Integrated Draft Feasibility & Environmental Impact Statement

Pearl River Basin, Mississippi
Federal Flood Risk Management Project
Hinds & Rankin Counties, MS

Project Sponsor:
Rankin-Hinds Pearl River Flood and Drainage Control District

June 13, 2018

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EXECUTIVE SUMMARY

INTRODUCTION

The Integrated Draft Feasibility Study and Environmental Impact Statement (FS/EIS) was prepared in order to provide a recommendation for federal participation in flood risk management within the Pearl River Basin in Mississippi. The project for Pearl River Basin flood control has a long history of Congressional support and authorization, demonstrated in the most recently enacted Water Resources Development Act (WRDA) legislation, the Water Infrastructure Improvements for the Nation Act (the WIIN Act), now codified as Public Law 114-322. This most recent action continues the project's status as a Congressionally-authorized project (Section 1322(b)(4)(A)) and accomplishes three things, specifically:

1. It affirms the project's history, as originating in Section 401(e)(3) of WRDA 1986 and modified by Section 3104 of WRDA 2007;
2. It preserves the project's authority and status under the provisions of Section 211 of WRDA 1996; and
3. It directs the Secretary of the Army to "expedite review and decisions on recommendations" for the project.

Section 3104 of WRDA 2007 modifies the Pearl River Basin project originally authorized by Section 401(e)(3) of WRDA 1986 to authorize the Assistant Secretary of the Army for Civil Works (ASACW) to construct a project generally in accordance with the plan described in the Pearl River Watershed, Mississippi, Feasibility Study Main Report, Preliminary Draft, dated February 2007 (2007 Preliminary Draft). The Tentatively Selected Plan, described herein, meets the requirements set out in Section 3104 while simultaneously reducing the footprint of the LeFleur Lakes plan mentioned in the 2007 Preliminary Draft, allowing for flood risk management and recreational benefits with fewer environmental impacts.

For the past 100 years, headwater flooding of the Pearl River has caused disruption to businesses and industry throughout the Jackson, Mississippi, metropolitan area, putting over 5,000 commercial and residential structures at risk of flood damage. The most notable of the numerous flood events that have affected the Study Area is the Easter Flood of 1979, which disrupted businesses across the Jackson metropolitan area and affected major transportation routes, including two interstate highways and access to critical care facilities. The resulting damage to residential and commercial structures and

infrastructure (including the 46 MGD wastewater treatment plant serving the metropolitan area) totaled approximately $223 million. If a comparable event occurred in 2016, damages would surpass $1 billion.

Federal involvement in the Pearl River Watershed with respect to flood control measures dates back to at least the early 1900s. Multiple studies have been conducted on the Pearl River Watershed over the past thirty years, ranging from reconnaissance level studies to feasibility level studies. However, no major flood risk management measures have been put in place, leaving the majority of the flood prone Jackson metropolitan area unprotected.

On July 19, 2012, the Rankin-Hinds Pearl River Flood and Drainage Control District (Flood Control District), as the non-Federal sponsor, and the U.S. Army Corp of Engineers (USACE) entered into a Memorandum of Agreement, allowing them to continue the work of the 2007 Feasibility Study. Prior studies, engineering data, scoping meetings, and other information sources were used to the fullest extent, and this FS/EIS completes, re-scopes, and supplements information contained in the 2007 Preliminary Draft.

The Integrated FS/EIS will serve as the document for expedited review and decision by the Secretary, in accordance with the requirements of Section 1322(b)(4) of the WIIN Act. This summary is intended to inform the reader of the major factors that were considered in the investigation and that influenced the decisions documented in the FS/EIS.

MAJOR CONCLUSIONS AND FINDINGS

Planning Objectives

The overarching study goal is to provide a comprehensive solution to flood risk in the Jackson metropolitan area caused by the Pearl River. The investigation of the problems and opportunities in the Study Area led to the establishment of the following planning objectives:

- Reduce estimated annual flood risk from the Pearl River in the Jackson metropolitan area through the year 2065;
- Reduce loss of transportation routes with Average Daily Traffic (ADT) counts of 10,000 or higher and also routes to critical care facilities;
- Reduce the flood risk to critical infrastructure, specifically the Savanna Street Jackson Wastewater Treatment Facility;
- Integrate environmental design features into flood risk management features to conserve or improve natural resources.

Alternatives

The initial array of alternatives included five non-structural alternatives and sixteen structural plans. Many of the structural alternatives are similar to plans that have been studied before; therefore, much data was available for review and development of the screening criteria. All measures were screened for their capability to meet objectives and avoid constraints, for engineering and economic feasibility, and for the level of risk management. While several flood frequencies were used to analyze the alternatives, the design event was the annual 1% chance exceedance event. Measures that warranted continued consideration were assembled into alternative plans, and the following three, along with the No Action Alternative, were carried forward into the final array:

- No Action Alternative: Under this alternative, no flood risk management would occur. The area will continue to suffer damages to commercial and residential structures, infrastructure, and major transportation routes as a result of flooding from the Pearl River. These potential impacts will increase due to continuing urban development.
- Buy Out (Alternative A): Although logistics and costs render it an impractical alternative, the measure of relocating structures (buy-out) was carried forward in the final array of alternatives in order to comply with the USACE EP 1165-2-1 requirement that a standalone non-structural alternative be considered through the entire process.
- Levee Plan (Alternative B): This structural alternative consists of building new levees and expanding existing levees, resulting in over 28 miles of levees and floodwalls in the Study Area. Significant conveyance improvements would be constructed from River Mile (RM) 292 to RM 302, including seven new pump stations, thirteen gated drainage structures, and 6,100 feet of floodwalls. While the additional levees would achieve flood risk management in some areas, a risk of overtopping or levee section failure would remain during extreme events. Further, the significant number of additional structures would create a possible risk of interior flooding and would require regular maintenance and operators during flood events, increasing project costs.
- Channel Improvements Plan (Alternative C): This structural alternative consists of significant channel modification from RM 284 to RM 293.5, including channel excavation and widening of a 9.5 mile reach of the Pearl River, which falls within an existing USACE channelization/levee project area.

Identification of the National Economic Development Plan, the Tentatively Selected Plan, and the Locally Preferred Plan

The federal objective in water resources planning is to contribute to National Economic Development (NED) consistent with protecting the nation's environment, pursuant to federal environmental statutes, applicable executive orders, and other planning requirements. Based on the evaluation criteria, the Channel Improvements Plan (Alternative C) is both the Tentatively Selected Plan (TSP) and the Locally Preferred Plan (LPP). Thorough investigation and analysis reveal that the TSP is also the NED plan. The local community, local leadership, and the State of Mississippi have supported and continue to support the TSP because of its potential to provide flood risk management, positive social effects with the regional growth opportunities, and the recreation benefits from improved access to the Pearl River and its natural resources.

Features of the Tentatively Selected Plan

The TSP consists of the structural components described below, as well as non-structural measures including voluntary acquisition of structures in both Hinds and Rankin counties that would otherwise continue to be located in flood prone areas. The TSP fulfills the planning objectives as stated, reasonably maximizes net benefits, and is in accordance with federal environment statutes, applicable Executive Orders, and other federal planning regulations for the protection of the nation's environment.

The TSP calls for the following structural measures:

- Excavation of approximately 25 million yards from RM 284.0 to RM 293.5, ranging in width from 400 to 2,000 feet;
- Set back of several existing levees, creating substantial land mass and providing additional protection and risk management;
- Relocation of an existing weir to the downstream limits, creating a pool area that provides maximum flood risk management benefits, recreation, and long-term maintenance reduction;
- Creation of islands from RM 289.5 to RM 292.0, some of which will be used to maintain and create habitat areas for local species;
- Variation of excavation depths in order to create underwater habitat, spawning, and nesting areas; and
- Addition of a 12' x 12' gate within the relocated weir to maintain minimum low flows pursuant to permitted requirements.

Unlike the 2007 LeFleur Lakes plan, the TSP will not require flooding of Mayes Lake or the LeFleur's Bluff State Park area.

The TSP will provide the most positive impact to the human environment by virtue of the protection of existing businesses and neighborhoods from future disruption and destruction caused by a major flooding event. The TSP will also enhance community development through the newly accessible riverfront created by the channel improvement within the confines of the existing levee structure, reconnecting the community with the river through expanded riverfront access and recreational opportunities.

Environmental Compliance

All project components were evaluated for environmental impacts, and compliance with all applicable laws will be accomplished upon review of this report by appropriate agencies and the public and with the signing of a Record of Decision by the ASACW. A mitigation plan will be implemented to compensate for all unavoidable environmental impacts.

The TSP will be constructed within an area of the Pearl River that is already the subject of existing USACE channelization and levee projects. In fact, 80% of the Project Area is located within an existing USACE project area. The TSP will not result in a net increase of weirs. The excavation needed to complete the TSP would create substantial land mass or expanded levee widths, providing additional protection and risk management. The relocation of one of the current weirs to a higher elevation and expanded width will provide a larger body of water for recreation while reducing channel maintenance. As this report reveals, there are no impacts to minimum low flows downstream.

The Project Area includes habitat for two aquatic species listed on the Endangered Species Act as threatened species: the Gulf sturgeon and the ringed sawback (or, ringed map) turtle. By reducing the footprint of the 2007 Project Area, the TSP reduces potential impact to these species. Although the portion of the Pearl River within and upstream of the Project Area is part of the designated Critical Habitat for the Gulf sturgeon, an analysis of the most recent survey data and other available information indicates that it is not likely that the Gulf sturgeon utilizes the available spawning habitat within the Project Area. Furthermore, existing downstream structures currently limit upstream migration to portions of the lower Pearl River.

A critical habitat has not been established for the ringed sawback turtle, and a recovery plan is currently under development that is not scheduled for completion until 2020. Past dredging activities within the Project Area associated with previous flood control projects have resulted in an overall degradation in habitat for the ringed sawback turtle and the nesting habitat within this portion of the river is almost non-existent. To date, the highest

densities of ringed sawback turtle populations have been documented above the Ross Barnett Reservoir and below the Jackson metropolitan area in the general vicinity of the Study Area, but not within the Project Area.

The Project Area also includes suitable habitat for two avian species listed on the Endangered Species Act. On May 4, 2015 the USFWS issued the Interim Final 4(d) Rule under the Act relative to the protection of the Northern Long-eared Bat. The interim rule includes the project area within the current buffer zone for the summer hibernation area for the NLEB. In 2017, the USFWS added the Wood stork, a threatened species, to the listing for the entire state of Mississippi. Though no known nesting locations are present within the Project Area, suitable habitat is present.

BENEFITS AND COSTS OF THE TENTATIVELY SELECTED PLAN

Project Benefits

SUMMARY OF BENEFITS

- *Reduces structural damage*
- *Reduces damage to existing infrastructure and transportation routes*
- *Reduces the need for evacuation, thus reducing overall costs incurred during high-water events*

The majority of benefits attributable to the TSP result from the reduction of actual or potential damages caused by inundation. The benefits include the reduction of physical damages to structures, contents, vehicles, infrastructure, major transportation routes, and critical care facilities. They also include the reduction of emergency costs, evacuation and subsistence costs, reoccupation costs, residential and commercial clean up and restoration costs, and Federal Insurance Administration costs. Other benefits include transportation savings due to reduced need for traffic rerouting, decreased land fill required for certain areas, and recreation benefits due to proposed recreational facilities. Based on economic analyses performed during the study, annualized net benefits of the project are estimated at $25,300,000.

Project Costs

The estimated cost of the TSP is $345,850,000 (Table 1). Approximately 41% of the Project Area is currently owned by state or local entities. Included in the TSP cost figure is an estimated cost of $20,580,000 for real estate acquisition of structural features in the project footprint not currently controlled by the local sponsor or communities that are members of the Flood Control District.

Table 1. Cost Summary

Cost Summary Pearl River Basin, Mississippi, Federal Risk Reduction Project, Alternative C (October 2017 Price Levels)		
Construction Item		**Cost**
Lands and Damages		$ 23,056,200
Elements		
Relocation		$ 13,076,870
Channels and Levee Improvements		$ 198,911,978
Weir		$ 43,854,534
Recreation		$ 12,581,204
Mitigation		$ 17,400,000
Pre Construction Engineering		$ 30,241,493
Construction Management		$ 6,726,753
Total First Cost		**$345,849,032**

Benefit-Cost Ratio

According to the U.S. Army Corps of Engineers-certified Hydrologic Engineering Center Flood Damage Analysis model utilizing the annualized net project benefit estimate of $25,300,000 and the project cost estimate of $345,850,000, the benefit-cost ratio for the TSP is 2.83 (Table 2). This estimate includes implementation costs and annualized operation and maintenance, repair, rehabilitation and replacement costs (OMRR&R) associated with the TSP.

Table 2. Equivalent Annual Benefits and Cost

Equivalent Annual Benefits and Cost Pearl River Basin, Mississippi, Federal Risk Reduction Project, Alternative C (October 2017 Price Level, 50-Year Period of Analysis, 2.750 Percent Discount Rate)	
Investment Cost	
Total Project Construction Cost	$345,849,032
Interest During Construction*	$9,629,973
Total Investment Cost	$355,479,005
Average Annual Cost	
Interest/Amortization/Initial Investment	$13,209,902
OMRR&R	$650,000
Total Average Annual Cost	$13,859,902
Average Annual Benefits	$39,164,442
Net Annual Benefits	$25,304,540
Benefit-Cost Ratio	2.83
Benefit-Cost Ratio (computed at 7%)	1.41
*Estimated construction period of 3 years	

PUBLIC INVOLVEMENT

The Flood Control District has continued to encourage public participation and involvement throughout the process of developing the draft FS/EIS. The public has had several opportunities to obtain information and submit comments during the re-scoping process, including group meetings, public meetings, and the project website. Public comments were considered in the initial screening process. Extensive coordination with local, state, and federal agencies and environmental groups has occurred throughout the re-scoping and study process, primarily through agency cooperation meetings and public meetings in the Jackson metropolitan area and throughout the lower Pearl River region in both Mississippi and Louisiana. To further encourage public participation and involvement in the Study Area, the Flood Control District developed a survey to solicit input on specific issues, concerns, and opportunities for the Study Area, and public comments were considered in the initial screening process.

Publication of the draft FS/EIS will provide an opportunity for additional public comment in forums held in the Jackson metropolitan area and the lower Pearl River region. Further opportunity for public involvement will occur during future permitting processes.

NON-FEDERAL SPONSOR SUPPORT

The Rankin-Hinds Pearl River Flood and Drainage Control District (Flood Control District) is the non-federal sponsor of this project. The Flood Control District fully supports the project and is willing to sponsor detailed design and project construction with the USACE and local cooperation as set forth in this report.

AREAS OF CONTINUING DISCUSSION

- Endangered Species Act (Threatened Species): An adaptive management plan developed in conjunction with the U.S. Fish and Wildlife Service during the feasibility level design and analysis can provide alternative management measures and potential mitigation measures that will insure that the potential adverse impacts to the listed species are minimized.
- Recreational benefits: The location and extent of recreational benefits from the TSP will be finalized during the feasibility level design.
- Non-structural measures included in the TSP: Detailed evaluation of the number of landowners impacted will be determined during the economic reach analysis of the final feasibility level design. At that time, the proposed real estate interest to be acquired for non-structural measures and the real estate cost will be refined. Displaced persons and businesses may be entitled to Public Relocation Assistance.
- Environmental features: Final environmental features will be developed and design parameters will be further refined during the preconstruction, engineering, and design phase, which may result in changes.

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1.0 INTRODUCTION

This Integrated Draft Feasibility Study and Environmental Impact Statement for the Pearl River Watershed at Hinds and Rankin Counties, Mississippi, is prepared pursuant to Congressional authorization originally enacted in 1986 and most recently reconfirmed in 2016. The Water Infrastructure Improvements for the Nation Act (the WIIN Act), now codified as Public Law 114-322 continues the long-standing Congressional authorization for the project (Section 1322(b)(4)(A)). This recent project authorization instructs the Secretary to "expedite its review and decision on recommendations" made for the project, by continuing and modifying the language found in Section 3104 of the Water Resources Development Act (WRDA) of 2007. Section 3104 modifies the Pearl River Basin project originally authorized by Section 401(e)(3) of WRDA 1986 by allowing the Assistant Secretary of the Army for Civil Works (ASACW) to construct a project generally in accordance with the plan described in the Pearl River Watershed, Mississippi, Feasibility Study Main Report, Preliminary Draft, dated February 2007, and to make a determination as to the appropriate plan based upon the requirements set out in Section 3104. Section 3104 provides that the ASACW may construct the National Economic Development (NED) plan, the Locally Preferred Plan (LPP), or some combination thereof subject to a determination by the ASACW that the LPP provides the same level of flood protection as the NED plan and that the LPP is environmentally acceptable and technically feasible. Further, Section 3104 provides that the non-federal interests may carry out the project under Section 211 of WRDA 1996, as amended.

