Old Fort Bayou
Watershed Implementation Plan Update

August 2023

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY

LAND TRUST FOR THE MISSISSIPPI COASTAL PLAIN

Old Fort Bayou
Watershed Implementation Plan Update

August 2023

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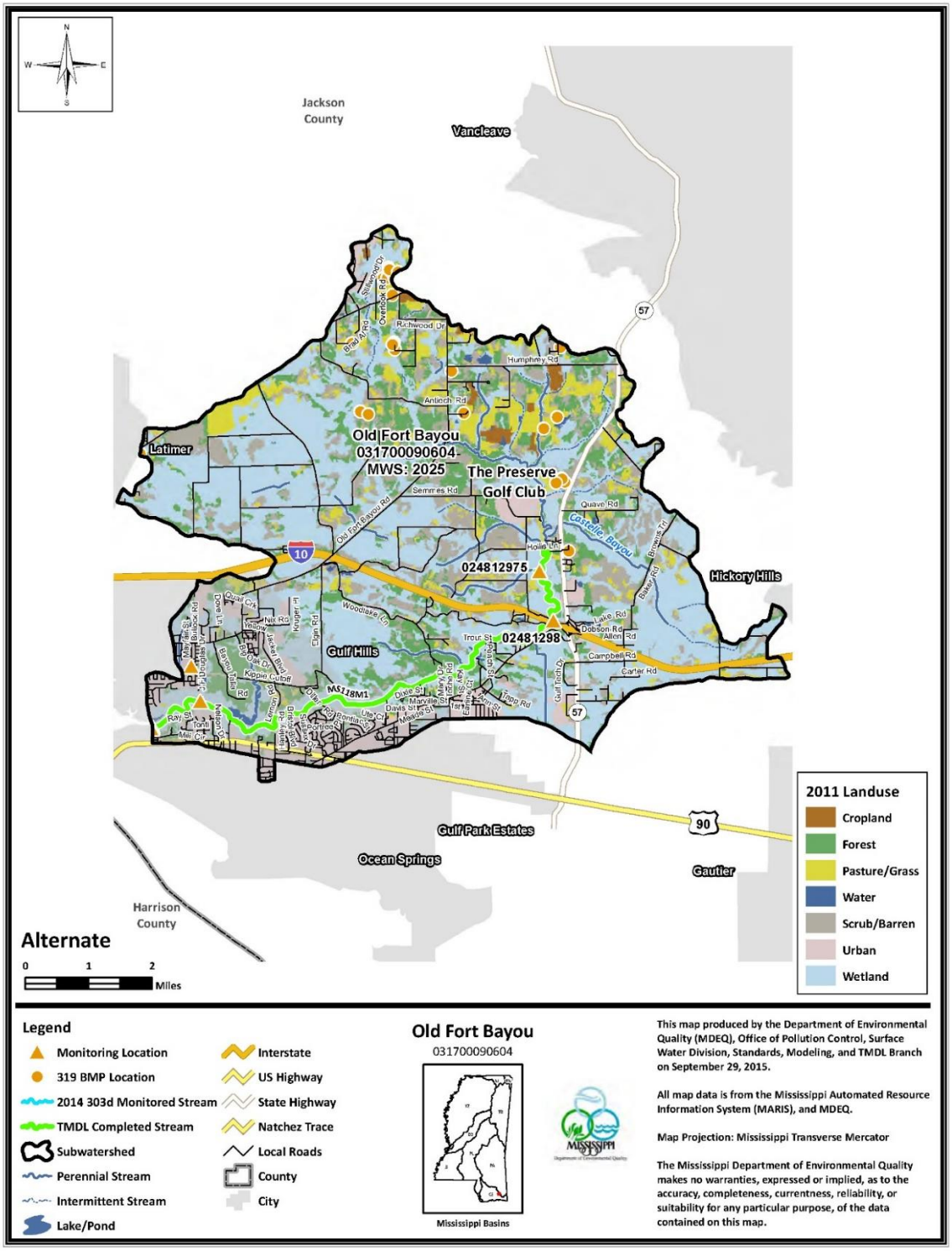
Section 1 Watershed Planning

1.1 Background, Process, and Acknowledgements

In May 2018, the Mississippi Department of Environmental Quality (MDEQ) enlisted the Land Trust for the Mississippi Coastal Plain, in partnership with Mississippi State University's Gulf Coast Community Design Studio, to facilitate the development of a Watershed Implementation Plan for Old Fort Bayou Watershed (HUC 031700090604) that would meet the required nine key elements for a Watershed Implementation Plan (See Figure 1). The planning work was funded partly through a U.S. Environmental Protection Agency (EPA) FY2015 Nonpoint Source Grant (#C999486615), CFDA 66.460, Nonpoint Source Implementation, awarded on August 18, 2015. Old Fort Bayou Watershed is just over 32,000 acres and includes parts of Ocean Springs, Gautier and Jackson County. The Watershed Implementation Plan addresses the fecal coliform TMDL (Total Maximum Daily Load) for Old Fort Bayou as documented in the 2002 TMDL report for the Back Bay of Biloxi and Biloxi Bay, as well as other environmental stressors impacting water quality and their sources. The plan was approved in December 2018 and includes specific recommendations and strategies for protecting and improving conditions in the watershed.

In March 2020, MDEQ again contracted with the Land Trust for the Mississippi Coastal Plain, in partnership with the Gulf Coast Community Design Studio, to implement priority projects and outreach initiatives as documented in the 2018 Old Fort Bayou Watershed Implementation Plan. As part of the work, the Design Studio was tasked with updating the 2018 plan. The work to implement the priority projects, conduct education and outreach activities, and update the 2018 Old Fort Bayou Watershed Implementation Plan was funded in part by the EPA under an assistance agreement FY2019 Nonpoint Source Grant (#C999486619) to MDEQ, and facilitated through the MDEQ Nonpoint Source and Basin Management Branch.

Figure 1: Old Fort Bayou Watershed



During the first couple of years of the project, while the pandemic was severely limiting face-to-face interaction, the project team was able to engage with the Watershed Committee virtually and make progress on several of the priority projects and education initiatives. One of the first exercises with the Watershed Committee was to reassess and prioritize the goals and objectives identified in the 2018 Watershed Implementation Plan. The results of this survey work are documented below in Section 1.2. Over the next several years the project team has worked to implement three priority projects including completing a boardwalk trail at The Inlet development adjacent to Old Fort Bayou in Ocean Springs; expanding the Old Fort Bayou Blueway to include Bayou Talla; and improving Yellow Jacket Educational Trail and Outdoor Classroom in St. Martin School District adjacent to Bayou Talla. In addition, the Soil and Water Conservation Commission managed a cost share program in Old Fort Bayou Watershed whereby landowners were encouraged to install agricultural Best Management Practices (BMPs) in the more rural parts of the watershed. All of these priority projects included significant education and outreach components and were conducted under the guidance of the Old Fort Bayou Watershed Committee. Active Watershed Committee participants are documented in Appendix A: Old Fort Bayou Watershed Committee.

This Old Fort Bayou Watershed Implementation Plan Update serves to accomplish the following:

- Document updates to the vision, goals, and objectives set forth in the 2018 Old Fort Bayou Watershed Implementation Plan;
- Document priority projects and BMPs implemented since the completion of the 2018 Plan;
- Review the Watershed Assessment components of the 2018 Plan and include any notable changes;
- Revise the recommendations and strategies included in the Watershed Plan based on the abovementioned process and assessment; and
- Ensure that the 2023 Old Fort Bayou Watershed Plan Update meets the standards for being a Watershed Implementation Plan by containing the required nine Key Elements (See Table 1).

Table 1: Cross Walk for Required 9 Key Elements for WIP

Required 9 Key Elements for 319 Grant	Location in WIP
Causes and Sources	Section 2: Watershed Assessment
Expected Load Reductions	2018 Old Fort Bayou Watershed Implementation Plan (Appendix D: Old Fort Bayou Fecal Coliform Bacteria Total Maximum Daily Load Reduction Plan)
NPS Management Measures	Appendix F: Management Actions
Project Costs and Implementing Authorities	Appendix F: Management Actions
Education and Outreach	Section 3.1.2: Education and Outreach Activities and Appendix F: Management Actions
Implementation Schedule	Appendix F: Management Actions
Milestones	Appendix F: Management Actions
Adaptations and Revisions	Section 3.2.2: Adaptive Management and Plan Revision and Appendix F: Management Actions
Monitoring	Section 3.2.1: Monitoring Plan

The remainder of the 2023 Old Fort Bayou Watershed Implementation Plan Update is organized in a similar manner to the 2018 Old Fort Bayou Watershed Implementation Plan. Each section acknowledges where conditions have changed or stayed the same since the original plan was created. Where conditions have not changed, the information in the original plan is not restated. As such, this plan update is meant to be used alongside the 2018 Old Fort Bayou Watershed Implementation Plan.

1.2 Vision, Goals and Objectives

One of the first tasks of the Watershed Committee was to revisit the assets/opportunities and concerns/challenges associated with Old Fort Bayou Watershed, along with the vision, goals and objectives identified in the 2018 Old Fort Bayou Watershed Implementation Plan. In October and November 2020, GCCDS surveyed the members of the Watershed Committee to determine if the existing vision and goals were still meaningful and if there were any new goals or objectives to add. In addition, committee members were asked to prioritize the goals and objectives – an exercise that was not done during the 2018 planning process. In February 2021, GCCDS did a similar exercise with St. Martin High School students participating in the programming. Results showed that the assets and challenges, along with the vision, goals and objectives from the 2018 plan were still relevant, and respondents did not have any significant additions to add to the plan update. The assets to be protected and the concerns/challenges are listed below in order of priority. In addition, the vision is restated and the goals and objectives are ranked below according to respondents' priorities.

1.2.1 Assets, Concerns, and challenges

Assets to be Protected:

1. Marsh areas and streamside buffers
2. Greenspace and land in conservation
3. Vistas and intrinsic beauty
4. Public access to the bayou and status as blueway
5. Rural character of upper watershed

Concerns/Challenges:

1. Protection of marsh and streamside buffers
2. Lack of funding and/or prioritization of funding for watershed-related projects
3. Lack of public awareness
4. Lack of knowledge and infrequent use of Low Impact Development strategies
5. Erosion/sedimentation from development
6. Coordination of planning efforts (comprehensive planning, watershed planning, etc.)
7. Lack of water quality data and monitoring
8. Enforcement of ordinances intended to protect watershed and water quality

1.2.2 Vision

The community envisions a cleaner watershed for healthier humans and ecosystems; where residents and visitors have access to the bayou and wholesome recreational opportunities; and where stakeholders are educated and actively engaged in protecting the watershed.

1.2.3 Goals and Objectives

1. Reduce erosion and sedimentation to improve water quality and protect navigability of Old Fort Bayou
   a. Identify and target key sources of erosion
   b. Encourage policies and practices to promote the use of Low Impact Development strategies and reduce stormwater runoff in the watershed
   c. Protect and re-establish riparian buffers where possible

2. Increase environmental awareness, stewardship and stakeholder participation in the watershed
   a. Build momentum of the Steering and Technical Advisory Committee for the Old Fort Bayou WIP and establish an Old Fort Bayou Watershed Partnership
   b. Implement and continue to improve plan for education and outreach in the watershed
   c. Create meaningful opportunities for schools, civic organizations and residents to participate in water quality monitoring and stewardship activities

3. Better understand and reduce pollutants entering the water system
   a. Update and continue to monitor water quality in Old Fort Bayou Watershed and add indicators including, but not limited to Total Nitrogen and Total Phosphorus

b. Identify specific contributors of pathogens and target to reduce harmful bacteria entering the water system
c. Promote and enforce litter prevention

4. Protect and improve quality access points and recreational opportunities on and around Old Fort Bayou
   a. Re-assess, update and promote Old Fort Bayou blueway and supporting infrastructure
   b. Coordinate planning and development of future public access points, keeping in line with current Best Management Practices
   c. Support environmentally-sensitive recreation and economic development opportunities that allow for preservation of marshes and riparian buffers

1.3 Related Plans and Projects

A significant amount of planning and plan implementation has and is being done that relates to watershed planning in Old Fort Bayou watershed. Relevant plans and projects completed or being implemented during the development of the 2018 Old Fort Bayou Watershed Plan were documented in the original plan and are not repeated below. Data and recommendations from those plans and projects were incorporated into Section 2: Watershed Assessment and Section 3: Management and Monitoring Plans of the 2018 Old Fort Bayou Watershed Plan. Several additional projects of relevance came to fruition after the 2018 plan was completed are documented below.

