal	At Ramah, Louisiana	30.40413	-91.50691	Iberville	X	X	X	1-2x
4918	Bayou Maringouin	South-Southeast of Valverda, Louisiana	30.51119	-91.53493	Pointe Coupee	X	X	X	removed[4]
Subsegment 120104									
0968	Bayou Portage	At Hospital Rd (LA-1) bridge	-91.47224	30.69445	Pointe Coupee	x	x	x	1-2x
0970[5]	Bayou Grosse Tete	At Rosedale Rd (LA-76) bridge	-91.45205	30.44242	Iberville	x	x	x	1-2x
0978	Bayou Fordoche	At Callicot Road bridge (west side)	-91.55659	30.56820	Pointe Coupee	x	x	x	1-2x
1682	Bayou Grosse Tete	at LA-78 bridge	-91.52541	30.58541	Pointe Coupee	x	x	x	1-2x
1683	Bayou Grosse Tete	at Bridge Road bridge, between Fordoche Rd (LA-77) and LA-78	-91.55650	30.55934	Pointe Coupee	x	x	x	1-2x
1684	Bayou Grosse Tete	at Landry Street (LA-977) bridge	-91.51497	30.49441	Iberville	x	x	x	1-2x

1685	Bayou Grosse Tete	at Sidney Rd bridge	-91.39508	30.37173	Iberville	x	x	x	removed[4]
1686	Bayou Grosse Tete	at LA-77 boat launch, 0.3 miles south of LA-77 and Babin Rd intersection	-91.32729	30.30451	Iberville	x	x	x	removed[4]
1689	False River Overflow Canal	at LA-979 bridge	-91.50158	30.57342	Pointe Coupee	x	x	x	1-2x
4787	Lighthouse Canal	at LA-1 control structure, near outlet to False River	-91.47635	30.62058	Pointe Coupee	x	x	x	1-2x
4899	Bayou Fordoche	at Luelt Street bridge	-91.60680	30.59340	Pointe Coupee	x	x	x	1-2x
4900	Bayou Fordoche	at unnamed bridge off LA-77 (west side), 2.1 miles southeast of LA-77 and Levee Rd intersection	-91.63500	30.64720	Pointe Coupee	x	x	x	1-2x
4901	Unnamed Canal (near Bayou Portage)	at Callicot Road bridge	-91.54643	30.58471	Pointe Coupee	x	x	x	1-2x
4902	Unnamed Bayou (near Bayou Grosse Tete)	at Manda Rd. bridge	-91.47598	30.56879	Pointe Coupee	x	x	x	1-2x
4903	Unnamed Canal (near Bayou Barre)	at Callegan Lane W bridge	-91.61124	30.71355	Pointe Coupee	x	x	x	1-2x
4905	Portage Canal No. 2	at Deaton Lane bridge	-91.56062	30.68921	Pointe Coupee	x	x	x	1-2x
4906	Portage Canal No. 2	at unnamed bridge off LA-78, 3.5 miles northwest of LA-78 and DeTernant Ln intersection	-91.56764	30.64535	Pointe Coupee	x	x	x	1-2x
4907	Portage Canal No. 1	at unnamed bridge off LA-78, 2.5 miles northwest of LA-78 and DeTernant Ln intersection	-91.55015	30.63867	Pointe Coupee	x	x	x	1-2x
4909	Unnamed Canal (near Bayou Grosse Tete)	at Bigman Lane (LA-978) bridge, 0.9 mile north-northeast of intersection with Manda Rd (LA-979)	-91.48290	30.58146	Pointe Coupee	x	x	x	1-2x
4934	Bayou Grosse Tete	at Bigman Lane (LA-978) bridge at Torbert, 1.1 mile north of Airline Highway (US-190)	-91.48973	30.56877	Pointe Coupee	x	x	x	1-2x

1) The in situ parameters to be measured are pH, temperature, DO, DO percent saturation, specific conductance, salinity, depth, Secchi disk and tapedown measurements. Discharge will be collected at the ambient
monitoring site, or other representative site if required, with each sampling event when possible.
2) The water quality parameters to be collected for laboratory analysis are TKN, TP, TDS, FC, Nitrate Nitrite
3) Field Data Sheets will be completed at each sampling event and a NPS Site Characterization Form will be conducted initially and as needed.
4) Site no longer sampled but data used for targeting priority areas
5) Ambient monitoring location
6) See the current sampling plan and QAPP for further information on sampling frequency, QC measures, and other detailed information.