Section 211 of WRDA 1996 provides authority for non-federal sponsors to conduct feasibility studies/environmental impact studies (FS/EIS) and to design and construct federally authorized flood risk management projects without federal funding. The United States Army Corps of Engineers (USACE) may provide technical assistance to the non-federal sponsor during the FS/EIS.

The Rankin-Hinds Pearl River Flood and Drainage Control District (the Flood Control District) is a political subdivision of the State of Mississippi created in 1962 pursuant to the Urban Flood and Drainage Control Law, Miss. Code Ann. § 51-35-301, et. seq. Its responsibilities include construction of flood and drainage control improvements for the protection of property in the Jackson metropolitan area. Its Board of Directors is comprised of the mayors representing four municipalities (Jackson, Flowood, Pearl, and Richland) and representatives of the two counties (Hinds and Rankin) in which the district's boundaries lie, along with a representative from the state, appointed by the Governor of Mississippi.

Effective July 19, 2012, the Flood Control District and USACE entered into a Memorandum of Agreement to undertake and complete a Section 211 Feasibility Report for the purpose of identifying the federal interest in the Pearl River Watershed, Mississippi, Project, in accordance

with the Economic and Environmental Principles and Guidelines (P&G) for Water and Related Land Resources, March 10, 1983, and the Planning Guidance Notebook, ER 1105-2-100, April 22, 2000. This Section 211 Feasibility Report is an Integrated Draft FS/EIS and will serve as the decision document for review by the Secretary of the Army.

This FS/EIS is being undertaken in accordance with the National Environmental Policy Act of 1969 (NEPA) and USACE regulations for implementing NEPA.

The Pearl River Watershed is located in the south-central portion of Mississippi and in a small part of southeastern Louisiana. The river drains an area of 8,760 square miles (sq. mi.) consisting of all, or parts, of 23 counties in Mississippi and parts of three Louisiana parishes. The primary Study Area comprises the Pearl River Watershed between River Mile (RM) 280.0, located south of Richland, MS, and RM 301.77, located at the Ross Barnett Reservoir dam, as shown in Figure 1-1.

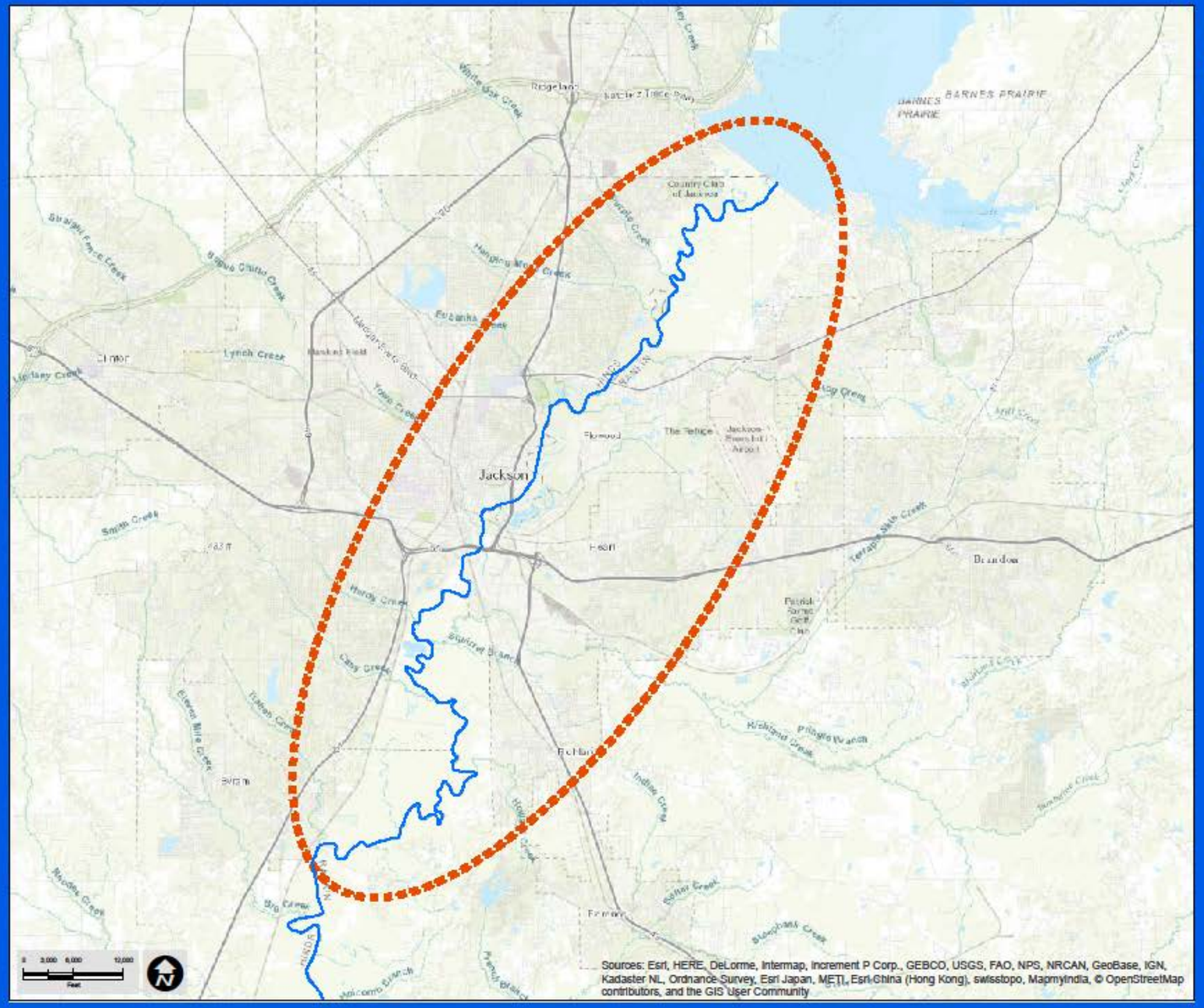
Municipalities within the Study Area include Flowood, Jackson, Pearl, and Richland. The Study Area includes parts of Hinds and Rankin counties. Major tributaries of the Pearl River within the Study Area include Caney, Eubanks, Hanging Moss, Hog, Lynch, Prairie Branch, Purple, Richland, and Town Creeks. The Study Area is primarily affected by headwater flooding caused by the Pearl River. Headwater flooding is caused by unusually heavy and intense rainfall over the upper Pearl River Watershed. Although the Study Area is located primarily within the boundaries described, additional areas downstream were considered to address any potential downstream impacts of the proposed project alternatives.

This draft FS/EIS describes the Study Area's[1] Problems and Opportunities[2] relative to flood risk management and evaluates certain alternatives meeting federal, environmental, and economic criteria. To assess the environmental and social effects of each selected plan, the identified alternatives were evaluated to determine maximum net economic development benefits. Prior studies, engineering data, scoping meetings, and other information sources were used to the fullest extent. This FS/EIS completes, re-scopes and supplements information contained in the most recent study, namely the Preliminary Feasibility Study and Draft Environmental Impact Statement (2007) for the Pearl River Watershed.

A levee system was constructed during the 1960s consisting of levees, pumps, and channelization, which provides limited protection from flood damage for a certain portion of the Jackson metropolitan area. This levee system is more expressly described in Section 2.2.1. The levee system has been effective in flood risk management for the protected areas; however, the

[1]The Study Area denotes the area that will be impacted by implementation of the project, which is different from the Project Area, the actual site the project will occupy.

[2] Refers to USACE ER 1105-2-100.



Rankin and Hinds Counties, Mississippi Flood Damage Reduction Study

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Rankin-Hinds Pearl River Flood and Drainage Control District

Figure 1-1
Study Area

Legend
- Pearl River Channel
- Study Area

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west levee was compromised during the 1979 flood of record. Since the 1979 Flood, numerous attempts to develop a feasible and reliable flood risk management alternative have failed to gain support from state and local leaders or the local community. The existing levee system only provides protection to approximately 30% of the structures within the flood-risk area. Most of the Jackson metropolitan area remains unprotected.

1.1 PURPOSE, SCOPE, AND NEED FOR THE STUDY (NEPA REQUIRED)

The purpose of this FS/EIS is to provide a recommendation for federal participation in Pearl River, Mississippi, flood risk management along the Pearl River in Hinds and Rankin Counties. The "scope", or extent of evaluation, for purposes of this FS/EIS includes the range of actions, alternatives, and impacts analyzed. Those impacts are direct, indirect, or cumulative. The scope of this FS/EIS includes the geographic range, as well as elements of the human-built and natural environment studied to determine all reasonable alternatives for flood control in the Study Area.

Over the past thirty years, multiple studies have been conducted on the Pearl River watershed ranging from reconnaissance level studies to feasibility level studies. The most recent study, Preliminary Feasibility Study and Draft Environmental Impact Statement (2007), included updated levee information from the 1996 study and an analysis of the LeFleur Lakes flood control plan. The LeFleur Lakes plan was the designated LPP in the 2007 document, with the non-federal interest paying additional project costs above the non-federal share, as determined by the NED plan. This FS/EIS presents an integrated plan, prepared in accordance with NEPA and USACE ER 1105-2-100. The main report of this FS/EIS provides an overview of the study and identifies expected benefits, estimated costs, and implementation responsibilities for a Tentatively Selected Plan (TSP). The report summarizes detailed information, which is available in the technical appendices.

Figure 1-2, Transportation Impacts at the Intersection of Interstate 55 and Highway 25 (Lakeland Drive)

1.2 PROBLEM

For the past 100 years, headwater flooding of the Pearl River (greater than 10 feet deep in some areas) has caused disruption to businesses and industry throughout the Jackson, MS, metropolitan area, putting over 5,000 commercial and residential structures at risk of flood damage. There have been numerous flood events that have affected the Study Area, most notably the Easter Flood of 1979 and the May Flood of 1983. The 1979 event flooded transportation routes (Figure 1-2), homes (Figure 1-3), and businesses (Figure 1-4), causing damages that at that time totaled approximately $223 million. If the same event occurred in the present day, damages would surpass $1 billion.

Problems in the Study Area

1. *Severe rainfall in the Upper Pearl River Watershed causes a high risk of downstream flooding in the Study Area, threatening approximately 5,000 structures.*
2. *High risk of flooding threatens critical infrastructure, including an existing wastewater treatment facility.*
3. *Major transportation routes and evacuation routes become impassible and damaged during flood events in the Study Area.*

In the Rankin and Hinds portions of the Jackson Metropolitan Statistical Area (MSA), there are more than 13,000 businesses employing over 180,000 people. As the capital of Mississippi, Jackson's downtown Central Business District (CBD), a flood prone area, is home to many state and federal offices. Major transportation routes, including two interstate highways, U.S. and state highways, local streets, and major rail carriers, are affected by flooding. Flooding has caused significant infrastructure damage, including damage to the 46 million gallons per day (mgd) Savanna Street Wastewater Treatment Plant (WWTP) (Figure 1-5), which serves the region.

As of the 2010 US Census, the population for the Jackson MSA has increased to over 500,000 and that number continues to increase. The Jackson MSA experienced a population growth rate of 8.5% for the period of 1980 to 1990, 11.2% for the period of 1990 to 2000, and 8.4% for the period of 2000 to 2010. Traffic counts on major highways and interstates in the metropolitan area have increased 100% over the last 25 years.

Approximately 13.5 miles of levees currently provide limited protection to portions of the Jackson metropolitan area. Much of Rankin and Hinds counties remain unprotected from Pearl River flooding, including major transportation routes. The Jackson levee was compromised during the 1979 Flood, inundating the Mississippi State Fairgrounds, surrounding businesses, and Interstate 55 (Figure 1-4).

Figure 1-3, Residential Flooding in Northeast Jackson

Figure 1-4, Flooding of Downtown Jackson, MS

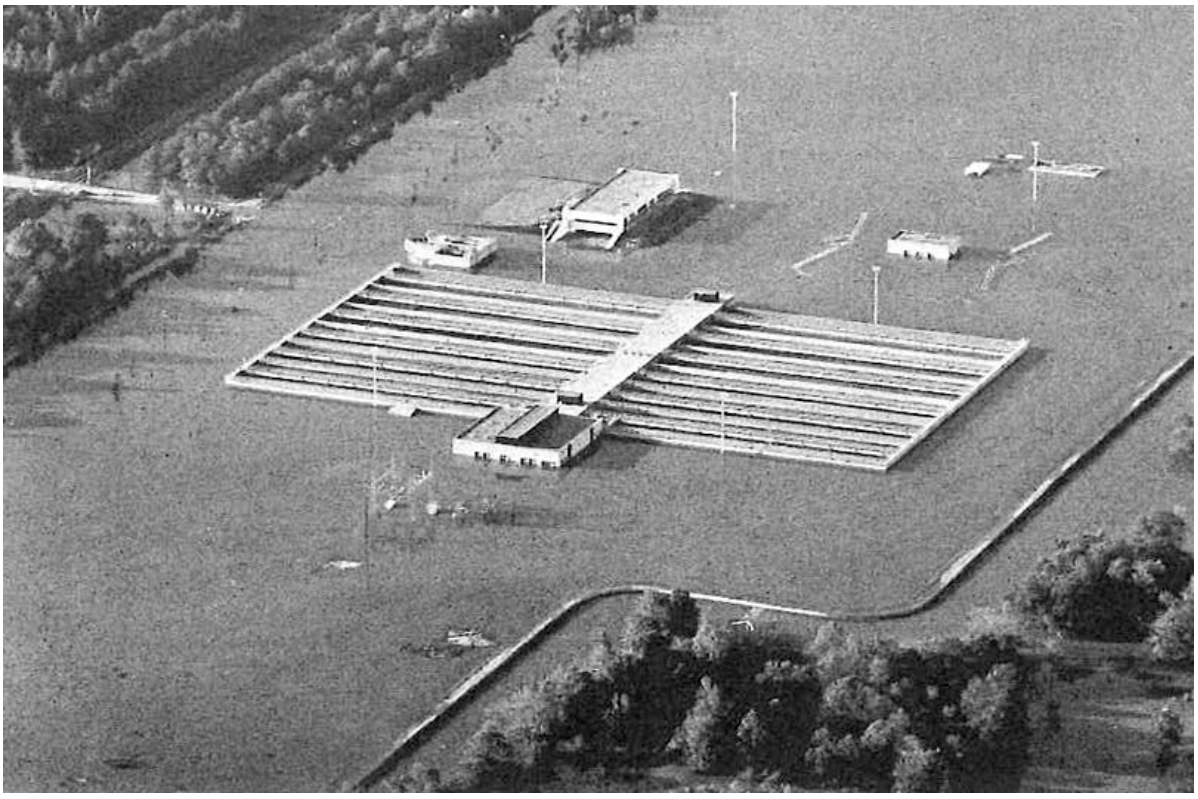
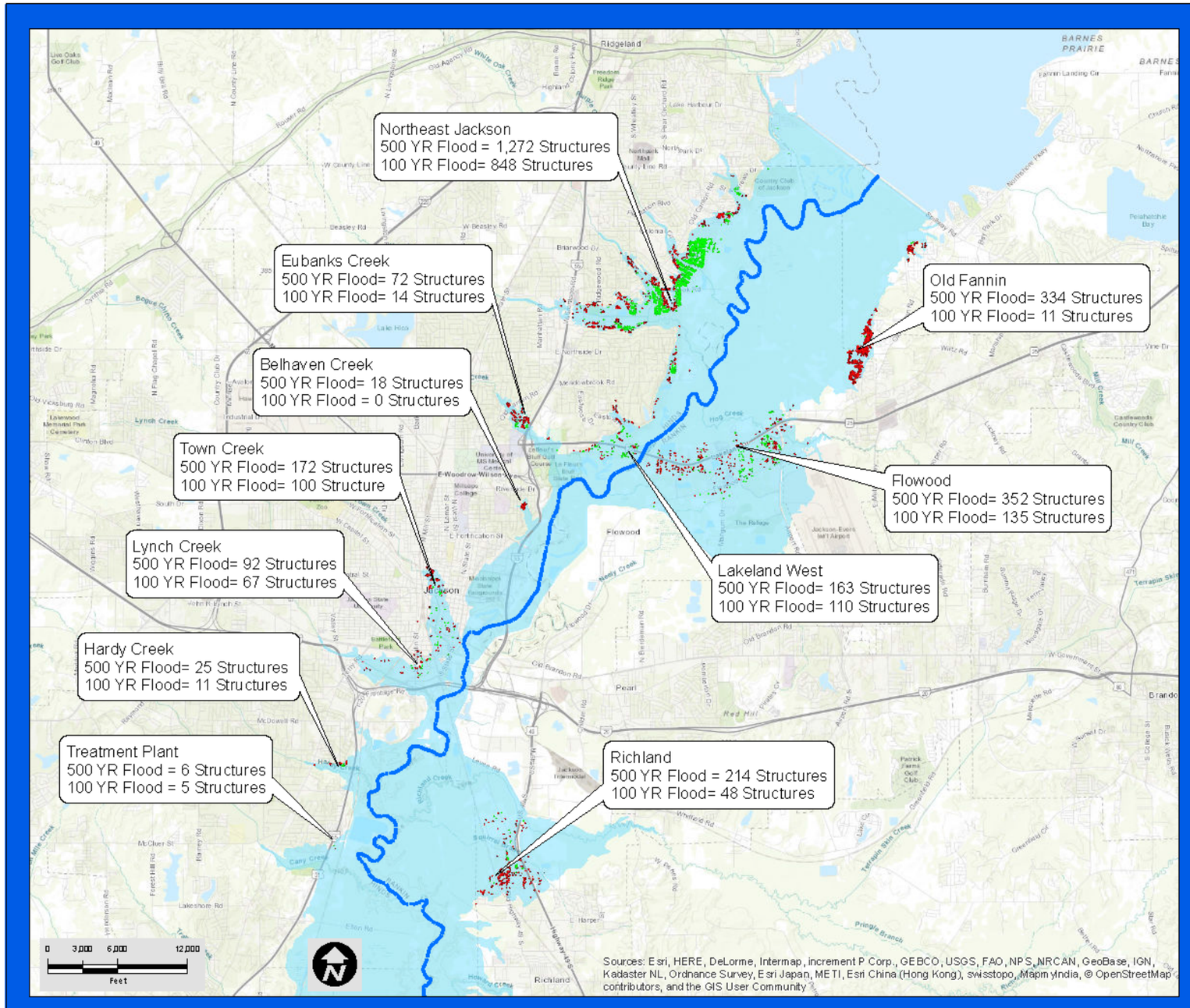