Project Title: Old Fort Bayou Watershed 319 Project
Funder: Environmental Protection Agency, Region IV FY 2018 Nonpoint Source Grant (#C999486618) to the Mississippi Department of Environmental Quality
Subgrant Awardee: Mississippi Soil and Water Conservation Commission
Project Partners: Mississippi Soil and Waters Conservation Commission, Mississippi Department of Environmental Quality, United States Environmental Protection Agency, United States Department of Agriculture Natural Resources Conservation Service, and the Jackson County Soil and Water Conservation District
Geographic Scope: Agricultural land in Old Fort Bayou Watershed
Deliverables: Install Best Management Practices on agricultural land (fencing, nutrient management, water & sediment control basins, critical area planning, etc.)
End Date: August 2022

Project Title: Septic Tanks Conversion to Modular Public Wastewater Systems in Old Fort Bayou, Mississippi: Developing a method for benefit-cost analyses in septic conversion projects
Funder: This project is supported by the FY16 USDA NIFA AFRI ELI Research and Extension Experiential Learning for Undergraduates (REEU) Fellowships Program of the National Institute of Food and Agriculture, USDA, Grant #2017-67033-26015
Awardee: Mississippi State University Coastal Research and Extension Center
Project Partners: PLACE: SLR, Jackson County Utility Authority, EDGe$,
Geographic Scope: Old Fort Bayou, MS
Deliverables: Final report
End Date: N/A

Project Title: Exploring Innovative Nature-Based Approaches to Regional Stormwater Management in Ocean Springs, MS
Funder: National Academies of Sciences, Engineering, and Medicine Gulf Research Program
Awardee: Mississippi State University Coastal Research and Extension Center
Project Partners: City and County Municipal Partners
Geographic Scope: Ocean Springs, MS
Deliverables: Feasibility Assessment
End Date: May 2023

Project Title: South Central Jackson County Septic Abatement Project
Funder: MS RESTORE Act
Awardee: Jackson County Utility Authority
Project Partners: Jackson County Utility Authority, MS Department of Environmental Quality
Geographic Scope: Installation of sewer mains along Fountainbleau Road Mary Mahoney Drive, and West Belle Fontaine Drive and connection of all existing residents to the public sewer system along with abandonment of onsite wastewater disposal system per MSDH requirements.
Deliverables: Removal of all onsite wastewater disposal systems and connection of resident homes (+/- 120) to the public sewer system.
End Date: Est. July 2026

Project Title: Jackson County Connection Assistance Program – Phase 1
Funder: GOMESA Act
Awardee: Jackson County Utility Authority
Project Partners: Jackson County Utility Authority, MS Department of Marine Resources
Geographic Scope: Connection of interested residents to publicly available sewer system throughout Vancleave, Wade, Big Point, Hurley, and Helena areas. Sewer Connection Assistance is being offered that will assist in covering approximately +95% of the connection cost.
Deliverables: Connection of residents to the public sewer system and abandonment of existing onsite wastewater disposal systems.
End Date: July 2026

Project Title: Jackson County Colonial Connection Assistance Program – Phase 2
Funder: American Recovery Plan Act (ARPA)
Awardee: Jackson County Utility Authority
Project Partners: Jackson County Utility Authority, Jackson County Board of Supervisors, MS Department of Environmental Quality
Geographic Scope: Connection of resident homes to the publicly available sewer system in Colonial Estates S/D (between Ocean Springs City Limits and Sunplex Industrial Park). Additional work is planned to extend service to underserved areas of Jackson County in the Vancleave, Hurley, Wade, Big Point, and Helena Areas while offering water and sewer connection assistance covering approximately +95% of the connection cost. All work will include abandonment of the existing onsite wastewater disposal system from use.

Deliverables: Connection of resident homes to the publicly available water (as applicable) and sewer systems.
End Date: July 2027

In addition to the aforementioned plans, the jurisdictions' Stormwater Phase II Program plans, and Small Municipal Separate Storm Sewer System (MS4) General Permit Reports are also relevant; particularly Section I: Summary of Implementation Activities by Minimum Measure and Best Management Practice which includes best management practices related to stormwater. The plans include strategies ranging from public education and involvement to pre- and post-construction stormwater controls. Per ACT7, S-2 of the MS4 General Permit, the "coverage recipient is to annually summarize the progress made in implementing the conditions of the permit and the elements of the Storm Water Management Program (SWMP)." Local plans are based on the State's permit which dictates the contents of local plans and is supposed to be updated every five years. MDEQ's latest permit was issued in 2016. As a result, the jurisdictions' plans for 2016 through 2020 have been grandfathered in until the state issues a new permit. Jackson County and the City of Gautier are still working off of their 2016 plans. The City of Ocean Springs voluntarily updated their plan in 2023. The MS4 plans for Jackson County and the Cities of Gautier and Ocean Springs were reviewed and incorporated, where applicable, in Section 3: Management and Monitoring Plan.

Section 2 Watershed Assessment

2.1 History and Land Use

2.1.2 Historical Context

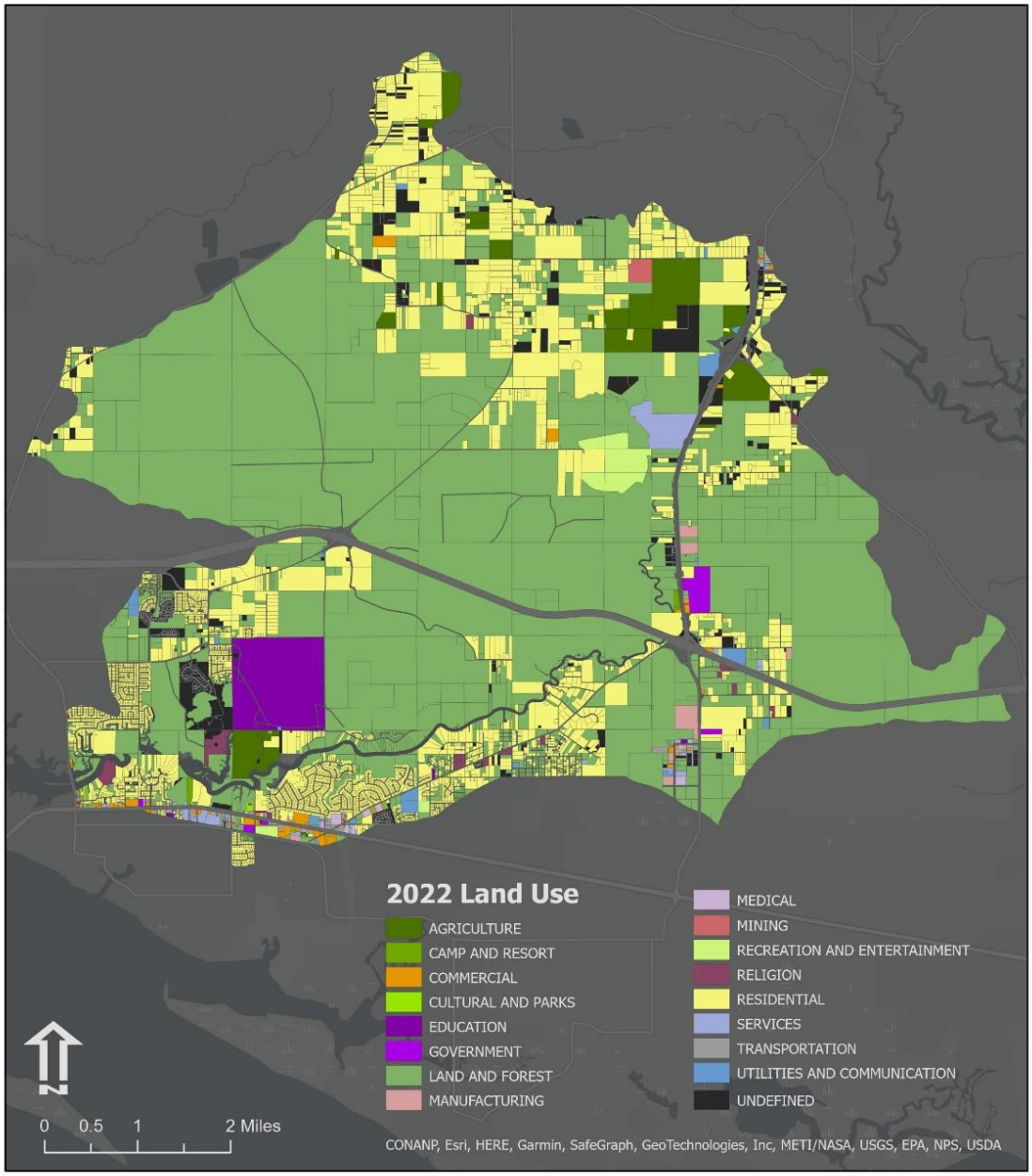
Old Fort Bayou and the surrounding area has a rich history with documented settlements dating back to the mid-19th Century. The history of the area is documented in the 2018 Old Fort Bayou Watershed Implementation Plan also in Section 2.1.2.

2.1.3 Current and Future Land Use

The 2018 Old Fort Bayou Watershed Implementation Plan assessed current and future land use. At that time the most recent land use data was from 2013. In May 2023, Mississippi State University's Geosystems Research Institute did a comparison of the 2013 "current" land use data and the updated current land use inventory with data from 2022. The watershed is still primarily undeveloped (66%) and lower density, single family residential (22%). Figure 2 shows current land use in Old Fort Bayou Watershed.

The only notable difference between the 2013 and 2022 land use data is that it appears that in 2022 more of what was considered "agricultural" land is now being considered "land and forest." There were also just over 1,014 acres that were "undefined" in the 2022 assessment where this category did not exist in the 2013 data set (See Table 2). It is important to note that this is not an indication of lack of development as the area has seen considerable development over the past several years.

Figure 2: Current Land Use



Source: Land use data from Gulf Regional Planning Commission (2023). Map by Geosystems Research Institute, Mississippi State University.

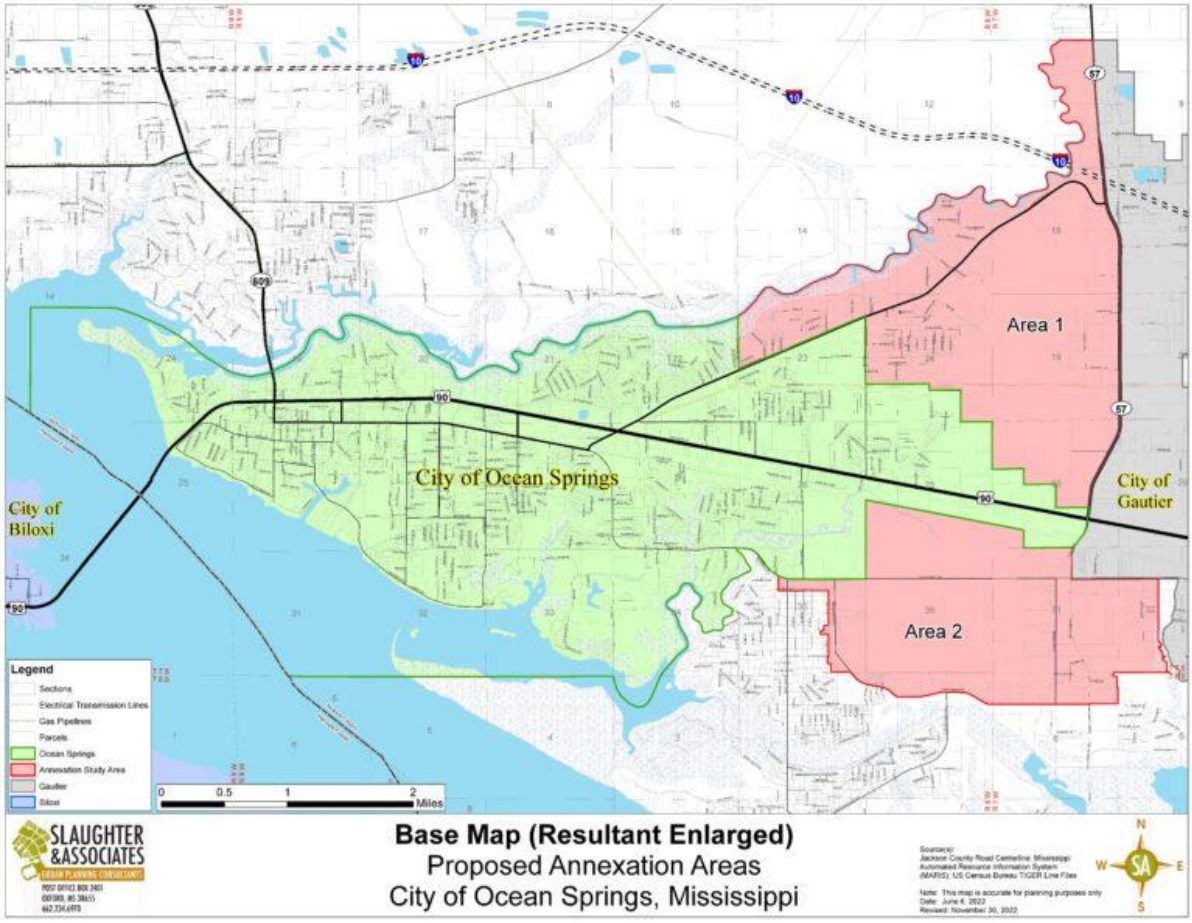
Table 2: Comparison of Current Land Use in Old Fort Bayou Watershed, 2013 and 2022

LAND USE CATEGORY	2013		2022	
	Acres	%	Acres	%
AGRICULTURE	2248.42	7.40	824.82	2.74
CAMP AND RESORT	22.86	0.08	18.72	0.06
COMMERCIAL	106.16	0.35	133.74	0.44
CULTURAL AND PARKS	6.70	0.02	6.70	0.02
EDUCATION	618.09	2.03	615.43	2.04
GOVERNMENT	98.98	0.33	93.19	0.31
LAND AND FOREST	18805.76	61.85	19921.63	66.17
MANUFACTURING	93.20	0.31	94.83	0.31
MEDICAL	40.17	0.13	41.84	0.14
MINING	39.32	0.13	39.32	0.13
RECREATION AND ENTERTAINMENT	149.13	0.49	224.78	0.75
RELIGION	130.53	0.43	117.23	0.39
RESIDENTIAL	6572.95	21.62	6568.94	21.82
SERVICES	375.91	1.24	224.14	0.74
TRANSPORTATION	24.47	0.08	27.51	0.09
UTILITIES AND COMMUNICATION	1070.76	3.52	138.86	0.46
UNDEFINED	0.00	0.00	1014.25	3.37
Total Area	30403.41		30105.93	

Source: Land use data from Gulf Regional Planning Commission (2023). Analysis by Geosystems Research Institute, Mississippi State University.