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Appendix A

LDAF 2018 Forestry BMP Survey

BMP MONITORING	Tracts
Silvicultural Activity:	**Surveyed**
Regeneration Cut - 82.35%	168
Thinning - 16.18%	33
Other - 1.47%	3
Tract Size:	
10-40 Acres - 23.52%	48
41-80 Acres - 36.27%	74
81-120 Acres - 18.13%	37
121-160 Acres - 11.76%	24
161 + Acres - 10.29%	21
Ownership:	
PNIF - 47.55%	97
Industry - 52.45%	107
Federal - 0%	0
State - 0%	0

3. Streamside Management Zone:

A. SMZ Width Established According to BMP Specifications
151 - YES 4 - NO 49 - N/A
97.42% 2.58%

B. Harvesting/Thinning with SMZ According BMP Specifications
150 - YES 3 - NO 51 - N/A
98.04% 1.96%

C. SMZ Integrity Preserved
152 - YES 1 - NO 51- N/A
99.35% 0.65%

D. Stream Course Clear of Logging Debris
154 - YES 2 - NO 48 - N/A
98.72% 1.28%

E. SMZ Free of Roads and Landings
154 - YES 1 - NO 49 - N/A
99.35% 0.65%

F. Stream Free of Sediment Dute to Silvicultural Activity
152 - YES 2 - NO 50 - N/A
98.70% 1.30%

G. Rutting Through Steams or Drains Avoided
152 - YES 4 - NO 48 - N/A
97.44% 2.56%

H. Hot Site Prep Fire Avoided in SMZ
61 - YES 0- NO 143 N/A
100.00% 0.00%

I. Blocking The Natural Flow of Water Avoided
153 - YES 3 - NO 48 - N/A
98.08% 1.92%

J. Stream Bank Integrity Preserved
152 - YES 1 - NO 51 - N/A
99.35% 0.65%

Percent Compliance 98.64%

4. Stream Crossings

A. Ditches That Dump Into Streams Avoided
105 - YES 1 - NO 98 - N/A
99.06% 0.94%

B. Streams Crossing Properly Installed
104 - YES 9 - NO 91 - N/A
92.04% 7.96%

C. Number of Stream Crossing Minimized
122 - YES 0- NO 82- N/A
100.00% 0.00%

D. Stream or Drain Crossing at Right Angle Only
115- YES 0 - NO 89 - N/A
100.00% 0.00%

E. Stream Crossing Stabilized During Use
106 - YES 3 - NO 95 - N/A
97.25% 2.75%

Percent Compliance 97.68%

5. Permanent Roads

A. Road Respect Sensitive Areas
156 - YES 1 - NO 47 - N/A
99.36% 0.64%

B. Rutting is Not Excessive
157 - YES 7 - NO 40 - N/A
95.73% 4.27%

C. Roads Located Where Side Drainage Can Be Achieved
159 - YES 2 - NO 43 - N/A
98.76% 1.24%

D. Roads Wide Enough to Achieve Surface Drying
162 - YES 1 - NO 41 - N/A
99.39% 0.61%

E. Roads Reshaped and/Or Stabilized If Needed
139 - YES 14 - NO 51 - N/A
90.85% 9.15%

F. Roads Meet Grade Specifications
159 - YES 2 - NO 43 - N/A
98.76% 1.24%

G. Roads Are Well Drained with Appropriate Structures
168 - YES 4 - NO 32 - N/A
97.67% 2.33%

H. Side Ditches Do Not Dump Into Streams
134 - YES 6 - NO 64 - N/A
95.71% 4.29%

I. Flat No Grade Road Avoided if Possible
149 - YES 9 - NO 46 - N/A
97.30% 5.70%

J. Streambeds, Rocky Places, And Steep Slopes Avoided
149 - YES 4 - NO 51 - N/A
97.39% 2.61%

K. Potential Problems Soils Avoided
161 - YES 1 - NO 42 - N/A
99.38% 0.62%

Percent Compliance 97.03%

6. Skid Trails/Temporary (Secondary) Roads

A. Sensitive Areas Respected