Figure 1-5, Flooding at the Savanna Street Wastewater Treatment Plant



Rankin and Hinds Counties, Mississippi Flood Damage Reduction Study

Integrated Draft Feasibility and Environmental Impact Statement Pearl River Watershed

Rankin-Hinds Pearl River Flood and Drainage Control District

Figure 1-6 Location of Structure Damage

Legend

- Impacted by the annual 1% chance exceedance flood event
- Impacted by the annual 0.2% chance exceedance flood event
- Pearl River Channel
- 1979 Flood Event

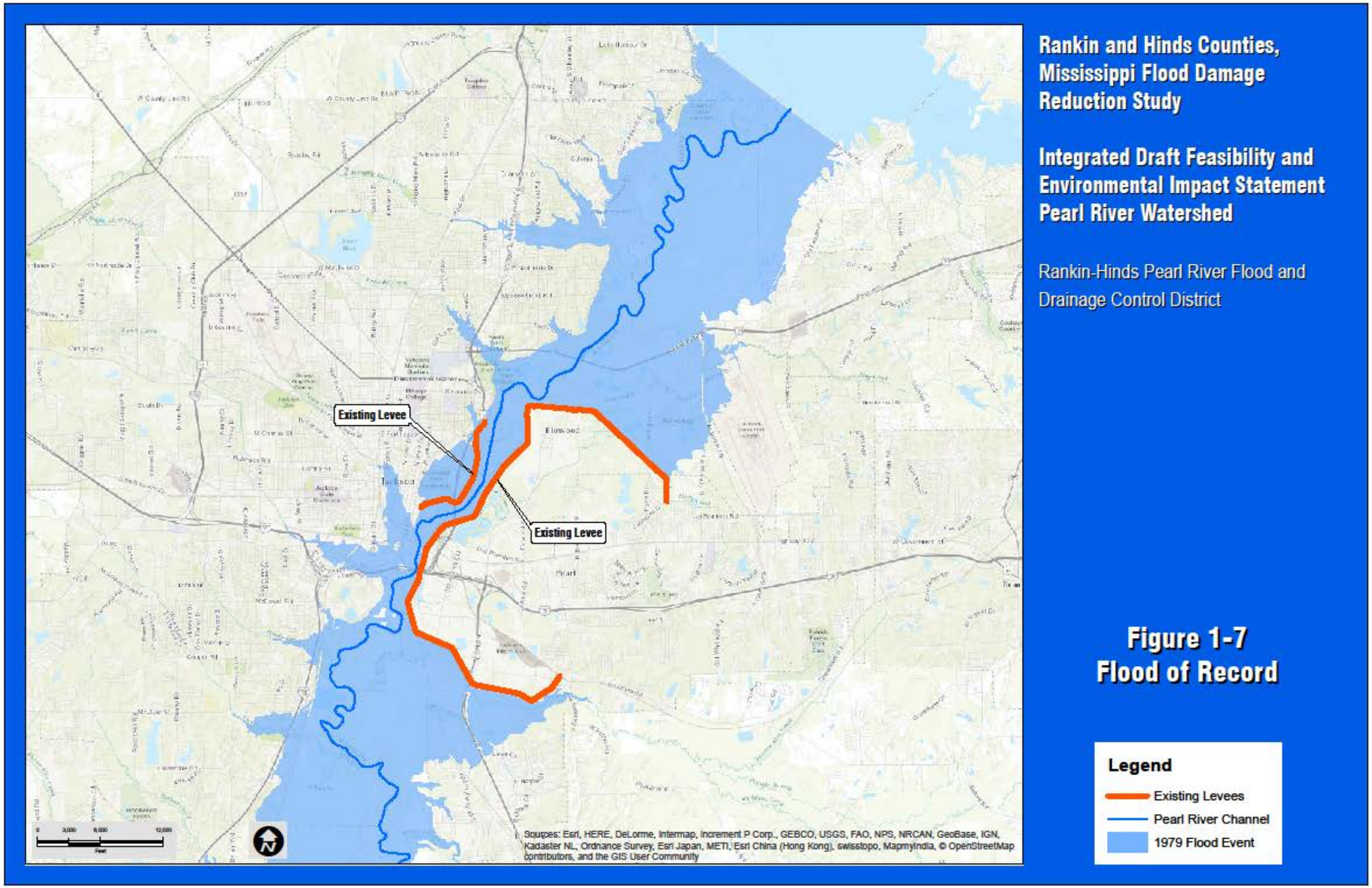

Existing Levee
Existing Levee
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
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Figure 1-7
Flood of Record
Legend
Existing Levees
Pearl River Channel
1979 Flood Event

1.3 NEED FOR ACTION

Critical flood protection needs were identified based on historic problems that have been experienced within the Study Area. These critical needs include:

- ✓ Reduce flood risk in the Jackson metropolitan area;
- ✓ Reduce the flood risk of critical infrastructure, including the Savanna Street Wastewater Treatment Facility; and
- ✓ Improve access to transportation routes, evacuation routes, and critical care facilities during flood events.

In response to local efforts, the U.S. Congress recognized the need for flood risk management and, beginning in 1960, authorized studies of the Pearl River Watershed, MS, specifically the areas in the vicinity of the Jackson MSA. A federally funded levee system was constructed in the 1960s to help reduce flood risk for a portion of the Jackson metropolitan area. This project, consisting of levees, pumps, clearing, and channelization, is more expressly described in Section 2.2.1. The existing levee system only provides protection for approximately 30% of the structures within the flood-risk area.

1.3.1 PROJECT AUTHORITY

Year	Public Law	Relevance
1960	86-645	Authorized Jackson West and East Levees
1983	98-63	Authorized interim flood control plan
1986	99-662 (401(e)(3))	Authorized construction for the Pearl River Basin
2007	110-114 (3104)	Modified authorization (WRDA 1986) to construct NED, LPP, or combination thereof and may carry out under Section 211 WRDA 1996
2016	114-322 (1322(b)(4)(A))	Instructs Secretary to expedite its review and decision, continues project's previous authorization and Section 211 status

Federal involvement in the Pearl River Watershed in Mississippi with respect to flood control measures date back to at least the early 1900s, while existing water projects date back to the early 1960s.

In 1968, the USACE completed the Jackson, MS, Levee Project (Fairgrounds and East Jackson levees) which consists of two earthen levees (Figure 2-4, Figure 2-5, and Figure 2-6), four gated

outlets, and two pumping stations. The Flood Control District sponsored the project and currently operates and maintains the levees. The levee project pumping facilities include three 15-cubic feet per second (cfs) pumps and one 45-cfs pump at the Fairgrounds Levee and four 150-cfs pumps at the East Jackson Levee. As a result of the 1979 catastrophic Easter Flood, studies were authorized by a congressional resolution adopted on May 9, 1979, which requested the Board of Engineers for Rivers and Harbors to review the reports of the Chief Engineers on Pearl River Basin, MS and LA, and on the Pearl River and Tributaries, MS, to determine whether any further improvements for flood damage prevention and related purposes would be advisable.

In 1983, to increase the conveyance of the Pearl River at the MS Highway 25 Bridge, the Pearl River Basin Development District (PRBDD), a political subdivision of the State of Mississippi, completed a project which consisted of removing material from the west bank of the Pearl River approximately 600 feet upstream and downstream of the bridge.

In 1984, the PRBDD, acting as local sponsor, completed a floodway clearing plan from about 0.5 miles below the old Jackson sanitary landfill to the Woodrow Wilson Bridge, a total of 3.3 river miles (Floodway Clearing Project). The project consisted of 237 acres of complete clearing, 20 acres of selective clearing, 89 acres of partial clearing, and the placement of 39,000 tons of riprap for protection around bridges (Figure 2-6, Figure 2-7).

Authorization for construction of Shoccoe Dam, a dry dam that was to be located north of the Ross Barnett Reservoir, was contained in Section 401(e) WRDA 1986 to provide flood control for the Pearl River Basin in Mississippi. The Shoccoe Dam project was subsequently abandoned due to lack of local support. Thereafter, the PRBDD and the Hinds County Board of Supervisors requested the USACE-Vicksburg District (MVK), to undertake an investigation of alternative flood control measures. The USACE-MVK completed reconnaissance studies for the Pearl River Watershed in June 1990, focusing on an evaluation of a comprehensive levee system consisting of approximately 24 miles of new levees and raising approximately 11 miles of existing levees. The resulting levee plan was not advanced due to lack of local support, opposition from downstream and upstream citizens, and refusal of the Mississippi Legislature to fund the project.

In 1996, an alternative to the comprehensive levee plan was proposed consisting of upper and lower lakes covering approximately 4,700 acres along the Pearl River south of the Ross Barnett Reservoir. An independent evaluation of the lakes plan conducted in 2000 indicated that the plan could reduce Pearl River flooding in the Jackson area.

In September 2001, the PRBDD and the Flood Control District agreed that the Flood Control District would be the non-federal sponsor for developing a compromise plan incorporating aspects of both the levee and lakes plans. The draft Project Management Plan (PMP) was presented in May 2002. Thereafter, in accordance with the directives of the sponsor, the PMP

was revised to include only the levee plan and the LeFleur Lakes plan. The Feasibility Cost-Sharing Agreement (FCSA) was signed by the Flood Control District on October 15, 2003. In 2006, it appeared that economic justification, in accordance with the federal guidelines, of the LeFleur Lakes plan was unlikely, therefore, study efforts concentrated on completing draft documentation for the non-federal sponsor's use in the NEPA process. The resulting report, "Pearl River Watershed, Mississippi Feasibility Study Main Report, Preliminary Draft", was presented in February 2007 and included the Comprehensive Levee Plan and the LeFleur Lakes Plan. This report was never released for public comment.

Section 3104 of WRDA 2007 modified section 401(e)(3) of WRDA 1986, authorizing the 2007 plan described in the "Pearl River Watershed, Mississippi, Feasibility Study Main Report, Preliminary Draft" under section 211 of the WRDA of 1996. Before initiating construction, Congress instructed that the level of flood risk management provided by the various project alternatives be compared in order to implement the plan that is environmentally acceptable and technically feasible.

The table below identifies prior USACE studies and reports concerning flood risk management in the Pearl River watershed.

Table 1-1, Prior USACE Studies and Reports

Project	Relevant Dates	Status
Survey Recommending Existing Levee Project	May 2, 1949: Authorization June 2, 1959: Report Submitted	Completed Construction in 1968
Comprehensive Survey of the Pearl River Basin, MS and LA	1970: Included Structural and Nonstructural measures	Never Implemented
Edinburg Dam Phase I Design Memorandum	January 1972: Only Edinburg Dam economically justified 1974: WRDA authorized Edinburg project 1980: No longer economically justified	Re-evaluated in 2007
Town Creek, Jackson, MS Flood Protection Measures	August 1970	Not economically feasible
Richland Creek, Rankin County/Mobile District	1979: investigated flooding	Not economically feasible

Table 1-1 (continued), Prior USACE Studies and Reports

Project	Relevant Dates	Status
Pearl River Basin Interim Report on Flood Control	1979: after Easter Flood 1981: Four Point Plan developed July 1985: recommended Shoccoe Dam	1984: Only MS Highway 25 crossing on the Pearl River sediment removal was completed due to lack of interest/justification of other projects Shoccoe Dam not implementable due to opposition
Mendenhall, MS/Sellers Creek Mobile District	October 1984: investigation of various flood control measures	Not economically justified
Carthage/Leake County, MS Interim Flood Control Report	February 1987: studies recommend Shoccoe Dam, levees and channel improvements	Not implemented, not economically feasible
Pearl and Flowood, MS/Neely Creek Vicksburg District	May 1988: investigated flooding	Not implemented, no agreement with sponsor
Caney Creek, MS – studies for flood risk management and bank stabilization	November 1990: study completed	Not implemented, not economically justifiable
Jackson Metropolitan Area, MS	1996: report recommended comprehensive levee plan July 1998: suspended	Not implemented due to lack of support

Other USACE flood related reports include: Caney Creek Flood Insurance Administration (FIA) Report, 1969; Hanging Moss and White Oak Creeks FIA Report, 1975; Lynch Creek FIA Report, 1971; Pearl River and Neely Creek FIA Report, 1973; and Purple Creek FIA Report, 1968. In 1983, the Natural Resources Conservation Service (NRCS) participated with the Mobile District's study of the Pearl River Basin involving potential reservoir sites above Jackson for floodwater storage. NRCS has also completed several evaluations of flood problems in the Pearl River Basin, including Sellers Creek in Mendenhall; Town Creek in Carthage; Magees Creek in Tylertown; and certain tributaries in Columbia, MS. Additionally, there have been numerous flood control studies on the

Pearl River conducted by local interests. Seven major studies were prepared from 1981 through 1985 by local engineering firms retained by the PRBDD, and studies have been conducted by the Pearl River Valley Water Supply District (PRVWSD), the City of Jackson, and other municipalities.

1.4 OPPORTUNITIES

Opportunities to address flood risk issues caused by the Pearl River within the Jackson metropolitan area were identified based on input from the local sponsor, stakeholders, government agencies and the public.

Study Opportunities

- Reduce flood risk to residential, commercial and industrial structures within the Jackson metropolitan area and provide additional protection for areas where existing levees exist;
- Provide measures to ensure accessible public transportation corridors for public safety during flood events;
- Provide measures to remove properties with recurring flood risk;
- Provide education to local officials and residents of risk of living in flood prone areas;
- Provide environmental design features to conserve and improve natural resources, and provide recreational opportunities.

1.5 GOALS AND OBJECTIVES

National Economic Development (NED) is the primary purpose for federal participation in a water resources project. Maximizing economic development is the federal goal consistent with the protection of the environment. This FS/EIS was developed to help prioritize solutions to be targeted, based on recognized problems, needs, and opportunities. Reducing flood-associated damage, providing long-needed flood relief, was identified. The objective of the FS/EIS is to investigate measures to alleviate flooding in the Study Area based on the FS/EIS goal.

Study Goal

To provide a comprehensive solution to reduce flood risk in the Jackson metropolitan area caused by the Pearl River.

Objectives

1. Reduce flood risk in the Jackson metropolitan area through the year 2065;
2. Reduce loss of transportation routes with Average Daily Traffic (ADT) Counts of 10,000 or higher and also routes to critical care facilities;
3. Reduce the flood risk of critical infrastructure, specifically the Savanna Street Jackson Wastewater Treatment Facility; and
4. Integrate environmental design features into flood risk reduction features to conserve and improve natural resources.