Future land use was also assessed in the 2018 Old Fort Bayou Watershed Implementation Plan. Future land use data was compiled by the Gulf Regional Planning Commission in 2013 and based on the jurisdictions' comprehensive plans. Jackson County is the only jurisdiction that has updated its comprehensive plan since that assessment with no notable changes to anticipated future land use in the Old Fort Bayou Watershed.[1] One potentially significant development, however, is that the City of Ocean Springs is working through the process of annexing two areas of Jackson County. A large part of Area 1 being considered for annexation (See Figure 3) is within Old Fort Bayou Watershed. Currently, there is no timeline available for this project. If annexed, there could be potential implications for future land use plans, zoning, and water/sewer infrastructure.

Figure 3: Proposed Annexation Areas, City of Ocean Springs, MS



2.2 Human Resources

2.2.1 Demographics

In the spring of 2021, the Census Bureau released the data from the 2020 Census. The available data has been included in this plan update. It is important to note that there was a modification of census tracts between 2010 and 2020 so the data from 2010 and 2020 are not a completely accurate direct comparison; however, the data can be used to examine overall trends. From 2010 to 2020, the population of the watershed increased from 20,235 people to 30,900 people. Of the total population, 77% are white, 11% are Black/African American, 7% are Hispanic/Latino(a), and 7% are Asian. The growing Hispanic and Asian populations suggest that consideration should continue to be given to tailoring education and outreach such that it can overcome potential language barriers to those communities.

Over the past decade, the percentage of residents living below the poverty limit has increased to almost 10%. This is still well below the rates for Jackson County (15%), Mississippi (20%), and

the USA (13%). It is also below the 20% threshold that is considered the rate of high poverty for rural areas and tipping point at which poverty will continue to grow in neighborhoods.

There is a total of 13,026 housing units within Old Fort Bayou Watershed – an increase of more than 4,000 housing units since 2010. Of the current housing, 7% are vacant – a decrease of 11% since 2010. This is a relatively low vacancy rate compared to Jackson County (10%), Mississippi (12%), and the USA (10%). The majority of the housing in the watershed is owner occupied (69%) which may continue to be a positive factor in improving environmental stewardship in the watershed.

An increasing number of households in the watershed continue to be homes to seniors (41%) and children (35%). These are important factors to continue to consider when developing programming, education and outreach strategies, and waterway access points.

2.2.2 Municipal

Old Fort Bayou Watershed is a multi-jurisdictional watershed. The watershed includes part of the City of Ocean Springs to the southwest, part of Gautier to the southeast, and spans into Jackson County to the north. Municipal stakeholders and a map of the different jurisdictions were included in the 2018 Old Fort Bayou Watershed Implementation Plan. There are no changes to include in this plan update.

2.2.3 Civic Infrastructure

There are several civic organizations that are active in Old Fort Bayou Watershed and important to current and future watershed protection strategies. These include, but are not limited to, the Land Trust for the Mississippi Coastal Plain, The Nature Conservancy, and the Mississippi State University Extension Service. Brief descriptions of each organization was included in the 2018 Old Fort Bayou Watershed Implementation Plan. All of the organizations noted in the 2018 plan are still active in Old Fort Bayou Watershed. Since the 2018 plan was completed, representatives from the Ocean Springs Environmental Alliance and Old Fort Bayou Estates Civic Association have joined the Watershed Committee. Descriptions of these organizations are included below.

Ocean Springs Environmental Alliance

Ocean Springs Environmental Alliance are a group of local citizens who came together to develop socially responsible, business responsive, and environmentally sustainable programs that provide community and educational benefits for the citizens of Ocean Springs. These programs are focused on balancing environmental sustainability with the integration of community use and protection of natural resources. The alliance is committed to the stewardship of the area's natural resources for the benefit of current and future generations. The Alliance's vision is to work toward a sustainable community in harmony with the coastal environment.

Old Fort Bayou Estates Civic Association

The Fort Bayou Estates Civic Association includes the residences of Fort Bayou Estates, Braemar and Mount Vernon neighborhoods. The association provides community events within the

neighborhoods along with publishing two newsletters per year. The association is available for all residents in the area to participate and help make the neighborhood friendly, safe, and fun.

2.3 Physical Setting

Section 2.3 of the 2018 Old Fort Bayou Watershed Implementation Plan covers aspects of the physical setting of Old Fort Bayou Watershed including soils and geology; ecoregion; wetlands; climate and climate change; and conservation mapping. As part of this plan update process MDEQ and the U.S. Fish and Wildlife Service ran a comparison of the 2018 and 2022 National Wetlands Inventory data for Old Fort Bayou Watershed. No change was found in the analysis.[2] In addition, no other changes have occurred in the other subsections of the watershed's physical setting section.

2.4 Water Resources

2.4.1 Groundwater

Since the development of the 2018 Old Fort Bayou Watershed Implementation Plan a report on the groundwater resources of Jackson County was published by the Mississippi Department of Environmental Quality's Office of Geology in cooperation with the Office of Land and Water Resources.[3] This report was in the process of being completed at the time the original watershed assessment was being conducted and the primary author of the report was actively involved in providing general information as cited in the 2018 plan, but the specifics of the report were not publicly available at the time.

The 2019 report did note the areas where aquifers that service Jackson County are recharged. This was not documented in the 2018 Old Fort Bayou Watershed Implementation Plan and is important to know so that infiltration opportunities can be protected in these areas. Drinking and potable water in Old Fort Bayou Watershed is mainly supplied by water from the Lower Graham Ferry and Upper Pascagoula aquifers.[4] The recharge for the Lower Graham Ferry is primarily from the exposed sands in the northwestern part of Jackson County and somewhat from river terraces in the northeast part of the county. The recharge area for the Upper Pascagoula is in the northeastern part of Jackson County, as well as from exposed sands in the northern part of George County.[5]

After going through the final report published in 2019, the overall findings documented in the 2018 Watershed Plan are still accurate. The 2019 report found the following:

- Static water levels in Jackson County have generally been stable or only slightly declining since the mid-1970's;
- There is ample water supply for future generations;
- There has been no evidence of saltwater intrusion in confined aquifers and is not anticipated to be a problem in the future; and

- The main drinking water quality problem is color and recent advances in filtration systems have essentially removed the problem.[6]

2.4.2 Access and Recreation

The coast and its upland waterways provide the opportunity for a wide range of recreational activities including fishing and kayaking. Old Fort Bayou is well positioned in terms of public access and recreation opportunities. The Bayou became a designated blueway under the direction of the Land Trust for the Mississippi Coastal Plain following the development of the 2007 Action Plan. Public access and recreation opportunities are well documented in the blueway guide that was included as Appendix G in the 2018 Old Fort Bayou Watershed Implementation Plan. The 2018 Old Fort Bayou Watershed Implementation Plan and the Jackson County Bicycle, Pedestrian and Trails Master Plan, also developed in 2018, both incorporated recommendations to extend the Old Fort Bayou Blueway to include Bayou Talla.[7] This project is now in the final phase of being completed and updated maps and guides are expected to be available online early fall 2023.

2.4.3 Wildlife and Fisheries

Old Fort Bayou Watershed supports a broad diversity of wildlife as documented in the 2018 Old Fort Bayou Watershed Implementation Plan. The Mississippi National Heritage Inventory keeps a database of critical species known as species of "special concern". After review by the U.S. Fish and Wildlife Service office in Hancock County, several of the species identified as being of "special concern" and possibly in Jackson County are listed as threatened.[8] Critical species confirmed or likely in Old Fort Bayou Watershed include the following:

- Mississippi Sandhill Crane (Endangered/Critical Habitat)
- Gulf Sturgeon (Threatened/Critical Habitat)
- Alabama Red-bellied Turtle (Endangered)
- Black Pinesnake (Threatened)
- Gopher Tortoise (Threatened)
- Dusky Gopher Frog (Endangered/Critical Habitat)
- Louisiana Quillwort (Endangered)

2.4.4 Designated Use Classifications and Water Quality Standards

Old Fort Bayou is classified as suitable for "Recreation" from Biloxi Bay to Bayou Talla and suitable for "Fish and Wildlife" from Bayou Talla to its headwaters. Waters in the Recreation classification are suitable for primary contract recreation such as swimming, while waters in the Fish and Wildlife classification are suitable for secondary contact recreations (i.e. kayaking, where full body immersion is unlikely), fish consumption and aquatic life uses.[9] There has been no change in this classification since the development of the 2018 Old Fort Bayou Watershed Implementation Plan.

The current water quality standards for bacteria for Recreation set a threshold based on a geometric mean of 126 culturable e. coli bacteria per 100 ml, and state that the samples analyzed during a 30-day period not to exceed 410 e. coli per 100 ml more than 10% of the time. In addition, there should be a minimum of five samples taken over a 30-day period with no less than 12 hours between individual samples. For both marine and estuarine coastal recreational watershed, enterococci shall not exceed a 90-day geometric mean of 35 per 100 ml. In addition, no samples examined during the 90-day period should exceed 130 per 100 ml more than 10% of the time.[10] The guidance document was updated in 2021, but the standards for bacteria are the same as the 2017 standards used for the 2018 Old Fort Bayou Watershed Implementation Plan. Results are further discussed in Section 2.4.5.

The 2018 Plan also recommended monitoring for nutrients in the watershed including Total Phosphorus (TP) and Total Nitrogen (TN) due to existing land uses and the likelihood of future development. As a result, MDEQ did ambient fixed monitoring at two sites on Old Fort Bayou in 2019, 2021 and 2023. Results are further discussed in Section 2.4.5. MDEQ has not yet adopted numeric water quality standards for allowable nutrient concentrations but there are several proposed thresholds that should be considered if future monitoring is arranged. The State of Mississippi, for example, has developed numeric nutrient thresholds for non-tidal streams and rivers to protect aquatic life in Mississippi. The recommended threshold for TN in southeast Mississippi rivers and streams ranges from 0.31 to 0.68 mg/l and the recommended threshold for TP ranges from 0.01 to 0.05 mg/L, depending on the approach.[11]

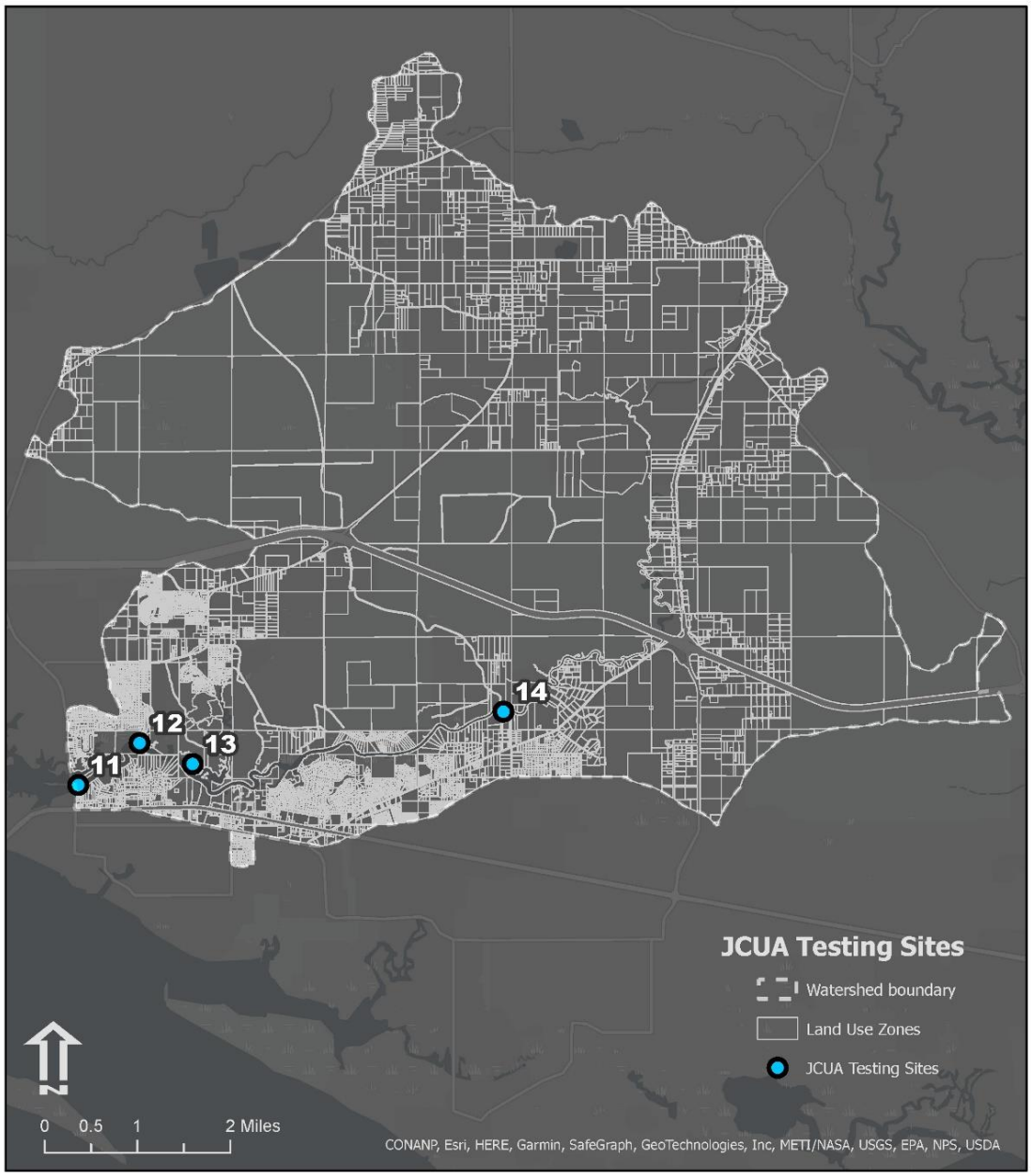
2.4.5 Current Status of Water Bodies

Pathogens

As previously mentioned, Old Fort Bayou (Waterbody ID MS118M1) is a tributary of the Back Bay of Biloxi and Biloxi Bay and, as a result, was listed on the EPA's 1998 Section 303(d) list of impaired waterbodies for fecal coliform levels that did not meet water quality standards. BMI Environmental Services, LLC, in partnership with Nutter & Associates was hired as a project consultant between August and December 2018 to analyze available water quality data for Old Fort Bayou as compared to the TMDL and approved thresholds. A final report was included in the 2018 Old Fort Bayou Watershed Implementation Plan as Appendix D: Old Fort Bayou Fecal Coliform Bacteria Total Maximum Daily Load Reduction Plan. The report found that "bacterial water quality between 2009 and 2017 was generally in compliance with MDEQ designated use standard for Recreation."[12] Where thresholds were exceeded tended to be correlated to heavy rainfall and bacterial loading was found to primarily be associated with stormwater runoff from upland areas.[13] The sampling point, however, was at a state ambient monitoring station (#0481299) near the mouth of Old Fort Bayou and the report noted a "lack of spatial water quality data within the watershed."[14]

Since the development of the 2018 Old Fort Bayou Watershed Implementation Plan, the Jackson County Utility Authority (JCUA) has been sampling and reporting enterococci county-wide. Figure 3 shows the sampling sites that are within Old Fort Bayou Watershed.