196 - YES 0 - NO 8 - N/A
100.00% 0.00%

B. Majority of Skid Trail Grades Below 15 Percent
197 - YES 2 - NO 5 - N/A
98.99% 1.01%

C. Excessive Tract Rutting Area Does Not Exceed 25%
189 - YES 10 - NO 5 - N/A
94.97% 5.03%

D. Water Bars, Turnouts, and Other Water Control Structures
131 - YES 17 - NO 56 - N/A
88.51% 11.49%

E. Roads and Skid Trails are Stabilized
177 - YES 16 - NO 11 - N/A
91.71% 8.29%

Percent Compliance 94.84%

7. Site Preparation

A. Sensitive Areas Respected
144- YES 0 - NO 60 - N/A
100.00% 0.00%

B. Contour Followed
140 - YES 0 - NO 64 - N/A
100.00% 0.00%

C. SMZ Integrity Preserved
118 - YES 6 - NO 80 - N/A
95.16% 4.84%

D. Soil Disturbance Kept To A Minimum
145 - YES 5 - NO 54 - N/A 1 - S/R
96.67% 3.33%

E. Excessive Soil Compaction Avoided
147 - YES 2 - NO 55 - N/A
98.66% 1.34%

F. Does It Appear That Chemicals Were Used to Label Specs
107 - YES 6 - NO 91 - N/A
94.69% 5.31%

G. Disturbance On Slope Minimized
142 - YES 0 - NO 62 - N/A
100.00% 0.00%

H. Water Diverted from Site Prep Area to Vegetated Surface
101 - YES 3 - NO 100 - N/A
97.12% 2.88%

I. Extremely Hot Burns Avoided
69 - YES 1 - NO 134 - N/A
98.57% 1.43%

Percent Compliance 97.87%

8. Landings

A. Location Outside of SMZ
175 - YES 0 - NO 29 - N/A
100.00% 0.00%

B. Well-Drained Location
191 - YES 8 - NO 5 - N/A
95.98% 4.02%

C. Number and Size Minimized
201 - YES 0 - NO 3 - N/A
100.00% 0.00%

D. Sensitive Areas Respected
194 - YES 0 - NO 10 - N/A
100.00% 0.00%

E. Restored/Stabilized
174 - YES 11 - NO 19 - N/A
94.05% 5.95%

Percent Compliance 98.01%

9. Wetlands (Wetlands BMPs Are Mandatory Practices)

A. Hydrology of Site Unaltered
80 - YES 1 - NO 123 - N/A
98.77% 1.23%

B. Roads, Drainage Strutures Applied Properly
75 - YES 0 - NO 129 - N/A
100.00% 0.00%

C. Mandatory BMPs Followed If Indicated
69 - YES 0 - NO 135 - N/A
100.00% 0.00%

Percent Compliance 99.59%

10. Fireline Construction

A. Fireline Erosion Controlled
43 - YES 4 - NO 157 - N/A
91.49% 8.51%

B. Majority of Fireline Constructed Around Slopes/Grades <10%
48 - YES 0 - NO 156 - N/A
100.00% 0.00%

C. Water Bars, Turnouts, & Other Water Control Structures Properly Installed
32 - YES 8 - NO 164 - N/A
80.00% 20.00%

D. Diversion Ditches Not Constructed At the Head of a Drain
40 - YES 1 - NO 163 - N/A
97.56% 2.44%

E. Firelines Not Constructed Down the Slope of Natural Gully
44 - YES 0 - NO 160 - N/A
100.00% 0.00%

F. SMZs Left Beween the Fireline and Streams
40 - YES 0 - NO 164 - N/A
100.00% 0.00%

G. Avoid Constructing Firelines Into An SMZ
43 - YES 1 - NO 160 - N/A
97.73% 2.27%

Percent Compliance 95.25%

SUMMARY COMPLIANCE TOTALS

Streamside Management Zone:	98.64%
Stream Crossings:	97.68%
Permanent Roads:	97.03%
Skid Trails/Temporary(Secondary) Roads:	94.84%
Site Preparation:	97.87%
Landings:	98.01%
Wetlands:	99.59%
Fireline Construction:	95.25%