1.6 USACE CIVIL WORKS GUIDANCE

USACE planning is based on The Economic and Environmental Principles and Guidelines (P&G) for Water and Related Land Implementation Studies (1983) which provide for "the formulation of reasonable plans responsive to National, State, and local concerns" (ER 1105-2-100). When addressing water resource problems, the USACE uses the framework provided by the P&G in order to balance economic development and environmental needs so as to "reasonably maximize net national benefits" (ER 1105-2-100). According to the P&G, the federal objective of water and related land resources projects is to contribute to NED while following national environmental laws, Executive Orders, and other federal planning requirements as to protect the environment. The Planning Guidance Notebook sets forth a structured planning process to guide the formulation of plans, the evaluation of alternatives, and the selection of projects for implementation.

1.7 NEPA RE-SCOPING PROCESS

NEPA is the nation's charter for protecting the environment. The federal regulations for implementing NEPA are found in Title 40 Code of Federal Regulations (CFR) Parts 1500-1508. The intent of NEPA is both to ensure that information regarding major actions taken by federal agencies is made available to public officials and citizens, and to identify and consider concerns and issues from the public. "*Any environmental document in compliance with NEPA may be combined with any other agency document to reduce duplication and paperwork*" (40 CFR §1506.4). This document integrates discussions that normally would appear in an EIS into the feasibility report. Sections in this report include NEPA-required discussions marked "*(*NEPA required)*" in both the Table of Contents and within the body of the document to assist readers.

Table 1-1 lists the required EIS information and its location in this document. Although this report is a completion of an existing study, this FS/EIS has been re-scoped and discussed in more detail in Section 7.3 of this report and Appendix G.

Table 1-2, EIS Summary

EIS REQUIREMENTS	LOCATION IN THIS DOCUMENT
Cover Sheet	Cover Page
Summary	Executive Summary
Table of Contents	Table of Contents
Purpose and Need for Action	Section 1
Alternatives and Proposed Action	Section 3
Affected Environment	Section 2
Environmental Consequences	Section 4
List of Preparers	Section 9
List of Recipients	Section 7
Index	Section 12
Appendices	Listed in the Table of Contents

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2.0 AFFECTED ENVIRONMENT (NEPA REQUIRED)

The historic conditions, existing conditions, and a predicted "future without-project" conditions provide the foundation for plan formulation. The "future without-project" condition is the "No Action Alternative". Important resources that could potentially be impacted by the proposed action and their significance are explained in Appendix A. Topics in this chapter are analogous to those found in Section 4, where the "future with-project" conditions are considered with Alternatives derived from the plan formulation.

2.1 GENERAL SETTING

2.1.1 WATERSHED CHARACTERISTICS

The Pearl River Watershed, as shown on Figure 2-1, is located in the south-central portion of Mississippi and in a small part of southeastern Louisiana. The river drains an area of 8,760 sq. mi. consisting of all or parts of 23 counties in Mississippi and parts of 3 Louisiana parishes. The watershed has a maximum length of 240 miles and a maximum width of 50 miles. It is bounded on the north by the Tombigbee River Basin, on the east by the Pascagoula River Basin, on the south by Lake Borgne and the Mississippi Sound, and on the west by the Mississippi River Basin and several coastal streams which drain the eastern portion of Louisiana. There are numerous lakes within the watershed, but only a few of significant size. The largest of these is Ross Barnett Reservoir, which is located on the Pearl River about 12 miles northeast of downtown Jackson. A more detailed discussion of the Ross Barnett Reservoir is included in Section 2.2.1.3.

2.1.2 CLIMATE

The climate in the Upper Pearl River Watershed is generally characterized by long, warm summers and mild, short winters. The average annual temperature is about 65 degrees Fahrenheit (°F), with normal monthly temperatures ranging from 44°F in January to 82°F in July.

2.1.3 PRECIPITATION

The section of the Pearl River Watershed above Jackson lies in a moderate rainfall belt with an average annual rainfall of approximately 57 inches. The heaviest rains generally occur in the winter and spring months with the lightest occurring during the fall. However, excessive rainfall events producing locally intense runoff can occur at any time during the year.

2.1.4 TOPOGRAPHY AND PHYSIOGRAPHY

The Pearl River Watershed lies within the East Gulf Coastal Plain which is physiographically subdivided into the North Central Hills (or Plateau), Jackson Prairie, Southern Pine Hills and

Coastal Pine Meadows districts. These districts cross the watershed generally in a northwesterly direction. Elevations in the watershed range from mean sea level (0.0 feet) to approximately 650 feet above sea level referenced to National Geodetic Vertical Datum (NGVD).

The proposed Project Area lies within the Jackson Prairie topographic region. The Jackson Prairie Belt is one of two physiographic regions in Mississippi containing prairies and is known as a "Blackland Prairie". One of ten topographic regions in the state of Mississippi, the Jackson Prairie Belt extends across the central portion of the state from the edge of the Loess Bluff Region to the eastern border of the state. The Jackson Prairie Belt is characterized by gently rolling terrain with black, fertile soils. More specifically, the Project Area contains gently rolling terrain with elevations that range from approximately 280 feet NGVD to approximately 220 feet NGVD.

2.1.5 GEOLOGY AND SOILS

Geologically, the Pearl River Watershed is not a contained unit because the formations extend beyond the topographic divides into adjoining watersheds. The formations at the surface are sedimentary in origin and range in age from early Eocene to Recent.

Sand and clay, in various proportions, constitute nearly all the immense prism of sedimentary deposits extending from the northern part of the watershed to the coast. Also, a few thin units of marl, limestone, and glauconitic and lignite material are present in several places. Individual sand beds are irregular in thickness and few can be traced more than 5 miles. However, predominantly sandy zones, as differentiated from predominantly clayey zones, can be correlated over wide areas, some throughout much of the watershed. The formations dip southwestward at 20 to 80 feet per mile throughout the northern three-fourths of the watershed, except where they are interrupted by such structural features as the Jackson Dome and many smaller salt domes. The rate of dip becomes steeper in the southern part of the watershed where pronounced down warping toward the Mississippi River structural trough has resulted in a dip of 100 feet per mile or more.

2.2 WATER ENVIRONMENT

The Pearl River is formed in Neshoba County, Mississippi, by the Confluence of Nanawaya and Tallahaga Creeks and flows southwesterly for 130 miles to the vicinity of Jackson (including the 43-mile-long Ross Barnett Reservoir), then southeasterly for 233 miles to the head of its outlet channels, the Pearl and West Pearl Rivers. The Pearl River has an average fall of approximately 1.0 foot per mile. The river banks, exclusive of the Ross Barnett Reservoir, vary from about 12 to 40 feet high between Edinburg and Jackson and from 20 to 90 feet high between Jackson and the head of the Pearl and West Pearl Rivers. The width of the channel varies from about 100 to 300

feet between Jackson and Edinburg, except for the reach of the Ross Barnett Reservoir, and from about 400 to 1,000 feet below Jackson.

The stream flow through Jackson is mainly attributed to runoff from the Upper Pearl River, upstream of Jackson. The Ross Barnett Reservoir passes inflows and does not have an appreciable effect on the stream flow through Jackson, except when the Pearl River is at or above flood stage. However, locally intense rainfall in the Jackson area can produce significant stream flow in the Pearl River from the numerous tributary streams that drain into the river below the Ross Barnett Reservoir. Typically, these streams are flashy and peak much sooner than the Pearl River.

Stream flow and gage records for the Pearl River at Jackson are available from 1902 to date 2014. Historic peaks for this station date to 1874. The gaging station for Jackson is located on the downstream side of the U.S. Highway 80 bridge, which is at RM 286.98. Limited stream flow and stage data are available for certain tributary streams within the Study Area. These include Eubanks Creek, Hanging Moss Creek, Lynch Creek, Purple Creek, Three Mile Creek, and Town Creek.

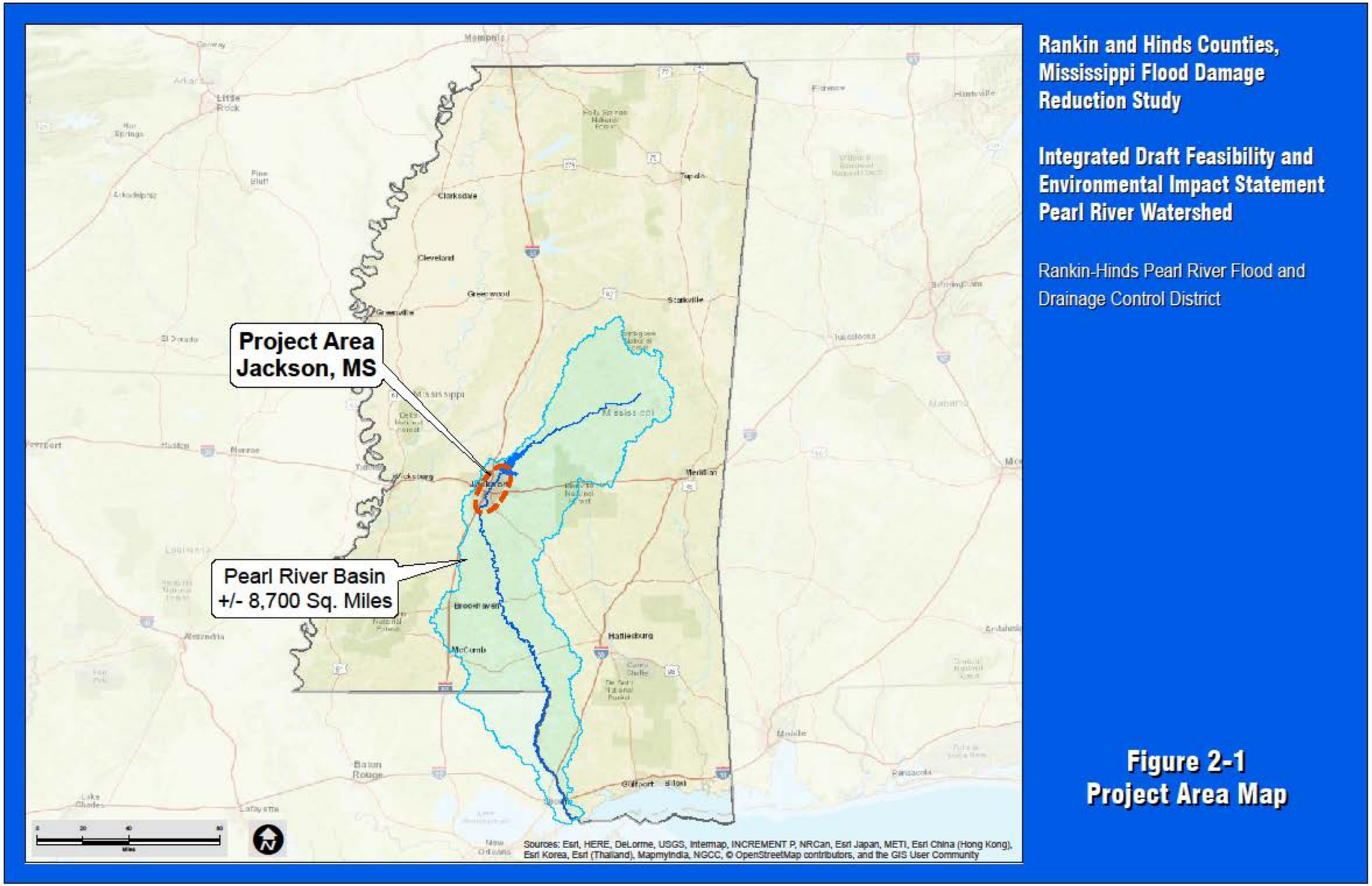
2.2.1 HISTORICAL FLOODING AND EXISTING CONDITIONS

Major Floods:

Prior to 1979, the flood of record was the 1902 flood which had a recorded peak discharge of 85,000 cfs at the Jackson gage. The modern-day flood of record had occurred in 1961, with a peak discharge of 66,000 cfs. These record flood levels were far surpassed by the events of 1979 and 1983. The worst flood in Jackson's history occurred in April 1979. In a 2-day period between April 12-13, rainfall amounts measuring up to 19.6 inches fell over headwaters of the watershed. The resulting flood had an estimated peak flow of 160,000 cfs into the Ross Barnett Reservoir. Some control of discharge from the reservoir occurred and the measured peak at the Jackson gage was approximately 128,000 cfs. As previously mentioned, the discharge control consisted of pre-releasing inflows; therefore, when peak discharge reaches the reservoir, there is some storage available to reduce the downstream peak. During the April 1979 Flood, the resulting peak stage at the Jackson gage was measured at a stage of 43.3 feet. In May 1983, another severe rainfall in the upper Pearl River Watershed generated a peak inflow into the Ross Barnett Reservoir of 117,000 cfs which, through use of storage, was regulated down to 78,000 cfs at the Jackson gage. The resulting peak stage at the Jackson gage was 39.6 feet. As published by the United States Geological Survey (USGS), the frequencies of the 1979 and 1983 flood events at the Jackson gage were annual 0.5% and 2.86% chance exceedance events respectively. Because of the severity of those two floods, other floods occurring between 1979 and 1983 are rarely mentioned. Floods equivalent to the annual 20% to 10% chance exceedance events occurred on March 21, 1980; April 14-17, 1981; December 6, 1982; April 8-9, 1983; May 5, 1991; and April 11, 2014.

2.2.2 FUTURE WITHOUT-PROJECT CONDITIONS (NO ACTION ALTERNATIVE)

The No Action Alternative would have no direct impacts on the existing flows because no additional measures would be developed or improved. Watershed hydrology and hydraulics would remain unchanged when compared to existing conditions except for an increase in runoff due to development within the watershed. Increased urbanization, both inside and upstream of the Project Area, will have impacts to operations including in an increase in runoff and potential increase in localized flooding.



Rankin and Hinds Counties, Mississippi Flood Damage Reduction Study

Integrated Draft Feasibility and Environmental Impact Statement Pearl River Watershed

Rankin-Hinds Pearl River Flood and Drainage Control District

Figure 2-1
Project Area Map

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Figure A. 1963 Aerial Photograph

Figure B. 1968 Aerial Photograph

Figure 2-2, Historical aerial photography showing the Pearl River in 1963, before the construction of the levees and channelization of the river had begun, and 1968, when these projects were ongoing

Figure C. 1968 Aerial Photograph

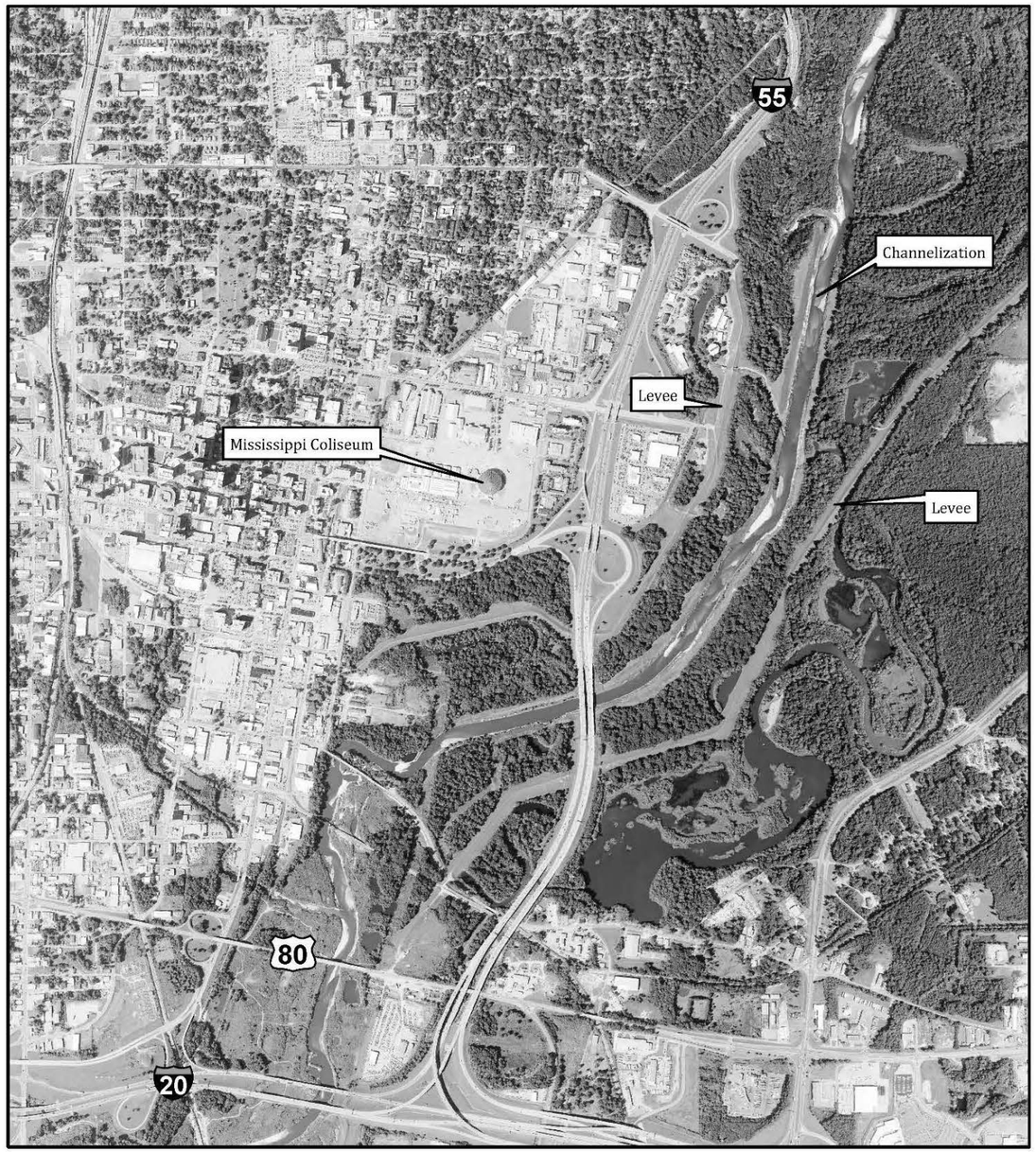

Figure D. 2014 Aerial Photograph

Figure 2-3, Historical aerial photography from 1968, during the construction of 1-55 and levees plus channelization of the Pearl River, and aerial photography from 2014, showing current conditions

2.3 COMPLETED PROJECTS WITHIN THE STUDY AREA

Projects already completed within the Study Area have greatly changed the course of the Pearl River. Many of these projects, including building of the levees and the construction of the Ross Barnett Reservoir, took place around the same time frame. Construction of Interstate 55, construction of the East and West Jackson Levees, and channelization of the Pearl River are all visible upon review of historical aerial photography from 1968.