Figure 3: JCUA Water Quality Testing Sites in Old Fort Bayou Watershed



Source: Testing site locations from Jackson County Utility Authority (2023). Map by Geosystems Research Institute, Mississippi State University.

Data was collected monthly at the Old Fort Bayou testing sites between December 2020 and November 2022, at which point it has started to be collected quarterly. The county-wide testing results by testing site are included as Appendix C: JCUA Water Quality Testing. Between December 2020 and June 2023, spikes in enterococci above the threshold were noted at all four sites in Old Fort Bayou Watershed ranging from 107.60 colonies per mg in November 2022 to 1,986.30 colonies per mg in March 2021 at site 12. Sites 11 and 12 saw the most spikes (6 per site for the sampling period), while site 13 saw five spikes and site 14 saw two spikes. This indicates that more pathogen loading is coming from the lower, more urbanized area of the

watershed. Spikes across the sites tended to occur at the same time indicating a correlation with stormwater runoff from significant rain events. JCUA is continuing to monitor at these sites throughout the watershed and has been implementing a number of projects as represented above in Section 1.3: Related Plans and Projects. In addition, JCUA is also pursuing additional project funding from such sources as the Gulf of Mexico Energy Security Act (GOMESA), American Rescue Plan Act (ARPA), and Gulf Coast Restoration Fund (GCRF).[15]

Nutrients

At the request of the Old Fort Bayou Watershed Committee, MDEQ did ambient fixed monitoring at two sites on Old Fort Bayou in 2019, 2021 and 2023. Data for Total Nitrogen and Total Phosphorus are summarized below in Table 3. Complete sample results are included as Appendix B: MDEQ Water Quality Testing. The first site is located in the headwaters of Old Fort Bayou adjacent to The Preserve Golf Club (8901 MS-57, Vancleave, MS 39565). This site is in the more rural part of the watershed. The second site is further downstream just east of where Bayou Talla connects with Old Fort Bayou, at a property known as Twelve Oaks (1112 Hanley Rd, Ocean Springs, MS 39564). This site is surrounded by more urban land uses and higher-density residential. These sites were chosen because of their locations in the watershed and differences in surrounding land uses and because they were monitoring locations for the students at St. Martin High School also participating in the Old Fort Bayou Watershed planning work.

Table 3: MDEQ Ambient Fixed Monitoring at Old Fort Bayou

The Preserve Golf Club

901 MS-57, Vancleave, MS (upstream)

Indicator	2019	2021	2023
Total Nitrogen	0.24 mg/L	0.24 mg/L	0.49 mg/L
Total Phosphorus	0.02 mg/L	0.02 mg/L	0.02 mg/L

Twelve Oaks

1112 Hanley Rd, Ocean Springs, MS (downstream)

Indicator	2019	2021	2023
Total Nitrogen	0.62 mg/L	0.40 mg/L	0.31 mg/L
Total Phosphorus	0.14 mg/L	0.12 mg/L	0.02 mg/L

Source: Mississippi Department of Environmental Quality, Office of Pollution Control Laboratory.

All results for Total Nitrogen were within the threshold range. Total Phosphorus was high and above the threshold range at the Twelve Oaks site in 2019 and 2021, but much lower in 2023. It is important to note that these were one-time samples and not part of a consistent sampling regime done over the recommended 30-day period, so the results are not conclusive. They do show that Total Phosphorus in connection to more urban land uses at the lower end of the watershed is a higher concern in terms of nutrient levels in Old Fort Bayou Watershed. Potential sources of pollutants are further discussed in Section 2.4.6.

Students at St. Martin High School also tested water quality in 2019 and 2023 at both The Preserve Golf Club at Twelve Oaks. The 2018 data was included in the 2018 Old Fort Bayou Watershed Implementation Plan. In 2023 the students also tested water quality at the site of the future water testing stand on Yellow Jacket Trail on school property. The waterway is a tributary of Bayou Talla. More information on the Yellow Jacket Trail project is included as Appendix H: Yellow Jacket Trail. The students used Earth Force® Low Cost Water Monitoring kits

and collected information on water temperature, turbidity, pH, Dissolved Oxygen, Phosphorus and Nitrates. A summary of the results is included below in Table 4.

Table 4: St. Martin High School Water Quality Testing Results.

The Preserve Golf Club

901 MS-57, Vancleave, MS (upstream)

Indicator	2018 Results	Rating	2023 Results	Rating
pH	6.3	Good	5.9	Good
Turbidity	30.6 JTU	Good	100 JTU	Poor
Dissolved Oxygen	66% Saturation	Fair	48% Saturation	Poor
Phosphate	1.5 ppm	Good	1.3 ppm	Good
Nitrate	5 ppm	Fair	1.3 ppm	Fair

Twelve Oaks

1112 Hanley Rd, Ocean Springs, MS (downstream)

Indicator	2018 Results	Rating	2023 Results	Rating
pH	6.1	Good	6.1	Good
Turbidity	15.8 JTU	Good	40 JTU	Fair
Dissolved Oxygen	67% Saturation	Fair	86.5% Saturation	Good
Phosphate	1.7 ppm	Good	1.25 ppm	Good
Nitrate	5.1 ppm	Fair	0.7 ppm	Fair

Yellow Jacket Trail

1112 Hanley Rd, Ocean Springs, MS (tributary of Bayou Talla)

Indicator	2023 Results	Rating
pH	6.1	Good
Turbidity	30 JTU	Good
Dissolved Oxygen	83.5% Saturation	Good
Phosphate	1.3 ppm	Good
Nitrate	1.3 ppm	Fair

Source: St. Martin High School student data from November 5, 2018 using Earth Force® Low Cost Water Monitoring kits. The last measurable rainfall was 0.81 inches on October 26, 2018. St. Martin High School student data from May 12, 2023 using Earth Force® Low Cost Water Monitoring kits. The last measurable rainfall was 1.33 inches on May 12, 2023 at 8:00 am.

While results from the students' water quality testing cannot be held to the same level of scientific scrutiny as the water quality results analyzed above or other water quality data typically utilized by MDEQ, it is useful comparatively and in highlighting if there are any major areas of concern. Of note in the student data is the significantly higher turbidity reading at The Preserve Golf Club site in 2023 compared to 2019. The change in water quality was attributed to a major highway realignment and widening project that started in March of 2023 adjacent to the monitoring site. The highway construction project and potential sources of pollutants are further discussed in Section 2.4.6.

2.4.6 Sources of Pollution

The main pollutants in Old Fort Bayou Watershed as determined by water quality testing and visual observation appear to be pathogens, nutrients (specifically Phosphorus), sediment and litter. Each is discussed in more detail below.

Pathogens

Pathogens such as fecal coliform, e. coli and enterococci can come from waste from humans from failing septic systems or discharge from sewer treatment plants, domestic animal waste such as from pets or livestock, or wildlife. Basic levels of testing do not provide enough data to determine the specific source, however additional testing can be done that will give a better indication of where the pathogens are coming from. As discussed in the previous section, JCUA has been monitoring enterococci at four locations in Old Fort Bayou Watershed. See Figure 3. The majority of the higher readings were found at sites 11, 12 and 13, but all four sites are withing the lower, more urbanized section of the watershed. Based on the analysis of water quality data by BMI Environmental Services and Nutter & Associates, nonpoint source loading from stormwater runoff, sewer system overflows and direct deposits are likely the greatest course of anthropogenic pathogen loading.[16] JCUA has been working extensively county-wide to address potential sources of pathogens. Efforts are documented above in Section 1.3: Related Plans and Projects

Nutrients

Phosphorus and nitrogen are critical nutrients for all life, but high concentrations in waterways can result in harmful algae blooms and low levels of dissolved oxygen. Phosphorus is found in fertilizers, detergents, and human and pet waste, among other sources.[17] Phosphorus tends to attach itself to soil particles and often accumulates in waterways through stormwater runoff carrying sediment.[18] Higher levels of phosphorus have been detected at the lower end of the watershed where there are more residential and commercial land uses. Strategies for reducing the amount of phosphorus and other nutrients entering surface waterways are described in Section 3.1: Watershed Management Actions.

Sediment

Erosion and sedimentation specifically due to residential and commercial development were noted as a significant source of pollution in the 2018 Old Fort Bayou Watershed Implementation Plan. New development has continued at an increasing rate throughout the watershed and specifically in the Ocean Springs and St. Martin areas.

In addition, water quality data findings from St. Martin High School students in May 2023 alerted the watershed team to likely impacts from a major highway construction project adjacent to Old Fort Bayou. Turbidity readings from water samples from the bridge at The Preserve Gulf Club taken on May 12, 2023 were more than double what they had been in the past. See Table 4. In March 2023 the Mississippi Department of Transportation (MDOT) started on a major roadway construction project along State Route 57 adjacent to Old Fort Bayou at The Preserve testing site. The project will likely take 5 years to complete and includes 9 miles of

road widening and realignment between I-10 and Vancleave. The Storm Water Pollution Prevention Plan (SWPPP) submitted by Yates Construction to MDEQ anticipated impacts to Old Fort Bayou in addition to Bluff Creek and Little Bluff Creek.

After seeing the water quality testing results and doing a windshield survey of the construction (see Figure 4), the watershed team reported concerns to Jackson County.

Figure 4: SR 57 Highway Construction Project

Source: Photo taken by Kelsey Johnson on June 7, 2023 along SR 57 in Vancleave, MS.

The County put the watershed team in contact with Neel-Schaffer, Inc., the company overseeing the work for MDOT. All agreed with the concerns that erosion control and stormwater management efforts were not keeping up with construction and likely negatively impacting the waterway. On June 13, 2023, Neel-Schaffer suspended construction operations with MDOT's approval to focus solely on erosion control. According to the contractor:

> Resumption of operations was staggered depending on the particular type of operation. Bridge construction was allowed to resume on June 19th once their construction areas were deemed sufficiently stabilized. Earthwork operations began to resume during the week of June 26th on a limited basis. Some of the areas remain closed off and have been seeded and mulched until MDOT and the construction management team feel that the contractor is able to manage more open areas.[19]

The watershed team continues to be in communication with Neel-Schaffer as they work to proactively manage and improve efforts to minimize disruption to the waterway.

Litter

As documented in the 2018 Old Fort Bayou Watershed Implementation Plan litter is not well monitored within the watershed it is a visible source of pollution that ends up in the stormwater system and waterways. St. Martin High School students participating in the watershed planning work in 2021 documented ongoing litter problems in the watershed. See Figure 5.

In addition to litter in the waterways and along the roadways, there is evidence of illegal dumping of larger items in some of the more rural areas. Current efforts and proposed strategies for reducing litter are described in Section 3.1.

Figure 5: Litter in Old Fort Bayou Watershed.

Source: Maya Williams, St. Martin High School Student. Photo taken in Old Fort Bayou Watershed in June 2021.