STATEWIDE TOTAL BMP COMPLIANCE: 97.36%

Appendix B

LDEQ Comments on Upper Terrebonne Watershed Plan and Environmental Assessment

JOHN BEL EDWARDS
GOVERNOR

CHUCK CARR BROWN, PH.D.
SECRETARY

State of Louisiana
DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF ENVIRONMENTAL ASSESSMENT

November 14, 2019

Mr. Mohan Menon, PhD, PG, PMP
GIS Engineering, LLC
Coastal Design and Infrastructure
450 Laurel Street, Suite 1500
Baton Rouge, LA 70810

RE: Upper Terrebonne Watershed Plan and Environmental Assessment

Dear Mr. Menon:

LDEQ appreciates the opportunity to review the proposed study and provide the following recommendations and comments. We look forward to continued collaboration in this effort.

We encourage the use of nature-based solutions such as stream and floodplain restoration. Such activities may include, to the degree possible, restoring channels and floodplains to the hydrologic, ecological and water quality conditions present before any significant man-made alterations were made. Restoring the natural functions of the channels and floodplains by restoring hydrologic characteristics such as stream-floodplain connectivity, stream sinuosity, cross sectional area, length, and slope can both reduce flood elevation and duration as well as improve water quality, ecological, and economic conditions.

When streams are realigned by "straightening", the increased slope and decreased channel length increases water velocity, which increases bank instability and erosion. The increased water volume deposited downstream in a shorter period of time also leads to increased water elevations and flooding. Alternatively, restoring the natural meanders of waterways in this area would increase flood storage capacity of the channels by increasing the length of the channel and adjacent floodplains. By maintaining or reducing the slope of the channel and increasing the time it takes water to travel downstream, more water is absorbed by the soil and vegetation, resulting in reduced downstream water levels and flooding impacts. Reconnecting channels to existing swamps, sloughs, and other natural floodplains provides holding capacity during high flow events while refreshing natural wetlands.

Alternatives that include dredging or clearing and snagging can have significant potential adverse environmental, ecological, and economic impacts while often providing insignificant benefits for flood mitigation. Both dredging and clearing and snagging can lead to bank instability, erosion, and sedimentation. The resulting sediment deposited in other sections of the stream reduces flow capacity and increases concentrations of total suspended solids, turbidity and other pollutants. Additionally, some woody debris in the waterway is critical habitat for macroinvertebrates and other aquatic species.

While dredging increases channel cross-sectional area, stream velocities and the ability to reaerate and assimilate organic loading are reduced. This reduction in dissolved oxygen levels can cause the waterbody to be listed as impaired, resulting in discharge permit restrictions which adversely impact development and economic conditions. Low dissolved oxygen levels can also lead to septic conditions which can lead to various unforeseen water quality issues including toxicity and alter the quantity and diversity of macroinvertebrates, aquatic habitat, and species. Low-flow channel characteristics should be preserved.

Clearing and snagging by large track-type vehicles tends to alter channel widths and depths, producing similar impacts as described for dredging. At the same time, woody debris and sawdust from the operation can be carried downstream and deposited against bridge pilings, leading to reduced stream flow capacity, lower dissolved oxygen concentrations and other impairments, and increased scouring near bridge structures. Removal of this debris and other logs, trash, and white goods from bridge crossings would aid the waterway's flow capacity and reduce detrimental flooding, infrastructure, and environmental impacts.

Additionally, removal of riparian vegetation during clearing and snagging leads to increased bank instability and sedimentation as well as increased pollutant runoff, such as sediment, nutrients, and fecal coliform bacteria, from adjacent land. Removal of the overhead shading provided by the tree canopy also leads to increased stream temperatures, which increases the rate of decay of organic materials and further reduces dissolved oxygen concentrations in the water column. Prevention of pollutant runoff through use of best management practices on pasture and cropland, such as not tilling and planting on or along the streambank, would help maintain the channel's depth and protect water quality from degradation by preventing further sedimentation and pollutant runoff.