2.3.1 JACKSON AND EAST JACKSON LEVEES

There are two existing levee segments within the Study Area - Jackson (fairgrounds) and East Jackson (Figure 2-3). These levees were constructed between 1964 and 1968 by the Mobile District of the Corps of Engineers. On the west bank lies the Jackson levee (Figure 2-4), which is approximately 1.8 miles long. This levee segment consists of two 4 foot by 4 foot gated gravity outlets and three 15-cfs pumps. The Jackson levee segment protects approximately 420 acres, including the state owned fairgrounds area, businesses, residences, and Interstate 55. Although small, this area has a very high value of real estate, with over $100 million in state property in addition to other commercial real estate located in the vicinity.

Figure 2-4, Existing Levees on the Pearl River

Figure 2-5, The Jackson levee during the 1979 Flood event

In 1984, an extension on the north end of the Jackson levee was constructed to prevent flanking of the levee, such as occurred (along with overtopping) during the record flood of April 1979. This extension is approximately 0.2 miles in length and protects an additional 380 acres.

The East Jackson levee lies on the east bank and is approximately 11.3 miles long. This levee protects 5,870 acres, including the city of Pearl, MS, and portions of Flowood and Richland, MS. This levee consists of two 8 foot by 6 foot gated gravity outlets and three 150-cfs pumps. The major contributor of flows to the pump station is Conway Slough and Neely Creek. Neely Creek flows into Crystal Lake prior to discharging into Conway Slough where the pumps are located. Both of these tributaries together drain a large portion of the city of Pearl. When the Pearl River reaches a stage of 19.0 ft on the Highway 80 gage, the gates are closed and pumps are used until the river subsides below this stage.

Approximately 5.34 miles of Pearl River channel cutoffs were constructed as part of the levee project. In addition, a 650 foot wide cleared strip, centered on the channel, was constructed between the levees to increase the conveyance through this reach, as can be seen by Figure 2-6. The area spanning approximately 300 feet on each side of the altered and channelized section is maintained with no vegetation, other than grass, throughout the reach.

Figure 2-6, Existing Pearl River Levees/Top Bank Cleared Areas

2.3.2 FLOODWAY CLEARING PROJECT

The clearing of a portion of the Pearl River floodplain was completed in 1984 by the USACE and the Pearl River Basin Development District as local sponsor. The clearing extends from approximately 0.5 miles below the Jackson sanitary landfill to the Woodrow Wilson Bridge, a total of 3.3 river miles. The plan consisted of 237 acres of total clearing, 20 acres of selective clearing and 89 acres of partial clearing. In addition, approximately 39,000 tons of riprap were placed for protection around bridges. The clearing was done to improve conveyance through that reach, with numerous bridges located throughout it. The area continues to be sprayed to kill vegetation approximately every 4 to 5 years, and is typically free of large vegetation, as can be seen in Figure 2-7.

Figure 2-7, Area of Herbicide Spraying

2.3.3 ROSS BARNETT RESERVOIR (NON-FEDERAL PROJECT)

The Ross Barnett Reservoir, shown in Figure 2-8, was constructed on the Pearl River from 1962-1965. The reservoir is managed, operated, and maintained by the Pearl River Valley Water Supply District (PRVWSD). The dam of the reservoir is located approximately 12 miles northeast of downtown Jackson in Madison and Rankin Counties, MS.

The primary mission objectives of the PRVWSD are to provide water to the City of Jackson and water recreation opportunities with approximately 400,000 acre-feet of impoundment.

The impoundment consists of approximately 33,000 acres with a drainage area of approximately 3,050 sq. mi. The earth fill dam is 23,400 feet in length with a maximum height of 64 feet. Elevation at the top of the dam is 308 feet NGVD. The principal spillway consists of ten 40 foot (width) by 21 foot (height) Tainter gates with a discharge capacity of 180,000 cfs. The emergency spillway is a fuse plug-type with a discharge capacity of 70,000 cfs.

Figure 2-8, Ross Barnett Reservoir

It is not possible for the Ross Barnett Reservoir to meet its prescribed missions of providing both a reliable water supply and water based recreational opportunities, while simultaneously providing extensive flood control. During the design and construction of the reservoir, the desired purposes or objectives of the lake were widely discussed. Engineer Horace Lester, Sr. was quoted in the now defunct *Jackson Times* newspaper on September 23, 1964:

> *"By the time the engineering studies reached the point at which the engineers knew how much water would be needed, we were faced with three principal purposes for a reservoir – none of which were compatible with each other. These purposes were water supply, flood control and recreation. A water supply*

reservoir required a full pool. A flood control reservoir required an empty pool and a recreation reservoir required a stable level pool."

Although the Reservoir can and has provided some flood reduction during extreme events, it was not designed as a traditional flood control reservoir. Meaningful flood risk management can only be achieved through pre-releasing flows to provide storage prior to the peak flow entering the reservoir. This is not a requirement for operation of the reservoir; however, PRVWSD has tried, within the design limitations, to help reduce flooding downstream during extreme events.

Ross Barnett Reservoir was used beyond its normal limits in April 1979, and again to a lesser extent in May 1983, to regulate flood flows. The peak flow of the 1979 event was reduced by approximately 22%, and the peak flow of the 1983 event was reduced approximately 28%. By lowering the water elevation of the reservoir prior to the peak inflow reached, the reservoir was able to reduce the maximum downstream stages approximately 1.0 to 2.0 feet during these significant flood events.

2.4 HUMAN ENVIRONMENT

This section describes the social and economic environment that would be potentially affected by the proposed action and alternative actions. The social and economic environment of the Study Area is characterized by its demographic composition, the structure and size of its economy, and the types and levels of public services available to its citizens. Accordingly, this FS/EIS evaluates potential effects of USACE permitting actions on the region's population growth, employment and income levels, business activities, housing stock, public services, environmental justice, and the protection of children.

The socioeconomic environment for this FS/EIS encompasses 20 towns and cities within the 3 Mississippi counties of Hinds, Madison, and Rankin. The primary Study Area and region of influence (ROI) for this proposal comprises the Pearl River Watershed between RM 280.0 (south of Richland, MS) and RM 301.77, (at the dam of Ross Barnett Reservoir) (Figure 1-1). Municipalities within the Study Area include the Cities of Flowood, Jackson, Pearl, and Richland. The Study Area includes parts of Hinds and Rankin counties.

The cities and counties listed above form the economic ROI and define the geographic area in which the predominant social and economic impacts from USACE activities are likely to take place. Nonetheless, the FS/EIS recognizes that socioeconomic effects from proposed and alternative actions may well extend beyond the ROI, although these impacts would be significantly reduced beyond the ROI evaluated in this FS/EIS.

2.4.1 POPULATION AND HOUSING

Population growth in the Study Area during the last decade has been characterized by modest growth among the three counties affected by the proposed project, with declines in some cities and towns within each affected county. Trends in population growth for the Jackson metropolitan area are summarized in Table 2-1 and Figure 2-9.

2.4.1.1 *HISTORIC AND EXISTING CONDITIONS*

The historic population levels and rates of change in the ROI can be broadly correlated with recessions and changing demographic patterns which affected Mississippi as a whole in the past 30 years. Hinds County, which includes the city of Jackson, has seen a decline in population as people have moved out of the urban core to the surrounding suburban communities within Madison and Rankin counties, both of which have experienced increased population figures. However, Jackson is the state capital and the city's decline in population is somewhat slowed by the state's governmental operations occurring in Jackson. In general, the regional population has grown over the past 20 years and is now home to over 500,000 people.

Table 2-1, Historical Population Levels, 2000-2010

Location	1990	2000	2010	Rate of Change (%)
Hinds County	**254,441**	**250,800**	**245,285**	-3.73
Bolton	637	614	567	-12.35
Byram	----	5,912	11,489	6.87
Clinton	21,847	24,932	25,216	13.36
Edwards	1,279	1,214	1,034	-23.69
Jackson	196,637	187,614	173,514	-13.33
Learned	111	83	94	-18.09
Raymond	2,275	2,016	1,933	-17.69
Terry	613	928	1,063	42.33
Utica	1,033	910	820	-25.98
Madison County	**53,794**	**74,674**	**95,203**	43.50
Canton	10,062	12,060	13,189	23.71
Flora	1,482	1,656	1,886	21.42
Madison	7,471	18,557	24,149	69.06
Ridgeland	11,714	20,464	24,047	51.29
Rankin County	**87,161**	**115,327**	**141,617**	38.45
Brandon	11,077	17,165	21,705	48.97
Flowood	3,860	5,780	7,823	50.66
Pearl	19,588	23,171	25,092	21.94
Pelahatchie	1,553	1,403	1,334	-16.42
Puckett	294	315	316	6.96
Richland	4,014	6,072	6,912	41.93
Robinhood	---	1,642	1,605	-0.23
Mississippi	**2,573,216**	**2,844,658**	**2,967,297**	13.28

Source: U.S. Census Bureau

Housing

Residential housing stock has shown predictable gains and losses throughout the ROI cities and towns, consistent with population growth or loss in a given jurisdiction. The city of Jackson has seen a loss of residential housing while the outlying suburban areas of Rankin and Madison show significant growth. Towns with significant renter populations have remained relatively static, despite shifts in the economy over the past two decades, although owner-occupied housing has increased in some jurisdictions in the past ten years.

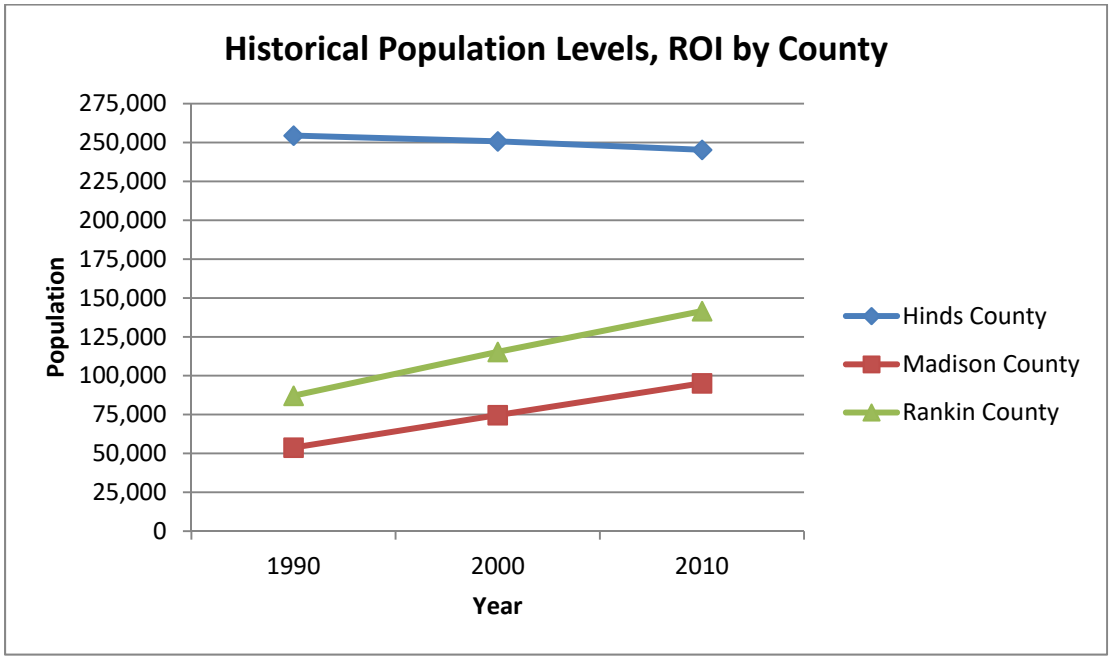

Figure 2-9, Historical Population Levels

2.4.1.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

The no action alternative will likely result in continuing steady population growth based directly and indirectly on changes in the economic climate of the region. Declines in the population of the city of Jackson are likely to continue as people continue to move to the suburban areas for newer housing stock. However, if no action is taken and the area experiences another major flood event similar to the flood event of 1979, the ROI could experience an accelerated population decline corresponding with an increase in insurance risk and a decline in the perception of livability in the at-risk areas.

2.4.2 EMPLOYMENT, BUSINESS, AND INDUSTRIAL ACTIVITY

The ROI's economy has become more service sector-oriented and less dependent on traditional manufacturing sectors to generate employment, a general trend that has occurred throughout

the United States. However, there has been some growth in the manufacturing sector with the 2003 opening of a Nissan plant in Madison County, along with other complementary manufacturing industries. Still, as shown in the following tables, the services sector remains the single largest source of regional employment.

2.4.2.1 *HISTORIC CONDITIONS*

Historically, Jackson was established as a trading post due to its convenient proximity to the Pearl River and the ability to establish the post on the Bluffs above the river. Commerce quickly grew around Jackson as railroads were built. However, the city remained relatively small until the Civil War. Along with Jackson's historic industry of timber and textiles, the war spurred the growth of related industries including more textile, weapons, ammunition factories, and arsenals. After the war, the Jackson region saw the growth of other industries around oil and natural gas exploration, manufacturing, and agricultural trading.

2.4.2.2 *CURRENT EMPLOYMENT CONDITIONS*

In the modern era, the ROI is home to several different manufacturing companies, although the bulk of area employers are in the healthcare, government, and service sectors. The majority of employers are found in Hinds County, seat of the state government.