Section 3 Management and Monitoring Plan

3.1 Watershed Management Actions

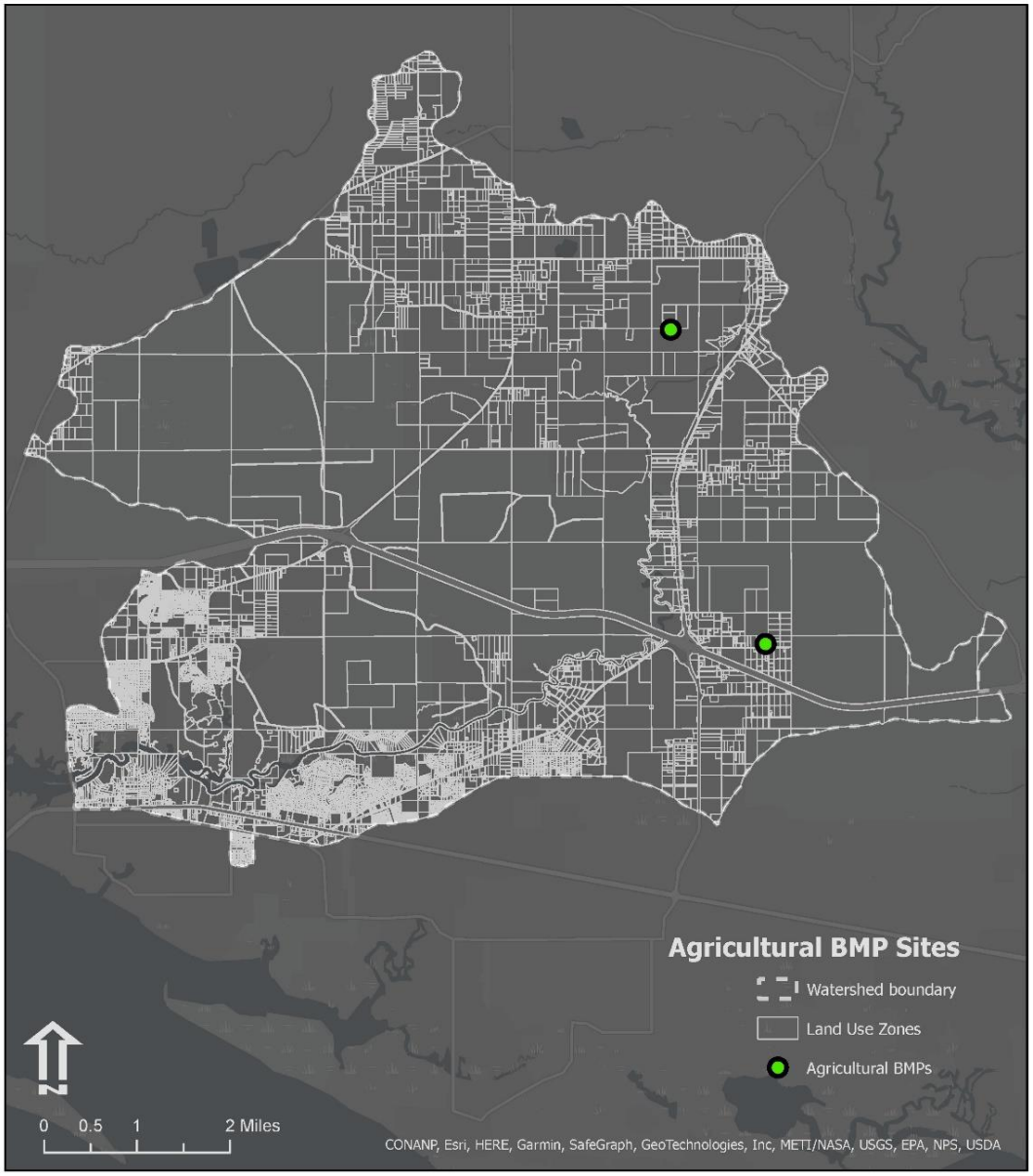
Best Management Practices (BMPs) are techniques used to manage and improve water quantity and quality. The goal of BMPs are to reduce or eliminate contaminants collected by stormwater as it moves into streams and rivers. Best management practices can be structural (i.e. permeable paving, living shorelines or bioretention areas) or nonstructural (i.e. wetland conservation or policies and ordinances that require or incentivize individuals to implement measures to improve water quality or manage the quantity of water coming off their property). Section 3.1.1 gives a summary of best management practices that have been completed since the development of the 2018 Old Fort Bayou Watershed Implementation Plan while Section 3.1.2 describes recommended best practices to be implemented in the future.

3.1.1 Current Management Actions

Old Fort Bayou Watershed 319 Project

The Old Fort Bayou Watershed 319 Project was the result of a partnership between the Mississippi Soil and Waters Conservation Commission, Mississippi Department of Environmental Quality, United States Environmental Protection Agency, United States Department of Agriculture Natural Resources Conservation Service, and the Jackson County Soil and Water Conservation District. The purpose of the project was to install selected Best Management Practices (BMP) in Old Fort Bayou Watershed. The project began in November 2019 and ended in August 2022. Two landowners participated in the program and project partners noted that the pandemic, weather, and market challenges were among the barriers to participation. One landowner installed a water and sediment control basin, and the other landowner did pasture and hayland planting in addition to installing a water and sediment control basin. A total of 22.7 acres was affected by the project. Total federal funds spent was $8,923 with a match of $4,237.40 bringing the project total to $13,160.40.[20] Figure 6 shows the locations of the BMPs within the watershed. Pollutant reductions from the project were calculated using the R5 model and are summarized below in Table 5. Appendix D contains the final report for the Old Fort Bayou Watershed 319 Project.

Figure 6: Agricultural BMP's in Old Fort Bayou Watershed.



Source: Site locations from Mississippi Soil and Water Conservation Commission (2023). Map by Geosystems Research Institute, Mississippi State University.

Table 5: Reductions from Agricultural BMP's Installed Based on R5 Model.

Nonpoint Source Pollutant	Level of Reduction
Sediment	149.2 tons
Phosphorus	124.5 lbs
Nitrogen	248.6 lbs

Source: Patrick Vowell, Water Quality Director, Mississippi Soil and Water Conservation Commission. Email Communication. 5 June 2023.

Jackson County SWCD continued to be involved with the two property owners that participated in the 319 project even after the program ended. An incredible result of the education and outreach provided by SWCD was that both properties owners installed additional BMPs post-award. One property owner did additional pasture plantings on 4 acres, installed 400 feet of cross fencing, and set up two additional watering facilities. The other property owner also did additional pasture plantings, installed 2,600 feet of cross fencing, set up two additional watering facilities, and installed a two-acre sediment basin/pond.[21] These BMPs were not factored into the reductions listed above in Table 5 but will undoubtedly have a positive effect on water quality in Old Fort Bayou Watershed.

During the project period Jackson County SWCD also conducted multiple school programs at St. Martin Elementary School and with the Vancleave Elementary Wings (gifted) class in which the Old Fort Bayou project was discussed. In addition, four Conservation Field Days were held with Vancleave Upper and Lower Elementary Schools. Through these efforts a total of 1000 students and teachers were exposed to the work.

NPDES Phase II Stormwater Management Plans

All three jurisdictions that overlap with Old Fort Bayou Watershed have NPDES Phase II Stormwater Management Plans are on file with the Mississippi Department of Environmental Quality. The purpose of the plans is to address any existing water quality issues and to prevent water quality impairment resulting from stormwater runoff within the jurisdiction's MS4 permitted area. The plans include strategies ranging from public education and involvement to pre and post-construction stormwater controls. Per ACT7, S-2 of the MS4 General Permit, the "coverage recipient is to annually summarize the progress made in implementing the conditions of the permit and the elements of the Storm Water Management Program (SWMP)." Local plans are based on the State's permit which dictates the contents of local plans and is supposed to be updated every five years. MDEQ's latest permit was issued in 2016. As a result, the jurisdictions' plans for 2016 through 2020 have been grandfathered in until the state issues a new permit. Jackson County and the City of Gautier are still working off their 2016 plans. The City of Ocean Springs voluntarily updated their plan in 2023. The MS4 plans for Jackson County and the Cities of Gautier and Ocean Springs were reviewed and incorporated, where applicable, in Section 3: Management and Monitoring Plan. The plans, however, do appear to be rather generic and a means for jurisdictions to remain in compliance with minimal effort and accountability. While this is understandable given the costs and additional capacity associated with higher levels of programming, it does little to accomplish water quality goals. As such, this plan update strongly recommends that MDEQ move forward with updating the state permit and requiring more monitoring and accountability tied with annual reporting. In addition, the plan also recommends some ways to improve and/or expand strategies included in the jurisdictions Stormwater Management Plans (See Section 3.1.2: Planned Management Actions and Section 3.1.3: Future Outreach and Education Activities)

Conservation Lands

The U.S. Fish and Wildlife Service (FWS), The Nature Conservancy (TNC), The Secretary of State Coastal Preserves, and the Land Trust for the Mississippi Coastal Plain (LTMCP) all have significant landholdings in Old Fort Bayou Watershed as described in the 2018 Old Fort Bayou

Watershed Implementation Plan. FWS and TNC both own and manage larger parcels in the middle of the watershed, while LTMCP has a number of smaller properties in the lower watershed along Old Fort Bayou. Secretary of State Coastal Preserves are managed by the Mississippi Department of Marine Resources. All four entities employ a range of BMPs on their properties. These too are well documented in the 2018 Old Fort Bayou Watershed Implementation Plan and there are no additions to include in the 2023 plan update.

One thing to note is that The Mississippi Sandhill Crane National Wildlife Refuge has a Comprehensive Conservation Plan that was approved in 2007 and was intended to guide the refuge's management programs for the next 15 years.[22] Currently the Refuge has no immediate plans for an update.[23] A recommendation is included in this 2023 watershed plan update for the Mississippi Sandhill Crane National Wildlife Refuge to thoroughly review and consider updating the 2007 Comprehensive Conservation Plan.

The Preserve Golf Club

The Preserve Golf Club, located in Vancleave and adjacent to Old Fort Bayou, has been a certified Audubon Signature Sanctuary since 2007. As such, The Preserve has been dedicated to protecting the natural environment in addition to providing a high-quality golf experience. In addition to being home to approximately 32 acres of mitigated wetlands, The Preserve is a showcase of many Best Management Practices. These BMPs were documented in the 2018 Old Fort Bayou Watershed Implementation Plan and are still being practiced. One interesting development since the 2018 plan is that The Preserve started using turf grass regulators more extensively throughout the golf course during the pandemic out of a financial need to reduce mowing and associated labor. By doing so The Preserve was able to save on labor costs in addition to reducing the amount of fertilizer, pesticide, and water needed to maintain the turf. Turf grass growth regulators were developed in the 1980's, are registered with the EPA, and are regulated just like pesticides and herbicides.[24] The Preserve has since continued to strategically use growth regulators due to the economic and environmental benefits.[25]

In addition to implementing an extensive range of BMPs at The Preserve, the Director of Golf Operations has been very involved in developing the BMP manual for golf courses in Louisiana and Mississippi. The manual was published in 2023 and is included as Appendix E: Water Resource Management BMPs for Golf Courses in Louisiana and Mississippi.

The Inlet

One of the priority projects identified in the 2018 Old Fort Bayou Watershed Implementation Plan was to design and implement an educational boardwalk trail adjacent to Old Fort Bayou at The Inlet Residences, a multi-use development in Ocean Springs. The Land Trust for the Mississippi Coastal Plain owns the land between the development and the bayou. The important habitat and marsh buffer had been negatively impacted by initial development and provided an important opportunity for restoration and environmentally-sensitive public access with an educational component. Between 2020 and 2023 the Gulf Coast Community Design Studio worked with LTMCP and other partners to design and install what is now called The Overlook at Old Fort Bayou. The official opening for the boardwalk and trail was held on July 19, 2023. The Overlook at Old Fort Bayou was designed to give residents and visitors the opportunity to view the bayou, wildlife, and surrounding habitats while not disturbing the delicate marsh environment adjacent to Old Fort Bayou. The long-term plan is to have the trail connect via a bridge to the Twelve Oaks nature trail also owned by the Land Trust for the

Mississippi Coastal Plain. A summary of the project is included as Appendix G: Boardwalk and Trail at The Inlet.

Yellow Jacket Trail and Outdoor Classroom

During the development of the 2018 Old Fort Bayou Watershed Implementation Plan the Gulf Coast Community Design Studio was able to work with St. Martin High School students with funding from a National Oceanic and Atmospheric Administration (NOAA) Bay Watershed Education and Training (B-WET) grant. During that time, it was identified that St. Martin High School, along with two other schools in the district (St. Martin Middle School and Upper Elementary School) had access to an outdoor classroom and trail which had not been managed or used for a period of time. Between 2020 and 2023, GCCDS and other partners worked with the school district to revitalize the trail and outdoor classroom including building a boardwalk over a continuously wet area and installing signage. During this time educational programming continued with St. Martin High School students. In addition, funding has been secured from Mississippi Power for materials to build a water quality testing stand along the trail where it reaches a tributary of Bayou Talla; one of the main tributaries of Old Fort Bayou. The testing stand is currently in the permitting phase and is expected to be completed in 2023. A summary of the project is included as Appendix H: Yellow Jacket Trail.

Bayou Talla Blueway

Another priority project identified in the 2018 Old Fort Bayou Watershed Implementation Plan was to extend the existing Old Fort Bayou Blueway up Bayou Talla. Bayou Talla is a 1.5-mile offshoot of Old Fort Bayou with headwaters that start near St. Martin High School. LTMCP worked with the Mississippi Department of Marine Resources (DMR) to install signage and updated printed and online blueways maps as part of the Mississippi Gulf Coast National Heritage Area Blueways program. Waterway signs were installed on July 7, 2023. The updated maps and guides are expected to be available online early fall 2023.