Many of the subsegments in this area are impaired due to sediment, nutrients, bacteria, and low dissolved oxygen. Low dissolved oxygen primarily occurs during low, or critical, flow periods. Because historical flushing due to Mississippi River overflows is now restricted by levees, increasing flow in many segments in the Upper Terrebonne Basin may help improve dissolved oxygen levels and flushing of stagnant waterways. In order to provide any such water quality enhancements using hydromodification, increasing fresh water flows during critical low flow months should be targeted. Removal of trash/debris and weirs, increasing culvert sizes or constructing bridges, removing or redesigning culverts in driveways that restrict flow, and reconnecting Bayou Maringouin to Bayou Grosse Tete, are additional means that may help address water quality issues in these subsegments. Any hydromodification should include maintaining the low-flow channel characteristics and well as improving high-flow channel characteristics.

Although LDEQ acknowledges lateral drainage limitations posed by the Atchafalaya floodway levee and the Mississippi River levee, the agency urges you to strongly consider evaluating scenarios that employ natural channel and floodplain restoration, trash/debris maintenance, connectivity to existing natural storage areas, and conservation practices to improve function of streams and floodplains without negatively impacting water quality. These measures align with other agencies' flood mitigation strategies that encourage nature-based solutions, including FEMA, the Louisiana Watershed Initiative, and the USEPA. This approach can reduce flood elevation and duration as well as improve water quality, ecological, and economic conditions. If you have any questions or comments, please contact Mr. William C. Berger, Jr. at (225) 219-3217 or by email at Chuck.Berger@la.gov.

Sincerely,

Jonathan McFarland, P.E.
Administrator
Water Planning and Assessment Division

c: Roger Gingles, LDEQ
Aimee Preau, LDEQ
William C. Berger, Jr., LDEQ
Linda (Brown) Piper, LDEQ
Albert E. Hindrichs, LDEQ

From:	Linda (Brown) Piper
To:	Mohan Menon
Cc:	Yasoob Zia
Subject:	DEQ SOV#190930/1010 Public Notice-Scoping Meeting for the Upper Terrebonne Watershed Plan
Date:	Friday, October 18, 2019 12:52:31 PM

October 18, 2019

Meghan Menon, PhD, PG, PMP
GIS Engineering, LLC
Coastal Design and Infrastructure
450 Laurel Street, Suite 1500
Baton Rouge, LA 70810
mmenon@gisy.com

RE: 190930/1010

Public Notice-Scoping Meeting for the Upper Terrebonne Watershed Plan and EA
Upper Delta Soil & Water Conservation District
Pointe Coupee, WBR and Iberville Parishes

Dear Ms. Menon:

The Air Planning and Assessment Division of the Office of Environmental Assessment has reviewed the information provided in your letter dated September 27, 2019, regarding the referenced project. Effective March 21, 2017, Iberville and West Baton Rouge Parish was designated by EPA as an ozone attainment area with a maintenance plan under the 8-hour standard (81 FR 95051, December 27, 2016). As part of the ozone maintenance area, federal activities proposed in Iberville and West Baton Rouge Parish may be subject to the State's general conformity regulations as promulgated under LAC 33:III.Chapter 14, Subchapter A, *Determining Conformity of General Federal Actions to State or Federal Implementation Plans*.

In order to determine if the proposed project in Iberville and West Baton Rouge Parish is subject to the full requirements of the general conformity regulations, the project sponsor must first make a general conformity applicability determination. This determination can be made by summing the total of direct and indirect volatile organic compound (VOC) and nitrogen oxide (NOx) emissions caused by the project. If the net total of VOC and NOx emissions is determined to be less than the prescribed *de minimis* level of 100 tons per year per pollutant, then this action will comply with the conformity provisions of Louisiana's State Implementation Plan (SIP) and the Air Planning and Assessment Division will not object to implementation of the project.

Please email your general conformity applicability determination to Linda (Brown) Piper Linda.Piper@LA.GOV. Should you have any questions regarding state rules and regulations pertaining to general conformity, please contact me at (225) 219-3586. Thank you for affording us the opportunity to comment on the proposed action.

Sincerely,

Yasoob Zia
Environmental Senior Scientist
Air Planning and Assessment Division

SOV #190930/1010

Linda (Brown) Piper
Louisiana Dept. of Environmental Quality
Office of the Secretary
Phone: (225) 219-3954
Email: linda.piper@la.gov