Table 2-2, Top 25 Regional Employers

Organization Name	Industry	Number of Employees	Location	County
State of Mississippi	Government, State	31,556	Jackson	Hinds
University of Mississippi Medical Center	Healthcare	8,000	Jackson	Hinds
United States Government	Government, Federal	5,500	Jackson	Hinds
Nissan	Manufacturing, Automotive	5,000	Canton	Madison
Jackson Public Schools	Education	4,814	Jackson	Hinds
Rankin County School District	Education	3,039	Brandon	Rankin
Baptist Health Systems	Healthcare	2,875	Jackson	Hinds
Wal-Mart Stores, Inc	Retail	2,725	Bentonville, AR	_____
St. Dominic	Healthcare	2,600	Jackson	Hinds
Mississippi State Hospital	Healthcare (Psychiatric)	2,500	Whitfield	Rankin
City of Jackson	Government, Municipal	2,323	Jackson	Hinds
Jackson State University	Education	1,500	Jackson	Hinds
Madison County School District	Education	1,500	Madison	Madison
AT&T	Telecommunications	1,300	Jackson	Hinds
River Oaks Health System	Healthcare	1,236	Flowood	Rankin
Central MS Medical Center	Healthcare	1,200	Jackson	Hinds
Kroger	Retail	1,200	Jackson	Hinds
Trustmark	Financial Services	1,075	Jackson	Hinds
Delphi Auto Systems	Manufacturing, Automotive	1,075	Clinton	Hinds
Hinds Community College	Education	1000	Raymond	Hinds
Rankin County Corrections Dept.	Correctional Institutions	1000	Pearl	Rankin
United Parcel Service	Logistics	975	Jackson	Hinds
Peco Foods of MS, Inc	Manufacturing, Food	900	Canton	Madison

Source: Greater Jackson Alliance (2014)

Table 2-3, 2013 Employment in the ROI

	2013 3 -Year Estimates				2010 3-Year Estimates				
	Hinds	**Madison**	**Rankin**	***Total***	**Hinds**	**Madison**	**Rankin**	***Total***	**% Change**
Total:	104,944	47,239	67,459	*219,642*	106,322	45,138	67,939	*219,399*	0
Industry									
Agriculture, forestry, fishing and hunting, and mining	836	339	695	*1,870*	1,058	608	960	*2,626*	-40
Construction	5,086	2,714	4,427	*12,227*	6,512	2,694	5,579	*14,785*	-21
Manufacturing	8,573	4,543	4,658	*17,774*	6,511	3,289	5,063	*14,863*	16
Wholesale trade	2,575	1,097	2,137	*5,809*	2,300	1,480	2,173	*5,953*	-2
Retail trade	12,095	6,027	7,240	*25,362*	12,583	4,484	8,458	*25,525*	-1
Transportation and warehousing, and utilities	4,909	1,723	3,215	*9,847*	6,062	1,972	3,960	*11,994*	-22
Information	2,060	1,164	1,558	*4,782*	2,401	1,014	1,951	*5,366*	-12
Finance and insurance, and real estate and rental and leasing	5,592	3,955	6,200	*15,747*	6,516	3,773	5,228	*15,517*	1
Professional, scientific, and management, and administrative and waste management services:	8,653	4,520	5,890	*19,063*	8,302	4,853	6,410	*19,565*	-3
Educational services, and health care and social assistance	29,981	13,119	17,364	*60,464*	30,934	12,865	15,541	*59,340*	2
Arts, entertainment, and recreation, and accommodation and food services	11,076	2,915	5,116	*19,107*	9,524	3,606	4,209	*17,339*	9
Other services, except public administration	5,214	1,833	3,813	*10,860*	5,283	1,966	3,668	*10,917*	-1
Public administration	8,294	3,290	5,146	*16,730*	8,336	2,534	4,739	*15,609*	7
Occupation									
Management, business, science, and arts occupations	33,779	22,693	27,795	*84,267*	34,186	21,019	25,798	*81,003*	4
Service occupations	22,925	6,039	9,218	*38,182*	22,651	6,315	9,932	*38,898*	-2
Sales and office occupations	26,535	12,036	17,454	*56,025*	28,083	10,816	18,183	*57,082*	-2
Natural resources, construction, and maintenance occupations	7,521	2,663	6,966	*17,150*	8,452	3,214	7,805	*19,471*	-14
Production, transportation, and material moving occupations	14,184	3,808	6,026	*24,018*	12,950	3,774	6,221	*22,945*	4

Source: U.S. Census Bureau

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While the top regional employers are primarily government entities, the majority of employment in the ROI is generated by the service sector. There has been an increase in manufacturing in the past decade with the opening of a Nissan plant and other automotive-related manufacturing facilities. Employment has significantly diminished in the agriculture and mining sectors, which have historically provided much employment. The healthcare sector continues to provide employment in the ROI, with the continued growth in the industry of healthcare-related services particularly in Madison and Hinds counties.

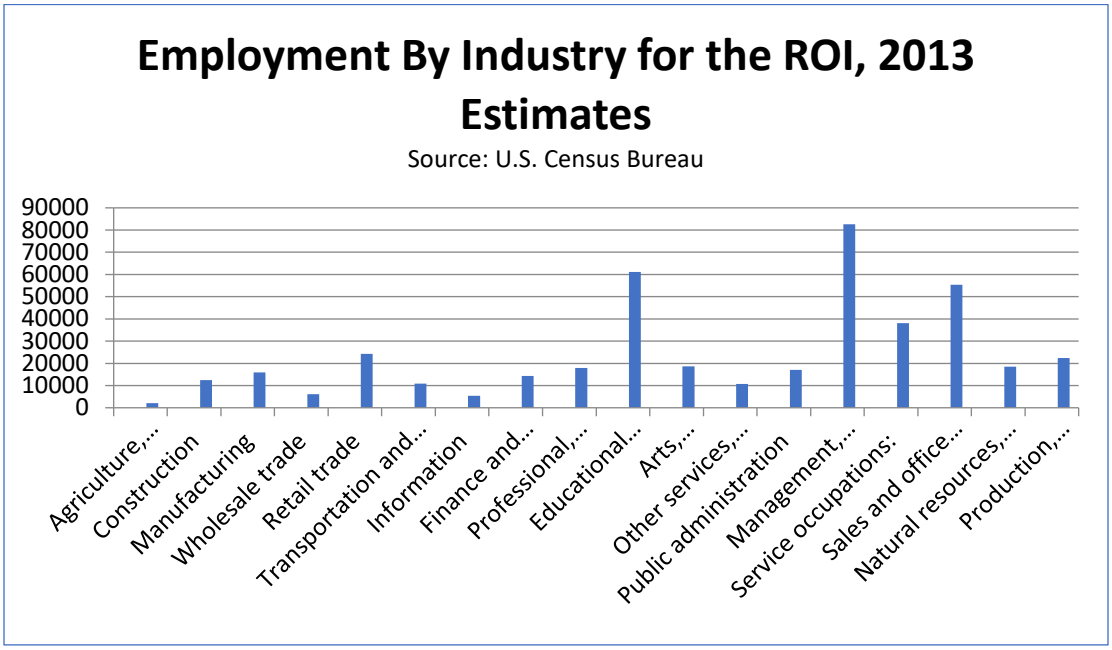

Figure 2-10, Employment by Industry

2.4.2.3 *INCOME*

Incomes in the ROI have increased significantly in the counties which have experienced the most growth in both population and industry. Madison County has seen the largest increase in median household income. This is likely due to the influx of population and the increase in manufacturing and retail development in Madison County over the past decade. In Hinds County, there has been a moderate increase in average income, although it has not increased at a rate that accounts for increases in cost-of-living and inflation.

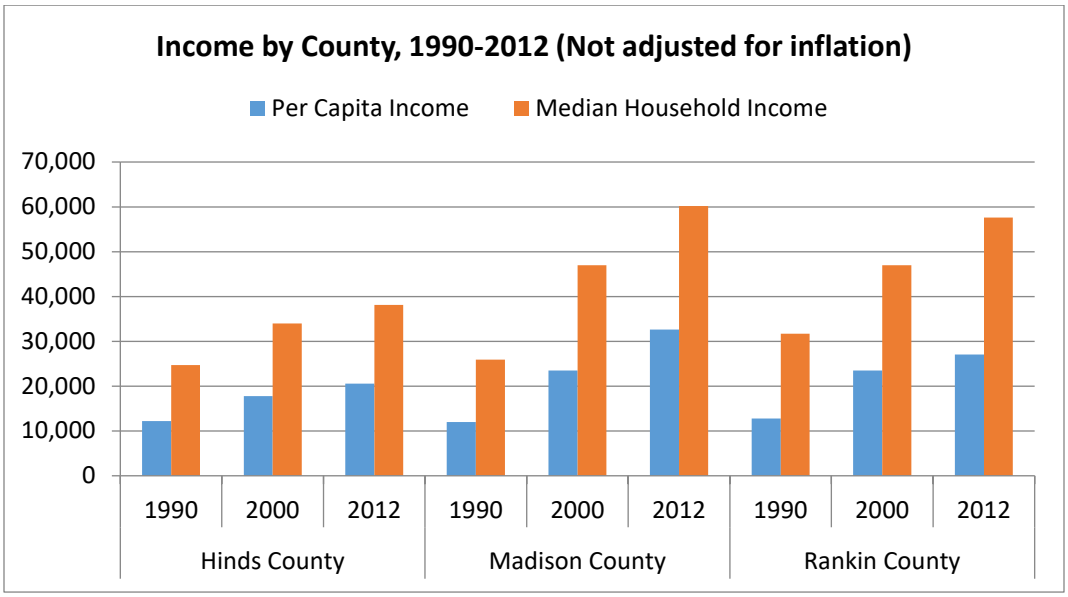

Figure 2-11, Income by County

2.4.2.4 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

The no action alternative will likely have limited effect on income and employment in the ROI. The region is likely to continue following national trends, with a continued rise in service sector employment opportunities. The region may also see some growth in the manufacturing sector if current manufacturing employers remain stable.

2.4.3 PUBLIC FACILITIES AND SERVICES

2.4.3.1 *HISTORIC AND EXISTING CONDITIONS*

2.4.3.1.1 *SCHOOLS*

There are six school districts in the ROI made up of three county and three city districts. These districts comprise over 75,000 students enrolled. The largest school district, the Jackson School District, has almost 30,000 students enrolled. The smallest of these districts, located in the town of Canton, has over 3,400 students. Most of the smaller towns in the ROI are serviced by county-wide districts. Private and parochial schools also play a significant role in educating young people in the ROI.

As population grows or declines in the ROI, school enrollment is impacted. Growth in the general population will produce growth in school enrollment. Conversely, decline in the general population will produce decline in enrollments.

2.4.3.1.2 *PUBLIC SAFETY*

Public safety in the ROI is provided by municipal, county, and state level law enforcement. Local police departments service municipalities, Sheriff's Departments serve primarily the non-municipal territory of the counties in the ROI, and state level agencies serve both. The Mississippi Highway Safety Patrol is the primary state level public safety agency serving the ROI.

2.4.3.1.3 *FIRE SERVICES/EMS*

Fire protection services in the ROI are provided through municipal, county, and volunteer fire departments. Municipal fire departments are responsible for fire protection services within their municipal boundaries, while county fire departments and volunteer fire departments are responsible for protection services within the unincorporated areas. Typically, municipal fire departments respond to nearby unincorporated areas if needed; however, most unincorporated communities in the ROI maintain volunteer fire departments. There are both paid and volunteer resources devoted to the work of fire safety and emergency medical services.

2.4.3.1.4 *HEALTH CARE FACILITIES AND PROFESSIONALS*

The entire ROI is well served by health care facilities and professionals. There are major healthcare facilities in each of the three counties and several large and growing facilities which serve the entire region beyond the ROI located in the city of Jackson. Table 2-4 lists the hospital facilities in the ROI.

Table 2-4, Hospital Facilities in the ROI

Hinds	Beds
Merit Health Central	319
Mississippi Baptist Medical Center	638
Miss. Methodist Rehabilitation Center	124
Regency Hospital of Jackson	36
St. Dominic-Jackson Memorial Hospital	571
Select Specialty Hospital Belhaven	25
Select Specialty Hospital Jackson	53
University Hospitals & Health System	697
Madison	
Merit Health Madison	67
Rankin	
Brentwood Behavioral Healthcare	105
Merit Health Rankin	134
Merit Health River Oaks	160
Merit Health Woman's Hospital	109
Mississippi State Hospital (Psychiatric)	1479
Mississippi State Hospital (Oak Circle Center)	60
Whitfield Medical Surgical Hospital	32
Source: Mississippi Department of Health	

2.4.3.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

Schools, public safety, fire protection and health care constitute core public facilities and services in the ROI. Under the option of no action, these services will continue to function as discussed above. However, the integrity of these services is jeopardized by the potential impacts of a major flooding event. Strains on public facilities and services would occur during a flooding event creating extraordinary demand on these services in the immediate time frame of the event, as well as after the event, due to potential population declines after the fact.

2.4.4 TAX REVENUES AND PROPERTY VALUES

2.4.4.1 *HISTORIC AND EXISTING CONDITIONS*

Table 2-5 indicates the assessed property values of the ROI. Total assessed valuation includes both real and personal property. As indicated, the total assessed value in the ROI is $4,684,515,960. Tax revenue is determined by applying a millage rate to the assessed values. Millage rates and the method by which they are applied to various classes of property vary by jurisdiction. Millage rates often differ from year to year, as deemed appropriate by local government, thus producing varying revenue streams.

2.4.4.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

Tax revenues and property values will be most impacted under a no action alternative in the ROI in the event of a major flooding event. Such an event would likely cause decline in community development activity. In the wake of potential population declines, values would fall, negatively impacting tax revenue streams and depriving local government of critical operating revenue.

Table 2-5, Assessed Property Values for the ROI, 2009-2012

Class	Hinds		Madison		Rankin	
	2012	**2009**	**2012**	**2009**	**2012**	**2009**
Personal Class 3	$479,047,101	$489,393,918	$371,134,313	$417,470,801	$364,024,625	$382,873,459
Personal Section 27-39-329 & School Tax	18,327,278	28,668,003	20,405,310	25,735,310	27,560,912	24,104,189
Real Property Class 1	488,355,618	486,548,904	434,446,830	320,279,597	474,230,100	463,903,310
Real Property Class 2	684,191,046	672,698,150	485,856,726	462,024,970	481,880,460	470,046,857
Real Property Section 27-39-329 & School Tax	2,225,643	7,182,945	18,915,525	19,173,652	12,264,638	14,217,226
Public Service Class 4	211,830,922	176,645,902	37,660,064	36,326,837	72,158,849	55,733,310
Total Excluding Section 27-39-329 & School Tax	1,863,424,687	1,825,286,874	1,329,097,933	1,236,102,205	1,392,294,034	1,372,556,936
Total 27-39-329 & School Tax	20,552,921	35,850,948	39,320,835	44,908,962	39,825,550	38,321,415
Total Assessment	$1,883,977,608	$1,861,137,822	$1,368,418,768	$1,281,011,167	$1,432,119,584	$1,410,878,351
Source: MS Dept. of Revenue. Class V (Motor Vehicle) included with personal property						

2.4.5 COMMUNITY COHESION

2.4.5.1 *HISTORIC AND EXISTING CONDITIONS*

The impact analysis area for community cohesion is more narrowly defined than for the ROI as a whole. In particular, community cohesion is most directly related to the cities of Jackson, Pearl, Richland, and Flowood. These communities would be more directly impacted by the proposed alternatives and the option of no action. According to city planners, these four cities are cohesive.

2.4.5.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

As with other impacts related to the human environment, the alternative of no action does not impact community cohesion except in the circumstance of a major flood event. Such an event will negatively impact community cohesion, likely causing the loss of population, the disruption of ongoing community life, and a loss of property value. In this case, community cohesion will be negatively impacted by this alternative.

2.4.6 INFRASTRUCTURE

2.4.6.1 *HISTORIC AND EXISTING CONDITIONS*

The incorporated areas within the Study Area are serviced by public water and wastewater facilities, gas, electricity, telecommunications, and solid waste collection. The level of service has been sufficient for the existing populations within the Study Area. The existing public facilities consist of numerous utilities provided by local municipalities, as well as private utilities for gas, electrical service, telecommunications, and solid waste.

Public infrastructure locations are typically included along roadways to service residential and commercial real estate. A major interceptor route for wastewater runs parallel to the Pearl River, and the wastewater is impacted by flood water from the Pearl River. The wastewater interceptor traverses the Pearl River floodplain before entering the Savanna Street WWTP on the west bank of the Pearl River. This WWTP has a discharge permit for 46 mgd. The plant is protected by a levee that is not USACE-certified and that was compromised in the flood of record in 1979. Under current conditions, this levee would be impacted by flood events less than the flood of record.

2.4.6.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

The No Action Alternative would have direct impacts on many public facilities. One major impact would be the continuing risk of the $300 million WWTP being compromised, as was the case in a prior flood event, as well as any environmental impacts associated with this structure being out of service. In addition, utilities within the Pearl River flood plain would be impacted by a flood event, including utility services to homes in the impacted areas. During the flood of record in

1979, the four electrical substations located within the floodplain were flooded and shutdown. Such damage to electrical substations could shut off electricity to thousands of customers living beyond the immediate flood area.

Figure 2-12, Flood Fighting Efforts at the Power Substation at Jefferson Street

With the Pearl River rising higher every minute Friday, city workers tried to fortify the levee surrounding the wastewater treatment plant in south Jackson with a 2-foot plywood wall. As workers put finishing touches on the makeshift barrier, the flood inched toward it.