3.1.2 Planned Management Actions

Previous sections in the Watershed Plan Update have described challenges and opportunities facing Old Fort Bayou Watershed (Section 2.4.6 Sources of Pollutions) and identified the goals and objectives for restoring the watershed (Section 1.2.4 Goals and Objectives). The following management strategies are organized around these challenges and opportunities and are recommended based on their ability to address the goals for restoring and enhancing Old Fort Bayou Watershed. Many of these recommendations were included in the 2018 Old Fort Bayou Watershed Implementation Plan and remain unchanged but are included here so that all recommendations going forward can easily be accessed in one place. A full listing of potential management strategies recommended for Old Fort Bayou Watershed including responsible parties, potential funders, estimated costs and a recommended implementation timeline is included in Appendix F: Management Actions. Where applicable, expected reductions to fecal coliform loads are indicated to demonstrate ability to meet and/or exceed the goal of a 35% reduction as put forth by the 2002 TMDL. Actual reductions in fecal indicator bacteria loading can only be determined with a better understanding of sources of contaminants and modeling based on the size and location of BMPs to be installed. While this level of data does not exist for

the Old Fort Bayou Watershed Implementation Plan, there is little doubt that a combination of the strategies recommended below will accomplish the goals set forth in the 2002 TMDL and this planning document.

Old Fort Bayou Watershed Partnership

Since watershed boundaries do not correspond to municipal boundaries and often include multiple jurisdictions, watershed plans are usually under the care of a watershed partnership. A formal watershed partnership was not established as part of this planning work, however, the active participation of the Watershed Committee has contributed greatly to the development of the Old Fort Bayou Watershed Implementation Plan Update and all that has been accomplished in Old Fort Bayou Watershed to date. Up to this point, however, the meetings and activities of the committees have been coordinated by a paid facilitator. According to a study of watershed management organizations conducted at the University of Oregon, "many [watershed groups] were unable to sustain themselves once the sponsoring agency withdrew its provisional leadership" and that "volunteer coordinators, or part-time coordinators loaned from partner agencies, are inadequate to maintain effective group leadership."[26] Jackson County's previous Stormwater Phase II Program plans have included regular meetings of a county-wide task force. Current reports, however, do not include this. The 2018 Old Fort Bayou Watershed Implementation Plan included a recommendation for the task force to form an Old Fort Bayou Watershed subcommittee to act as the coordinating body for a watershed partnership. It is recommended that Jackson County consider reinstating the stormwater task force and including an Old Fort Bayou Watershed subcommittee. Another option would be for The Mississippi Department of Environmental Quality to consider funding a watershed coordinator grant program similar to what was done in California through the Department of Conservation.[27]

Data Gaps

Seasonal water quality monitoring of fecal coliform levels was regularly performed by MDEQ at a state ambient monitoring station (#0481299) near the mouth of Old Fort Bayou between 2009 to 2017. Since then, Jackson County Utility Authority has been collecting data on enterococci at four monitoring sites within the watershed and plans to continue monitoring county-wide. In 2019, 2021, and 2023, MDEQ did one-time ambient fixed monitoring at two sites on Old Fort Bayou looking specifically at nutrients. Aside from JCUA continuing to monitor enterococci levels, there are no plans for additional water quality monitoring. Significant data gaps remain and are described below. In general, ambient water quality data should continue to be collected, but from multiple sites throughout the watershed to give a more comprehensive picture of sources of impairments in Old Fort Bayou.

Primary Source(s) of Pathogens

Results from ongoing monitoring by Jackson County Utility Authority for enterococci levels within the watershed should continue to be analyzed. It might also be worthwhile to add an additional site(s) in the middle and upper reaches of the watershed for additional coverage since all four exiting testing sites are in the lower, more urban area of the watershed. Additional testing and analysis may give insight into likely sources of pathogens affecting Old Fort Bayou.

Nutrients

Prior to MDEQ sampling in 2019, 2021 and 2023, very little data existed on nutrient loads (Total Nitrogen and Total Phosphorus) in the watershed. These were one-time samples, however, and not consistent sampling done over the recommended 30-day period, so the results are not conclusive. They do show that Total Phosphorus in connection to more urban land uses at the lower end of the watershed is a higher concern in terms of nutrient levels in Old Fort Bayou Watershed. MDEQ, potentially in partnership with USGS, might consider doing a period of extended ambient monitoring for nutrients to establish more conclusive results on nutrient loading and potential sources.

Erosion and Sediment Delivery Rates

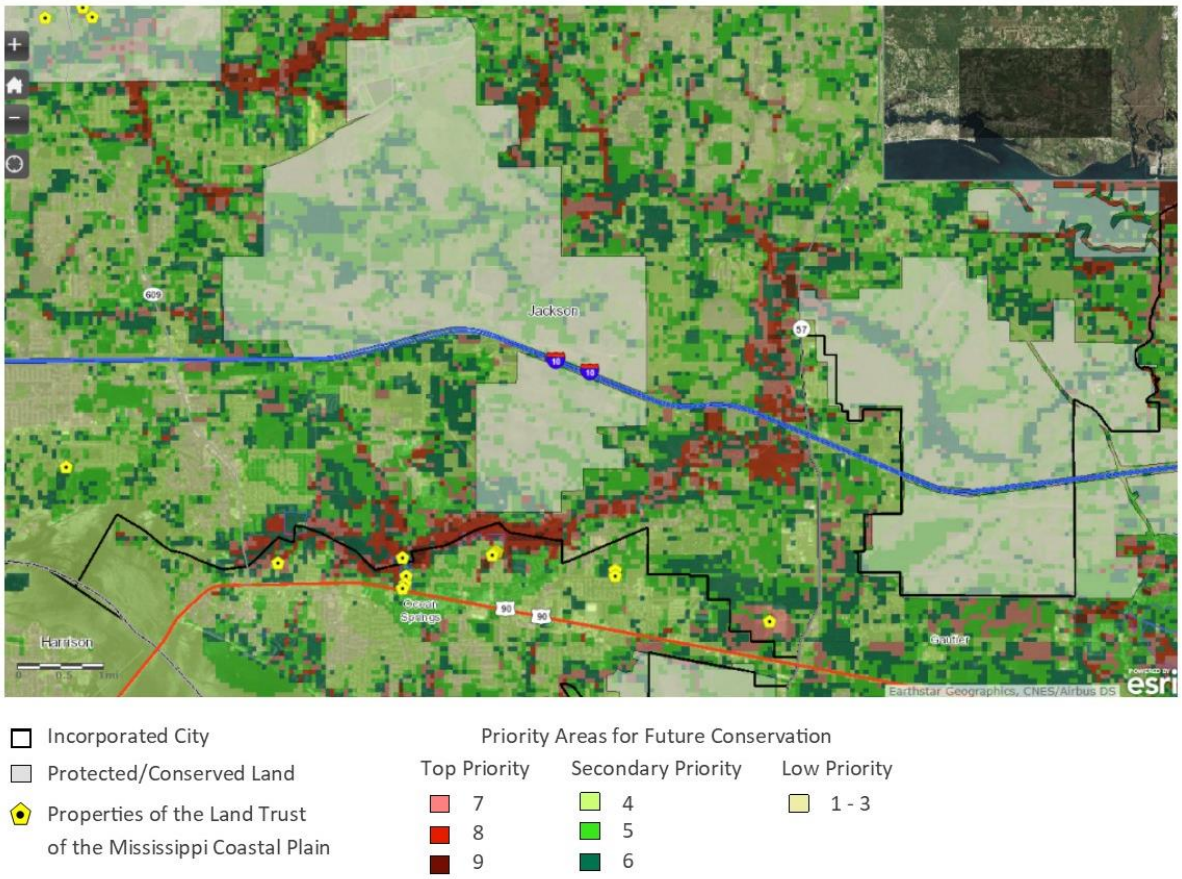
Based on visual surveys of the watershed and anecdotal information from longtime residents, sedimentation in Old Fort Bayou appears to be a growing concern. Main sources appear to be cleaned/cleared drainage ditches, new construction and major road construction projects. Methodologies such as semi-quantitative models developed for erosion and sediment yield assessments at the basin scale can be used to more narrowly define sources of erosion and sediment. After source and quantity are identified, a sediment delivery procedure can be used to determine how sediment is being naturally transported from the source of erosion to a specific location in the waterway. Employing such a model in Old Fort Bayou Watershed could help identify where to target BMPs so that more significant results can be realized with fewer investment dollars.

Conservation and Restoration

Conservation and Riparian Buffers

As part of the Conservation Legacy Project, the Land Trust for the Mississippi Coastal Plain has a map of Potential Conservation Lands that is a model of the suitability of land for conservation based on ranked environmental and land use conditions including wetlands, hydrological soil groups, flood zones, elevation/slope, upland forest and important ecosystems. Areas that are in Old Fort Bayou watershed and currently undeveloped were identified as being relatively high priority areas (See Figure 7) in terms of conservation and should be considered in planning and management strategies for Old Fort Bayou Watershed.

Figure 7: Conservation Priority Areas in Old Fort Bayou Watershed.



Source: Land Trust for the Mississippi Coastal Plain. Conservation Legacy: Potential Conservation Lands Map. < https://harcogis.maps.arcgis.com/apps/OnePane/basicviewer/index.html?appid=6662cd30b26f4f158cbb8fe7b5614272 >. Accessed 13 July 2023.

LTMCP should continue to work with Jackson County, Ocean Springs, Gautier and private landowners within the watershed to acquire property or easements that will protect critical land within the watershed. The focus of these efforts should be on preserving, expanding and restoring riparian buffers along Old Fort Bayou.

In addition, the Mississippi Sandhill Crane National Wildlife Refuge has established a partnership with Wildlife Mississippi, also known as the Mississippi Fish and Wildlife Foundation, to conserve private lands near the refuge through conservation easements. Conservation efforts should continue to be pursued and coordinated across the watershed.

Living Shorelines and Marsh Restoration

Streamside buffers and living shorelines are very effective in improving water quality and habitat along waterways. A living shoreline describes a natural approach to shoreline stabilization that reduces erosion while preserving or creating habitat along the shoreline. A visual survey done of Old Fort Bayou by members of the Steering and

Technical Advisory Committee on August 24, 2018 revealed that while many healthy marsh areas remain intact, there are also quite a few opportunities to remove derelict structures and hardened shorelines and replace them with living shorelines. The Living Shorelines Program, a sub-program of the Coastal Conservation and Restoration Program of Mississippi State University's Coastal Research and Extension Center is an excellent local resource for organizations and property owners.[28]

Education and outreach around living shorelines would be further enhanced by an incentive program for homeowners who willingly implement BMPs along the shorelines. The Scenic Streams Program and Partners for Fish and Wildlife Program are two examples designed to promote voluntary conservation and best management practices. The Scenic Streams program, under the leadership of the Department of Wildlife, Fisheries and Parks, began in 1999 and opened the door for participants in the program to be able to receive tax incentives that are or may become available. The Southeast Region Partners for Fish and Wildlife Program is a branch of the US Fish and Wildlife Service that provides technical and financial assistance to private landowners interested in improving habitat as they maintain their primary land management goals.

Recreation and Ecotourism

No Wake Zones

There are areas along the waterway where significant scouring is occurring. Some of this scouring may be the result of increases in stormwater runoff due to development, but some may be due to wake from boat traffic. Further observation of boat traffic could help to determine the level to which waves caused from water vehicles travelling at higher speeds is a problem in Old Fort Bayou. Signage or other means of educating the 35public on water quality impairments caused by scouring associated with wave action may be necessary.

Watershed Signage

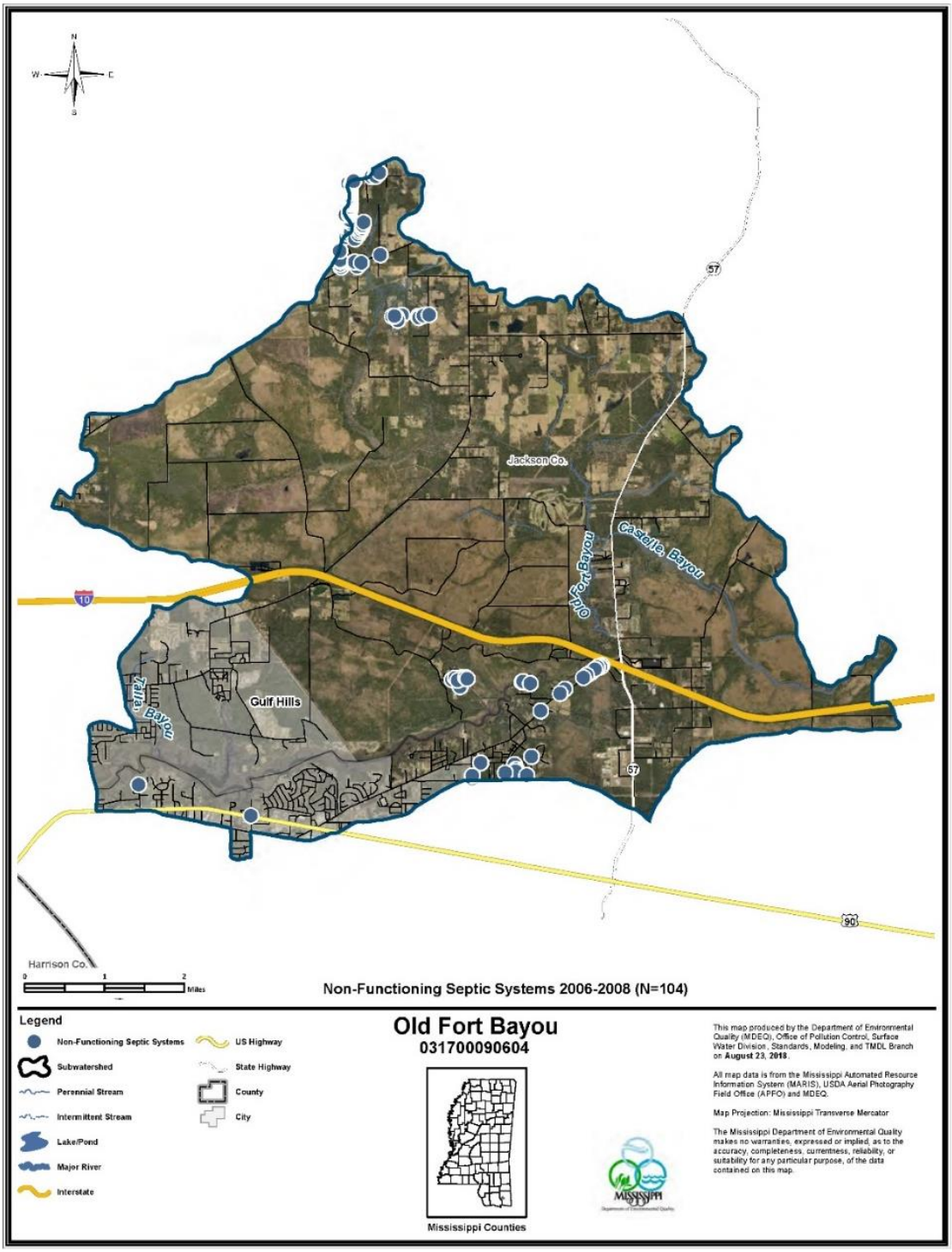
In addition to blueway signage, the addition of Old Fort Bayou Watershed signage strategically installed around the watershed is recommended as a low-cost tool for increasing community awareness of the watershed.

Waste and Wastewater

Nonfunctioning Septic Systems

According to a survey done by the Mississippi Department of Health (MSDH) in 2008, there were pockets of nonfunctioning septic systems in Old Fort Bayou Watershed. See Figure 8.

Figure 8: Nonfunctioning Septic Systems in Old Fort Bayou Watershed (2008)



The most significant clusters were in the northern tip of the watershed and in the south-central area. Following Hurricane Katrina, sewer and water districts across coastal Mississippi were able to tie-in many areas that were previously on septic systems,

primarily using funds through the Coastal Impact Assistance Program (CIAP). JCUA has been extremely proactive in its efforts to facilitate sewer tie-ins as documented in Section 1.3 Related Plans and Projects. An updated assessment of remaining nonfunctioning septic systems should be conducted, if possible. In addition, an inspection requirement should be included in Mississippi's onsite wastewater regulations. Current laws allow for installation of a septic system with initial approval by JCUA and MS Department of Health, in perpetuity, with no requirement for periodic inspection. The lack of an inspection requirement can be problematic as onsite disposal systems require specific maintenance (i.e. sludge removal from septic tanks over time, chlorine system repairs on sprinkler systems, etc).

The abovementioned efforts should also be coupled with an educational campaign targeted towards property owners about the risks of nonfunctioning septic systems and proper maintenance. An example program is being implemented in the town of Bluffton, South Carolina following recommendations in the May River Watershed Action Plan. The programming utilizes the Coast-A-Syst model of home assessment and action.[29]

Litter

Cleanups, Prevention, and Incentives

Mississippi State University's Coastal Research and Extension Center operates several programs on the coast related to litter removal and prevention. These include the Mississippi Coastal Cleanup Program, Mississippi Inland Cleanup Program, Plastic Free Gulf Coast, and S.W.A.P.S (Sustainability With Awareness and Prevention Solutions). The Coastal Cleanup Program reported three clean-up "events" between 2018 and 2019. In 2018, three volunteers removed 40 pounds of trash at Old Fort Bayou boat launch as part of the annual Coastal Cleanup event held in October. In 2019, one volunteer reported collecting 10 pounds of trash along Old Fort Bayou. In October 2019, 35 volunteers from Pecan Park Elementary removed 180 pounds of trash as part of the annual Coastal Cleanup.[30] During the spring semester 2020, S.W.A.P.S engaged with St. Martin High School students once a month over a four-month period. During that time, they had 89 student participants and 22 workshop participants.[31]

Between 2021 and 2022, the Plastic Free Gulf Coast program of MSU's Coastal Research and Extension Center partnered with the Walter Anderson Museum of Art in a year-long program of citizen science and art making targeting the root causes of microplastics that negatively impact coastal ecosystems. As part of the program students from St. Martin High School kayaked Old Fort Bayou and produced a mobile mural and short film about their experience. Plastic Free Gulf Coast also supported the lead science teacher at St. Martin with a microplastic water filtration set-up for continued education around microplastics in the environment.[32]

In addition to programs offered through the Coastal Research and Extension Center, Mississippi Power's Renew Our Rivers Program is another potential partner that can help with future cleanups from the water. Finally, restaurants on Old Fort Bayou and/or other businesses or organizations could also offer a reward or incentive to patrons to who document litter collection efforts along the bayou or in the watershed.

Trash Catches in Commercial Area

Where there are curb and gutter drainage systems, especially in commercial areas, litter can easily be washed down the storm drains and into waterways. Trash catches or drain guards installed at the catch basins would help prevent litter from entering the waterways.

Street sweeping

Roadway litter and debris are evident throughout the watershed and larger region and easily make their way into waterways through the drainage system. Regular street sweeping should be coordinated through the county and city road maintenance departments.

Adopt-a-Roadway

Currently, adopt-a-highway programs are administered by the federal and state departments of transportation. Eligible roadways include federal and state highways. Through these programs, public and private organizations and individuals agree to clean a one- to two-mile segment of the highway a certain number of times per year. In exchange, dedication signage and clean-up materials are provided by the Department of Transportation. These programs not only serve to clean-up roadway litter, but also help deter litter in the first place. Drivers and pedestrians that see Adopt-a-Roadway signage and witness volunteers picking up garbage are more likely to think twice about littering in that area.

Urban BMPs

Nonstructural

Ordinance Updates

It is likely that an assessment of the jurisdictions' ordinances related to stormwater management will indicate that improvements can be made. Related ordinances include stormwater management ordinances; ordinances for stormwater runoff, illicit discharges, and illegal connections; flood damage protection ordinances; and building codes. Strong stormwater management ordinances and enforcement of ordinances are critical to reducing nonpoint source pollutants especially when it comes to erosion and sediment control.

Coastal Technical Manual

Effective stormwater management requires connecting the dots from policy implementation to proper construction and installation of best management practices. Many of the jurisdictions on the coast are looking to implement policies that would allow, incentivize or require pre- and post-construction best management practices addressing stormwater runoff, but are unfamiliar with some of the technical aspects or unclear about the implications of certain policies. The State of Georgia addressed this concern and information gap by creating a Stormwater Management Manual. The Georgia Stormwater Management Manual has several volumes including a Policy Guidebook,

Technical Handbook and Coastal Supplement. Jurisdictions in Georgia refer to these volumes in their policies and ordinances so that standards and guidelines are clear for all affected parties.

The Mississippi Department of Environmental Quality has developed a similar manual called *Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas*; however, it does not have as many technical details as the Georgia Manual, does not have a coastal supplement and is not used as effectively by jurisdictions in Mississippi as the Georgia Manual is in Georgia. MDEQ should consider adding a coastal supplement to their technical manual, so it is more relevant to jurisdictions on the coast or adopting Georgia's *Coastal Stormwater Supplement to the Georgia Stormwater Management Manual*. The Georgia Coastal Supplement and other examples of stormwater manuals can be found on the EPA's website at https://www.epa.gov/green-infrastructure/green-infrastructure-design-and-implementation. In addition, MDEQ should look to partner with the Mississippi Alabama Sea Grant Consortium, Grand Bay National Estuarine Research Reserve (NERR), or similar organizations and agencies to provide training to jurisdictions and engineers on how to use the manual.

Fertilizer Ordinance

The available water quality data as documented in Section 2.4.5: Current Status of Water Bodies, suggest that nutrient loads entering Old Fort Bayou are coming from the more urban area of the watershed. One potential source of this is fertilizer use. To address fertilizer use in urban areas many jurisdictions in Florida have adopted some form of a fertilizer ordinance based off of the Florida Department of Environmental Quality's Model Ordinance for Florida-Friendly Fertilizer Use on Urban Landscapes.[33] The jurisdictions in Old Fort Bayou Watershed should consider adopting some form of fertilizer ordinance, in coordination with education and outreach to property owners and lawn care businesses about responsible fertilizer use, as a means of reducing nutrients entering Old Fort Bayou.

Structural

Pre and Post Construction

Any type of construction or earthwork exposes soil and makes areas more susceptible to erosion. Best management practices for controlling impacts from construction are extremely important, especially given the increase in development following the recession. For most development, a Stormwater Pollution Prevention Plan is required in which the developer must show what best management practices they intend to implement to minimize impacts downstream.

In most jurisdictions on the coast, if a site is over five acres, the site is the jurisdiction of MDEQ. A Stormwater Pollution Prevention Plan (SWPPP), Large Construction Notice of Intent (LCNOI) and permit are required and must be filed

with MDEQ and the jurisdiction. Under five acres is the jurisdiction's responsibility. Most jurisdictions require that development under five acres have a permit, Small Construction Notice of Intent (SCNOI) and SWPPP. Usually if a site is under one acre the jurisdiction does not require a plan or permit.

MDEQ has a technical guide to assist in the development of these plans titled *Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas*. Volume one, *Erosion and Sediment Control Manual*, covers BMPs through construction and volume two, *Stormwater Runoff Management Manual*, covers post construction BMPs. There does not appear to be a lack of regulation or guidance concerning pre and post construction BMPs. The issue appears to be more with lack of capacity to enforce the SWPPP's. As development continues to increase in Old Fort Bayou Watershed, MDEQ and the jurisdictions need to view erosion and stormwater control as a priority and increase their capacity to monitor and enforce SWPPP's.

Drainage swale maintenance

The drainage systems in Old Fort Bayou Watershed are primarily open, grassy swales. This is an excellent starting point in terms of stormwater management because there are theoretically more opportunities for infiltration than with piped, curb and gutter systems. In order to function at an optimal level, however, swales need to be properly maintained. Maintenance typically involves litter control and maintaining the grass or wetland plant cover. Sediment needs to be removed once it has exceeded 25 percent of the original design volume, but scouring ditches without revegetating only creates more problems downstream. Grass should be mowed to a height of 3-4 inches and alternate planting should be considered where appropriate or where grass has not been successfully established. In addition, during construction it is important to stabilize the embankment either with a temporary grass cover or with natural or synthetic erosion control products. General maintenance guidelines for grassed swales were updated by the EPA in 2021[34].

Small Scale Urban BMPs

Nature-based solutions to stormwater management are some of the most effective means of reducing flooding and improving water quality from nonpoint sources. Some terms used by professionals to describe these nature-based solutions include Low Impact Develop (LID) and Green Infrastructure (GI). Low Impact Development refers to specific design practices at the site scale to infiltrate, filter, store, evaporate, and detain stormwater on-site and close to its sources. Green Infrastructure refers to the greater regional context and patchwork to mimic pre-development hydrologic flows including LID elements, but also including things like forests and natural buffers. Together LID and GI form a "treatment train" approach to stormwater management. They work together at both the site and regional scale and share common goals to:

- Manage stormwater on-site rather than sending it downstream;
- Slow and disperse stormwater so it can soak it the soil and replenish groundwater supplies; and

- Filter runoff from nonpoint sources to remove pollutants prior to discharging to natural water bodies.

In more urban areas there may not be opportunities for large-scale preservation or Green Infrastructure projects, but there are often many opportunities to implement smaller-scale LID strategies in existing developments. The cumulative impact of many small installations can have a tremendous impact on water quality and quantity within the watershed and take pressure off the existing, aging municipal infrastructure. In addition, small and highly visible demonstration projects can be implemented at schools, businesses, and organizations in and around the watershed. Coupled with educational signage, these projects can serve to inform community members about BMPs. Organizations like the Walter Anderson Museum of Art and the Mary C O'Keefe Cultural Center, for example, would be excellent sites for demonstration projects that also incorporate artistic components.

Some examples of Low Impact Development strategies appropriate for more urban environments include rain gardens, bio-swales, dry swales, flow-through planters, infiltration landscapes, rainwater harvesting, permeable paving and subsurface storage. The Gulf Coast Community Design Studio has been working over the past several years to educate local leadership, developers, contractors, and property owners about the benefits of utilizing LID strategies. Some of these efforts are described further below in Section 3.1.3: Education and Outreach Activities.

While there are currently no cost-share programs for property owners in urban areas to implement LID on their property like the Old Fort Bayou Watershed 319 Project described above, NRCS is in the process of expanding its scope of work to include what it is calling Urban Conservation. Continuing to educate stakeholders in combination with cost-share or grant programs would likely go a long way to increase the prevalence of nature-based stormwater solutions employed in Old Fort Bayou Watershed and across the region.

Agricultural and Rural BMPs

Nonstructural

Logging BMPs

Forested areas within Old Fort Bayou Watershed are periodically used for harvesting lumber. The Mississippi Forestry Commission (MFC) encourages BMPs in regard to forestry and logging and has a guide called *Best Management Practices for Forestry in Mississippi*. MFC could go a step further, however, and incentivize implementation of these practices. In Missouri, the Missouri Department of Conservation implemented a cost-share program designed to be a partnership between the logger and property owner.[35] The MDC pays loggers $10 to $20 per acre and landowners $5 for every acre in which they implement BMPs. Funding was provided through a Natural Resources Conservation Service Conservation Innovation Grant. Ordinances can also help improve logging

practices through regulation and/or incentives. An example of such an ordinance is from Oconee County, Georgia, where County Commissioners passed a Timber Harvest Ordinance in 2021.[36] Jackson County should consider using a similar mechanism to increase the implementation of logging BMPs.