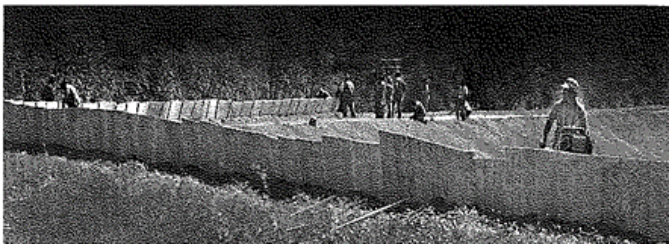

Figure 2-13, Flood Fighting Efforts WWTP

2.4.7 TRANSPORTATION

2.4.7.1 *ROADWAY NETWORKS*

2.4.7.1.1 *HISTORIC AND EXISTING CONDITIONS*

Roads and bridges comprise the majority of the transportation network serving the Study Area. Found within this network are several roadway classifications including interstate highways, U.S. highways, state highways, state routes, and local roads (Figure 2-14).

Economic productivity, jobs, and higher property values depend on reliable access to transportation. The locations of Mississippi's largest businesses follow interstate and state highway systems, highlighting the importance of highway access to the state's economy. The state's 2.9 million residents depend on highways, bridges, freight rail, passenger rail, ports and waterways, aviation, and pedestrian modes of transportation for work and play. The Mississippi Department of Transportation (MDOT) collects data on the state roads, highways, and interstates on a yearly basis. A summary of the estimated average daily traffic (ADT) for the Study Area is presented in Table 2-6.

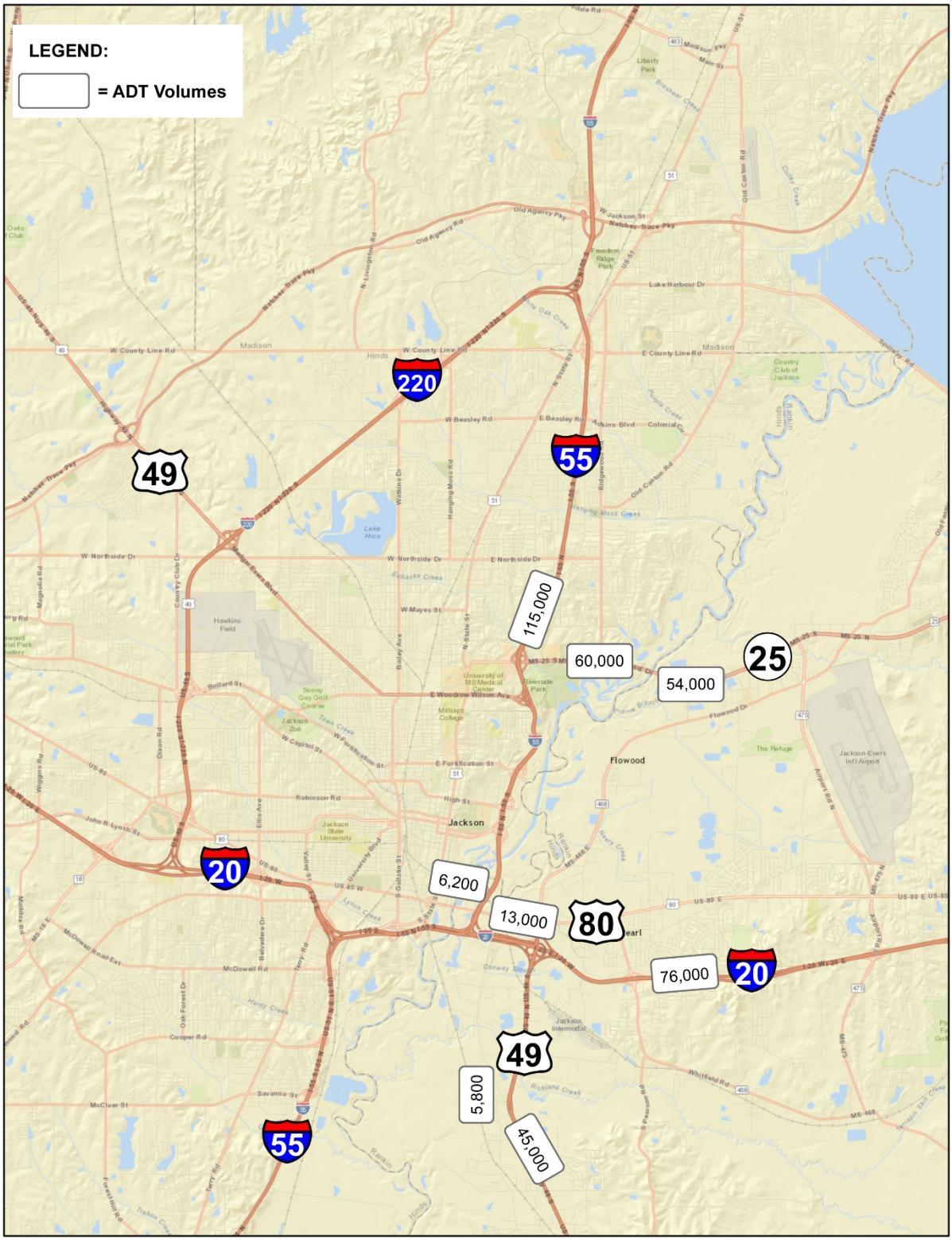

Figure 2-14, Major Transportation Routes
**ADT= Average Daily Traffic*

Table 2-6, Average Daily Traffic Volumes

Route ID	Station ID	County	2012	2009	2006
Lakeland at Ridgewood	251050	Hinds	60,000*	54,000*	69,000*
I-55 near Eastover Drive	250990	Hinds	115,000	113,000	121,000*
US Hwy 80 near I-55	610230	Rankin	13,000	15,000	25,000*
I-20 near Childre Road	610570	Rankin	76,000*	64,000	72,000
Lakeland at Treetops Blvd	610840	Rankin	54,000	56,000	59,000
US Hwy 49 at Quinn/McBride	610520	Rankin	45,000*	47,000*	48,000*
Old Hwy 49N at Club Oak Drive	611620	Rankin	5,800*	6,500*	4,800*
Old Brandon Rd at I-55	616004	Rankin	6,200	6,600	6,100*

Source: MDOT Traffic Count Application **Indicates estimated traffic count*

Interstates

Interstate 20 is a national interstate serving east-west traffic from Texas to South Carolina. The greatest commuting demand is into Jackson from the outlying areas. Interstate 20 crosses just south of the downtown area of Jackson and provides direct access to the Project Area by a number of direct exits as listed below.

- Exit 44: Interstate 55 South
- Exit 45: US Highway 51/State Street
- Exit 46: Interstate 55 North
- Exit 47A: US Highway 49 South
- Exit 47B: Highway 468 North/Flowood Drive
- Exit 48: Highway 468 South/Pearson Road

Interstate 55 is a regional interstate (964 miles) serving north-south traffic from Louisiana to Illinois. The greatest commuting demand is into Jackson from the outlying areas. Interstate 55 passes east of the downtown area and runs mostly parallel to the Pearl River. It crosses the Pearl River approximately 1 mile north of Interstate 20 and provides direct access to the Project Area by the direct exits listed below.

- Exit 94: Interstate 20 East and West
- Exit 96A: Pearl Street
- Exit 96B: High Street
- Exit 96C/E: Fortification Street
- Exit 98A: Woodrow Wilson Drive
- Exit 98B: MS Highway 25/Lakeland Drive
- Exit 99: Meadowbrook/ Old Canton Road
- Exit 100: Northside Drive

- Exit 102A: Briarwood Drive
- Exit 102B: Atkins Blvd / Beasley Road

U.S. Highways

U.S. Highway 51 (U.S. 51) is a four-lane highway that provides access to the areas on the west side of the Pearl River. U.S. 51 connects with Interstate 20 and runs through the downtown Jackson area past the state capitol.

U.S. Highway 80 (U.S. 80) is a four-lane divided highway that provides access to the areas on the east and west sides of the Pearl River just north of Interstate 20. U.S. 80 provides direct access to U.S. Highway 51, the cities of Pearl and Brandon, and Jackson-Medgar Wiley Evers International Airport.

U.S. Highway 49 (U.S. 49) is a four-lane highway that connects Jackson to the Mississippi Gulf Coast. At Jackson, U.S. 49 shares an alignment with segments of Interstates 20 and 220 before turning northwest to Yazoo City.

State Highways

MS Highway (Hwy) 25, also known as Lakeland Drive, is an eight-lane divided highway that provides access to the areas on the east and west sides of the Pearl River. MS Hwy 25 provides direct access to Interstate 55, the cities of Jackson and Flowood, including the University of Mississippi Medical Center and St. Dominic Medical Center, and Jackson-Medgar Wiley Evers International Airport.

MS Hwy 475, also known as Airport Road, is a four-lane divided highway that runs between MS Hwy 25 and Interstate 20. It crosses Interstate 20 south of Jackson-Medgar Wiley Evers International Airport. MS Hwy 475 provides direct access to the cities of Pearl and Flowood, and Jackson-Medgar Wiley Evers International Airport.

MS Hwy 468, also known as Flowood Drive, is a four-lane divided highway that runs between Interstate 20 and MS Hwy 475. It runs mostly parallel to the Pearl River on the southern portion of the highway and parallel to MS Hwy 25 on the northern portion. MS Hwy 468 provides access to the cities of Pearl and Flowood.

Local Roads

Old Brandon Road runs east-west and provides access to both sides of the Pearl River and connects with U.S. 51 and U.S. 80.

Major Traffic Corridors

Major corridors, including interstate, provide the transportation routes through the Jackson metropolitan area. However, during flood events, many miles of roadways are inundated, which

can cause significant congestion, delayed travel times, and infrastructure damage. Appendix B further details economic damages related to reroutes, congestion, and roadway damages.

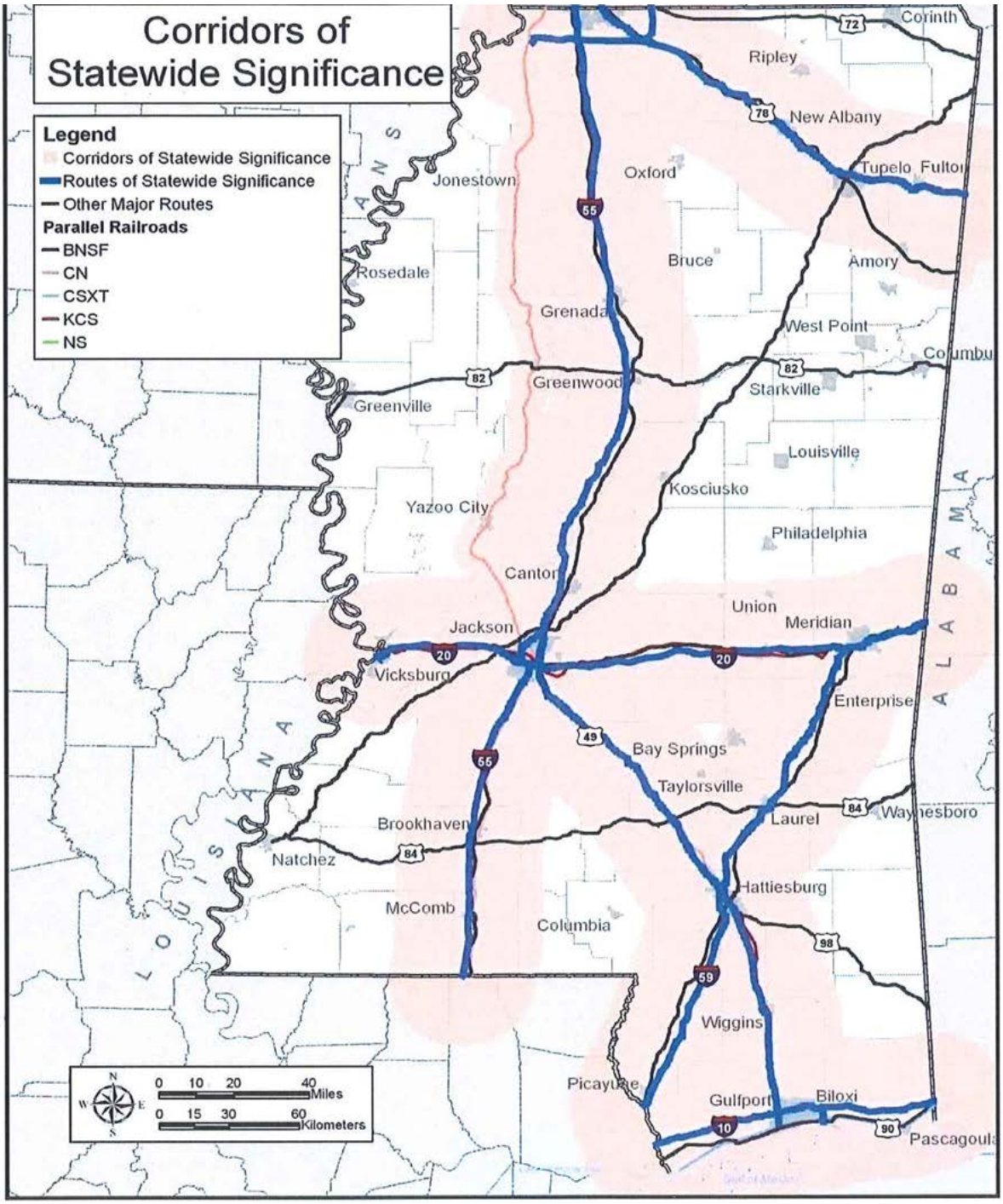

Figure 2-15, Corridors of Statewide Significance

Statewide transportation planning is required by federal law under guidelines established by the Intermodal Surface Transportation Efficiency Act of 1991. The state's eligibility for federal transportation funding is dependent on compliance with the statewide transportation planning requirement. Federal funding is critical to providing transportation facilities and services that are beyond the financial resources of state and local budgets. The State of Mississippi's MULTIPLAN 2035, an extension of the Safe, Accountable, Flexible, Efficient Transportation Equity Act – A Legacy for Users (SAFETEA-LU), is Mississippi's Long Range Transportation Plan with a planning horizon of 2035.

MULTIPLAN 2035 identified key transportation corridors of statewide significance to better understand proposed transportation solutions in the state. These corridors combined cover a total of approximately of 1,000 miles. As presented in Figure 2-15, the State Capital and Study Area has three statewide significant corridors. The large magnitude of traffic seen in these corridors establishes the importance of maintaining free flow of these corridors during flood events.

The primary area of congestion in the Study Area is along Interstates 55 and 20, U.S. 49, and MS Hwy 25, mainly during rush hours. The federal and state highways in the Study Area are subject to localized congestion varying throughout the roadway network. Several roadway improvement projects are in the planning or construction phase by MDOT; however, none of these projects will help relieve congestion during flood events.

As seen in Figure 2 17, major employment centers are located in and around the Jackson metropolitan area along major highways and rail corridors.