Structural

The following structural, agricultural BMPs are recommended by the Jackson County Soil and Water Conservation District, Mississippi Soil and Water Conservation Commission and Natural Resources Conservation Service based on remaining opportunities following the implementation of the Old Fort Bayou/Tuxachanie Creek Watershed Nonpoint Source Pollution Demonstration Project that concluded in 2006.

During the development of the 2018 Watershed Implementation Plan the Jackson County Soil and Water Conservation District in coordination with the Mississippi Soil and Water Conservation Commission and United States Department of Agriculture Natural Resources Conservation Service assessed the remaining opportunities for BMPs in the more rural area in the northern part of the watershed; taking into account investments that were made between 2001 and 2006 as part of the Old Fort Bayou/Tuxachanie Creek Watershed Nonpoint Source Pollution Demonstration Project. Table 4 below is a result of that assessment. Since very few additional agricultural BMPs were installed since the abovementioned assessment (see Section 3.1.1: Current Management Actions and Figure 6: Agricultural BMPs in Old Fort Bayou Watershed) it is included in this 2023 plan update. Given the cost of inflation since 2018 it is important to note that cost estimates included in Table 4 are likely significantly lower than what current estimates would be. Practices and estimated need, however, are likely still accurate. Brief descriptions of each strategy included in the table can be found below in the subsection on Agricultural and Rural BMPs: Structural.

Table 4: Summary of BMPs Recommended for Old Fort Bayou Watershed

Practice	Average Unit NRCS Cost	Units	Total Cost
Critical Area Planting	$248.10	32 acres	$7,939.20
Fence	$1.91	12,499 ft	$23,873.09
Grade Stabilization Structures	$5,000	5	$25,000.00
Heavy Use Area	$1.04	8,000 acres	$8,320.00
Pipeline	$1.75	3,600 ft	$6,300.00
Stream Bank Protection	$1.54	1,588 acres	$2,445.52
Grassed Waterways	$1,648	13	$21,424.00
Pond	$3.77	2,120 acres	$7,992.40
Tank/Trough	$4,600	10	$46,000.00
TOTAL			**$149,294.21**

Heavy Use Area Protection

Heavy use area protection methods reinforce locations that are frequented by livestock by establishing vegetative cover, surfacing with suitable materials, or installing needed structures. Heavy use protection areas are often combined with tanks or troughs that hold drinking water for livestock.

Fencing

Fencing should be strategically placed to exclude livestock from areas that should be protected from grazing or access, such as waterways.

Pond (Alternative Water Source)

Ponds can be installed by constructing a dam or an embankment or by excavating a pit or dug out. Ponds can serve to catch and store runoff and act as a water source for livestock.

Critical Area Planting

Appropriate vegetation should be planted in areas that are critically eroded or likely to experience erosion. It is important for water quality for any eroded/erodible areas to be planted, it is emphasized here for rural and agricultural zones because these areas can easily go overlooked on larger plots of land.

Tank/Trough

A watering facility to be able to hold water for the purpose of livestock to drink.

Grade Stabilization Structures

An earthing, concrete, or other structure(s) built across a drainage to prevent gully erosion.

Pipeline

A waterline from existing water wells, troughs, or other water sources.

Stream Bank Protection

A vegetative, structural or combination treatment of streams designed to stabilize the stream and reduce erosion.

Grassed Waterways

Broad, shallow, and typically saucer-shaped channels designed to move surface water across farmland without causing soil erosion. The vegetative cover in the waterway slows the water flow and protects the channel surface from the eroding forces of runoff water.

3.1.3 Education and Outreach Activities

Education and outreach efforts are critical to informing the community about challenges and opportunities that affect the water quality in Old Fort Bayou Watershed and causing large-scale behavior change needed to improve impairments coming from nonpoint sources. Outreach efforts were planned and conducted as part of the 2018 watershed planning work and documented in the 2018 Old Fort Bay Watershed Implementation Plan. Education and outreach were specifically included as part of developing this watershed plan update. In addition, the Jackson County Soil and Water Conservation District and Mississippi Sandhill Crane National Wildlife Refuge have been providing education and outreach programming and materials to local school groups and at other events as documented in the jurisdictions' MS4 plans and the Mississippi Sandhill Crane National Wildlife Refuge Comprehensive Conservation Plan. LTMCP, MSU's Coastal Research and Extension Center, and TNC also regularly disseminate information and programming as part of their missions.

As mentioned above, education and outreach have and will continue to be key to both the success of the Old Fort Bayou Watershed Implementation Plan and overarching goal of improving water quality by reducing impairments from nonpoint sources in the watershed. Education and outreach efforts conducted since the development of the 2018 Old Fort Bay Watershed Implementation Plan along with recommendations for future activities are documented below. In addition, a full listing of potential education and outreach activities recommended for Old Fort Bayou Watershed including responsible parties, potential funders, estimated costs and a recommended implementation timeline is included in Appendix F: Management Action.

Education in Schools

The Gulf Coast Community Design Studio started doing watershed education programming focused specifically on Old Fort Bayou Watershed with students at St. Martin High School in 2018 with funding from NOAA's Gulf of Mexico Bay Watershed Education and Training Program (B-WET). Student data and input was included in the development of the 2018 Old Fort Bay Watershed Implementation Plan along with a recommendation to continue and expand programming in the St. Martin School District. Through the funding associated with this watershed plan update, GCCDS was able to do another round of programming with St. Martin High School students during the 2021 spring term and again during the 2023 spring term. Programming was tied in with the improvements being made to Yellow Jacket Trail (See Appendix H) and student data and input was included in the development of this 2023 Watershed Plan Update. GCCDS has also been working on developing relationships and pathways for additional programming in St. Martin Middle School and Upper Elementary School.

In addition, Ocean Springs' schools should include programming focused on watershed dynamics and stormwater runoff specific to Old Fort Bayou Watershed. The two schools in the Ocean Springs School District in closest proximity to Old Fort Bayou are the Ocean Springs Upper Elementary School and Pecan Park Elementary School. GCCDS currently has a cooperative agreement with NRCS that allows for watershed-based education and outreach around urban conservation opportunities that can be a potential means of funding continued work in schools in Old Fort Bayou Watershed. Additional

opportunities exist for programs of the Coastal Research and Extension Center including Plastic Free Gulf Coast and S.W.A.P.S to continue and expand programming with the schools in the watershed.

Arts Organizations

There are several arts organizations in Ocean Springs that would be excellent partners in terms of both demonstrating small-scale urban BMPs and watershed outreach and education with an art component. The Walter Anderson Museum of Art (WAMA) located in downtown Ocean Springs is based on Walter Anderson's vision for communities that exist in harmony with their environment. He greatly valued and was inspired by nature, particularly coastal ecosystems, as is evident in this internationally renowned artwork. This joint vision of art and environmental stewardship and proximity to Old Fort Bayou make WAMA an ideal candidate for a future partner in outreach and education.

Since the development of the 2018 Old Fort Bay Watershed Implementation Plan, The Friends of Arts, Culture and Education (FACE) nonprofit organization formed and is operating out of the former house on the Land Trust's Twelve Oaks property on Old Fort Bayou. FACE is the next evolution of The Friends of Mary C, which was a 501c3 non-profit organization with a mission to save and restore the landmark 1927 school building located at on Government Street in Ocean Springs. FACE's mission is to "instill a love of learning, encourage creative expression, and enrich lives through arts and culture experiences." With its location at Twelve Oaks and arts programming often rooted in nature, FACE could be a very effective partner in education and outreach efforts.

Low Impact Development

Jurisdictions along the Mississippi Gulf Coast, including those in Old Fort Bayou Watershed, seem to be much less comfortable in implementing Low Impact Development (LID) strategies than other areas of the County and do relatively little to promote or incentivize the use of LID with private developers. This problem was identified during the 2018 watershed planning effort and a recommendation was made to educate the jurisdictions on Low Impact Development techniques and to provide the jurisdictions and developers with tools to increase their capacity to promote and use LID.

Since 2018 GCCDS has been working to identify barriers to implementing LID strategies on the Mississippi Gulf Coast and to educate stakeholders. Along with setting up booths at various events, festivals, and conferences, GCCDS has done surveying and created an ArcGIS StoryMap titled *LID Gulf Coast*. The StoryMap website was designed as an educational tool to prompt continued dialogue around Low Impact Development for the Mississippi Gulf Coast and to document the growing number of projects being implemented coastwide. Some of the barriers to LID that have been identified include resistance to change, costs (both real and perceived), lack of understanding and/or awareness, and lack of leadership (regulatory, municipal, etc.). Most recently GCCDS and LTMCP staffed a booth at the annual Mississippi Municipal League Conference held in Biloxi on June 26 and 27, 2023 focused on educating leadership and contractors on the benefits of LID. GCCDS will also be hosting an educational station at a training being put on by MS-AL Sea Grant for local officials and flood plain managers on August 16,

2023, in Biloxi. GCCDS plans to continue to provide education and outreach around LID and Green Infrastructure and to implement projects as funding allows.

Pollution Prevention

As previously mentioned, Mississippi State University's Coastal Research and Extension Center operates several programs on the coast related to litter removal and prevention. These include the Mississippi Coastal Cleanup Program, Mississippi Inland Cleanup Program, C (Sustainability With Awareness and Prevention Solutions). All of these programs have educational components. Where time and funding allows, these programs should seek opportunities to do work in areas of Old Fort Bayou Watershed.

Projects for Scout Troops

Many Boy and Girl Scout troops are active in Old Fort Bayou Watershed. Often these young men and women are looking for volunteer projects to help complete requirements of their programs. Projects related to the Soil and Water Conservation Badge, for example, are very relevant to the watershed work.[37] The Mississippi Sandhill Crane National Wildlife Refuge also recommends developing a fire ecology merit badge. Organizations like GCCDS, LTMCP, SWCCC and TNC could serve as resources for troops pursuing badges in these areas.

Septic System Maintenance

To compliment stronger requirements around onsite wastewater regulations and continued efforts to tie-in additional areas on septic system, an educational campaign about the risks of nonfunctioning septic system and proper maintenance should target areas in the watershed where high concentrations of septic systems remain. An example program is being implemented in the town of Bluffton, South Carolina following recommendations in the May River Watershed Action Plan. The programming utilizes the Coast-A-Syst model of home assessment and action.[38]

Signage

Strategically placed signage with an educational component can be a very cost-effective way to increase community members' awareness of water quality challenges and best management practices. Educational signage should be installed when publicly accessible BMPs are installed. If not already present, signage should be added at public access point or trails. It is also recommended that general Old Fort Bayou Watershed Signs be added strategically throughout the watershed. Signage should be consistent with the recently completed National Heritage Area's Blueways Design Guide.

Pet Waste

While the current level of pathogen testing does not distinguish between septic waste, domestic animal waste and wildlife, anecdotally, there appears to be an excessive amount of pet waste that is left on the ground. Bacteria in pet waste does break down naturally, however the ecosystem cannot handle the number of domestic dogs typically concentrated in a small area. The natural ecosystem can only handle two canines in a square mile. In urban areas, there are often as many as 125 dogs per square mile. Education around proper disposal of pet waste should be distributed by the local jurisdictions, property owners' associations, and local pet-related businesses such as

veterinary clinics. Signage and waste receptacles should also be provided in areas where people frequently walk pets.

3.2 Plan Evaluation and Revision

3.2.1 Monitoring Plan

Jackson County Utility Authority plans to continue with quarterly monitoring of enterococci at the four sites in Old Fort Bayou Watershed and throughout the county. This will be the most consistent source of monitoring going forward as MDEQ does not have any formal plans to continue monitoring in the watershed. It is also the hope that given the resources provided to St. Martin School District, teachers will continue monitoring water quality on a regular basis and report finding to MDEQ, GCCDS and LTMCP. GCCDS also plans to continue working with schools in the watershed to do watershed education programming focused specifically on Old Fort Bayou utilizing funding through an NRCS cooperative agreement and other potential sources of funding. Given the lack of a formal Old Fort Bayou Watershed Partnership, the Gulf Coast Community Design Studio and Land Trust for the Mississippi Coastal Plain will be the main local advocates to keep implementation of the 2023 Watershed Plan Update moving forward.

3.2.2 Adaptive Management and Plan Revision

The goals, objectives and resulting strategies and recommendations included in the Old Fort Bayou Watershed Plan Update have been determined based on an assessment conducted between 2020 and 2023. Environmental and socioeconomic conditions are ever changing. These conditions, as well as any implemented Best Management Practices, will likely have an impact on the watershed and water quality in Old Fort Bayou. As such, it is recommended that an integrated assessment of Old Fort Bayou Watershed be conducted on a routine basis and that adjustments or amendments be made to the Old Fort Bayou Watershed Implementation Plan as justified by the results of the assessments. According to the Mississippi Coastal Nutrient Reduction Strategy, "five years is considered adequate for observing near-field changes in water quality from the implementation of various management practices in the watershed."[39] The Old Fort Bayou Watershed Partnership should begin conducting its first assessment and plan revision in 2028.

Appendices:

A: Old Fort Bayou Watershed Committee
B: MDEQ Water Quality Testing
C: JCUA Water Quality Testing
D: Old Fort Bayou 319 Project Final Report
E: Water Resource Management BMPs for Golf Courses in Louisiana and Mississippi
F: Management Actions
G: Boardwalk and Trail at The Inlet
H: Yellow Jacket Trail

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