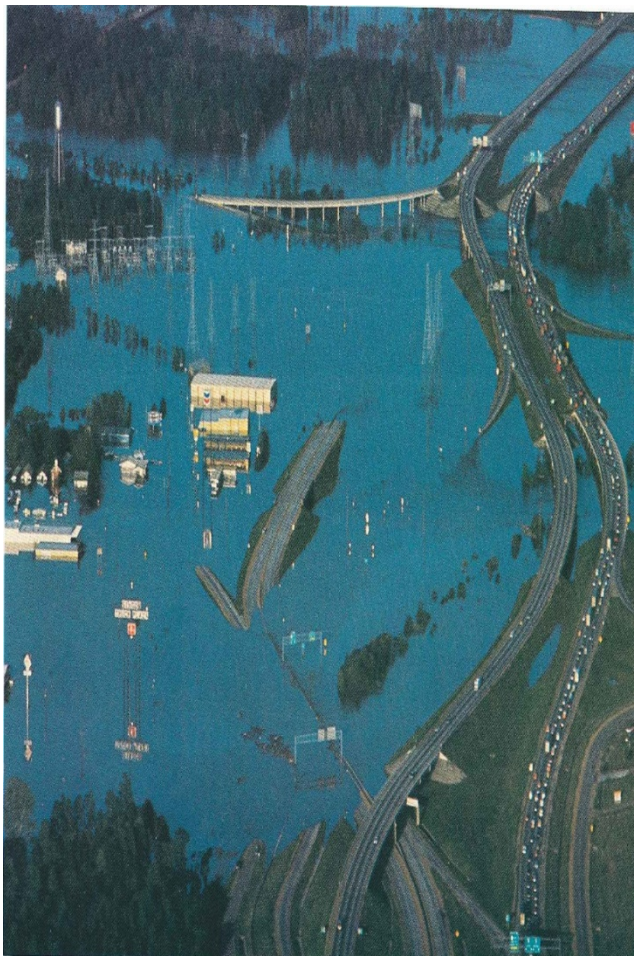

Figure 2-16, Traffic on Interstate 20 after the 1979 Flood event inundated the Gallatin and State Street exits

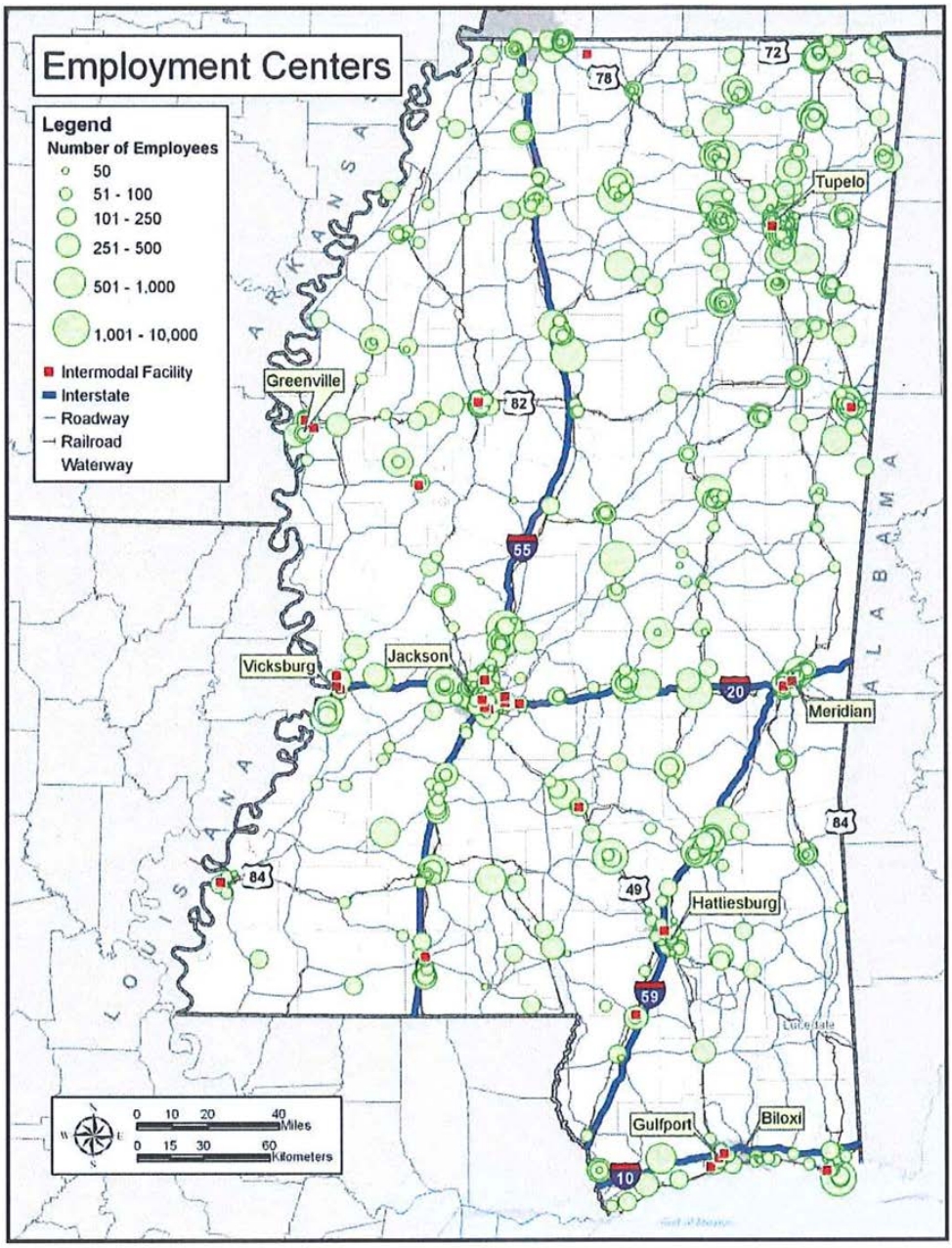

Figure 2-17, Employment Centers

2.4.7.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

The No Action Alternative would have direct impacts on transportation because no additional measures would be developed or improved even if traffic counts increase. With traffic on existing roads continuing to increase, traffic congestion and time of detour will increase during flood events. Corridors that will be impacted are of statewide and national significance and vital to the movement of goods and services across the nation. Figure 2-18 indicates roads that would be

impacted by the annual 0.2% chance exceedance flood event under existing conditions with the No Action Plan. Figure 2-19 shows the number of miles that would currently be impacted by different annual chance exceedance flood events. Figure 2-20 illustrates transportation impacts at Interstate 55 during the 1979 flood event.

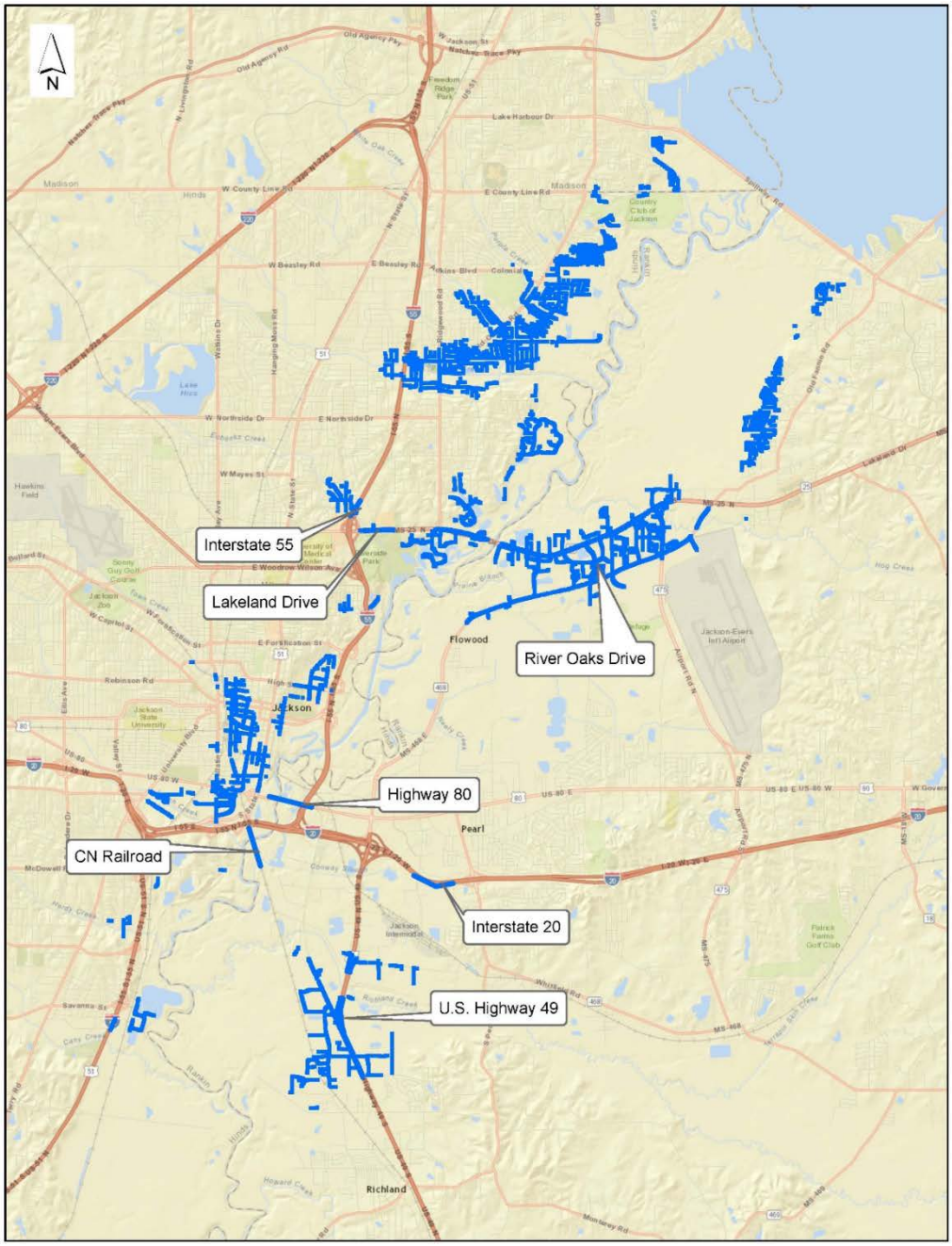

Figure 2-18, Roads inundated during the annual 0.2% chance exceedance flood event under the No Action Plan. A significant number of roads behind the levee in Pearl would also be inundated by an annual 0.2% chance exceedance flood event.

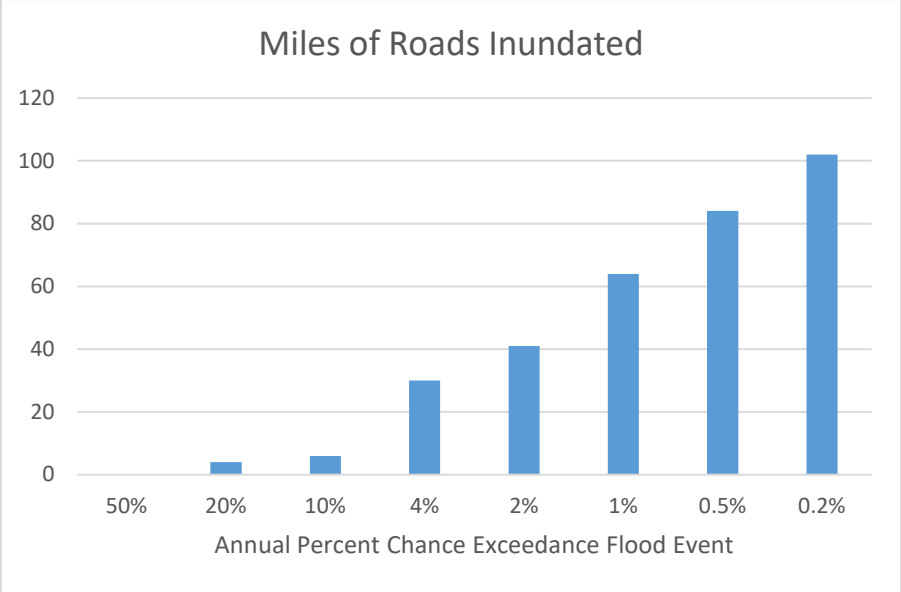

Figure 2-19, Miles of Roads Inundated

Figure 2-20, Interstate 55 inundation near the Jackson, MS, Fairgrounds

2.4.7.3 *RAILWAY NETWORKS*

2.4.7.3.1 *HISTORIC AND EXISTING CONDITIONS*

Railroads in the United States are separated into three broad categories: Class I, II, and III operators. Class I carriers have annual gross revenues of more than $250 million. Class II carriers have annual gross revenues of at least $20 million but not more than $250 million. Class III carriers have less than $20 million in gross annual revenues. Mississippi has two Class I railroads providing significant railroad capacity in the area.

The state of Mississippi plays an important role in the nation's freight rail transportation network. In 2006, Mississippi's railroads carried a total of 130 million tons and moved 2.2 million carloads of goods, for a total value of $126 billion. The vast majority, nearly 80 % of the total rail traffic or just over 100 million tons, passed through Mississippi without stopping. Most of this through-traffic results from flows between the markets located in the Southeast, Southwest, and Mountain regions. According to MDOT's *Mississippi State Rail Plan* (2011), three Primary Mississippi Trade Corridors include rail traffic through Jackson and the Project Area. In 2006, the Southhaven-McComb Corridor carried 19 million tons of freight valued at $17 billion, the Jackson-Hattiesburg-Gulfport Corridor carried 25 million tons valued at $28 billion, and the Vicksburg-Meridian Corridor carried 29 million tons valued at $37 billion. Between 2006 and 2030, MDOT estimates an increase in interstate inbound rail traffic of 10%, an increase in interstate outbound traffic of 60%, an increase in through-traffic of 57%, and a decrease in intrastate traffic of 5%. This forecast projects a total increase in Mississippi rail traffic of 51% by 2030.

Current rail passenger service in Mississippi is provided by two traditional long-distance trains operated by Amtrak, the Crescent, and the City of New Orleans. Based on FY 2009 Amtrak ridership reports, about 6% of Mississippi riders on the City of New Orleans are traveling locally (in both directions) between stations in Mississippi. Another 34% of the Mississippi riders are traveling (in both directions) from stations in Mississippi to New Orleans, LA, or Hammond, LA. The 926-mile City of New Orleans route from Chicago to New Orleans includes 292 miles in Mississippi and travels through the Study Area.

2.4.7.3.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

Presently, two railroads cross the Pearl River in Jackson. These railroads are impacted by flood events due to bridge overtopping or closure of railroad because of levee closures. The No Action Alternative would have direct impacts on rail transportation because no additional measures would be developed or improved as rail traffic continues to increase. With railroad volume continuing to increase, additional time delays will increase during flood events, impacting the delivery of goods.

2.4.7.4 *AIRPORTS*

2.4.7.4.1 *HISTORIC AND EXISTING CONDITIONS*

Jackson–Medgar Wiley Evers International Airport is a city-owned airport six miles east and across the Pearl River from the City of Jackson. The airport, situated to the north of Interstate 20 and to the east of Interstate 55, is the largest commercial airport in the state. Additionally, the airport serves private and military flights for the Jackson metropolitan area. The 172nd Airlift Wing, a unit of the Mississippi Air National Guard, is stationed at the airport.

Two long runways service an estimated 1.2 million passengers a year at the Jackson-Evers International Airport. It is served by three major airlines and their affiliates, offering non-stop flights to major US cities with global connections.

2.4.7.4.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

The No Action Alternative would continue to have direct impacts on the existing airport, including the continued risk of runway inundation, as occurred during the 1979 Flood. Additionally, access to the existing cargo and freight distribution facilities on the west side of the airport would be impeded.

2.4.8 ENVIRONMENTAL JUSTICE

On February 11, 1994, President Clinton issued Executive Order (EO) 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations. This EO is designed to focus the attention of federal agencies on human health and environmental conditions in minority communities and low-income communities. Environmental justice analyses of proposed actions are performed to identify potential adverse consequences that may affect these communities at a disproportionately high rate, and to then identify alternatives to potentially mitigate these effects. Population and housing data from the 2010 Census were used for this analysis. Poverty status, used in this EIS to define low-income status, is reported as the number of persons with income below the poverty level. The 2010 Census defines the poverty level as an annual income of $11,139 or less for an individual and an annual income of $22,314 or less for a family of four.

2.4.8.1 *HISTORIC AND EXISTING CONDITIONS*

The Study Area includes parts of Hinds and Rankin counties including the major tributaries of the Pearl River most affected by headwater flooding. The primary focus of the study is along the Pearl River and its tributaries particularly those areas most prone to flooding in the Jackson Metropolitan area. The population of the project area was analyzed by racial demographics (Table 2-7) and poverty level statistics produced by the most recently available U. S. Census data.

According to the data, minority and low income populations can be found throughout the Study Area, and are currently at risk from frequent flood events.

The three areas with recognized environmental justice concerns not only flood in response to an annual 1% chance exceedance flood event, but also experience flooding in response to an annual 4% or 2% chance exceedance flood event. In fact, one area in the southern portion of downtown Jackson floods more often due to the overflowing that occurs along Town Creek. In addition to downtown, the other two areas are located in Northeast Jackson and South Jackson.

Table 2-7, Race and Ethnicity (%), 2010

	Hinds County									Madison County				Rankin County							
	Bolton	Byram	Clinton	Edwards	Jackson	Learned	Raymond	Terry	Utica	Canton	Flora	Madison	Ridgeland	Brandon	Flowood	Pearl	Pelahatchie	Puckett	Richland	Robinhood	Mississippi
White	26.28	45.67	60.13	15.47	18.42	91.49	44.59	38.85	27.44	19.51	46.82	85.49	59.48	80.60	75.24	69.84	61.92	98.42	78.79	92.90	59.13
Black	73.37	52.14	33.88	82.68	79.37	5.32	53.65	59.27	64.15	74.68	51.22	10.23	32.70	16.86	18.60	22.99	32.83	0.32	14.45	1.99	37.02
American Indian	0	0.22	0.22	0.68	0.14	0	0.21	0.19	0.12	0.20	0.05	0.10	0.18	0.18	0.19	0.23	0.07	0	0.23	0.93	0.51
Asian	0	0.84	4.08	0.10	0.39	1.06	0.36	0.28	0	0.61	0.11	3.19	3.99	0.98	3.77	0.86	0.22	0.32	1.68	0.19	0.87
Pacific Islander	0	0.01	0.02	0	0.02	0	0.10	0	0.73	0.06	0	0.01	0.04	0.06	0	0.21	0	0	0.14	0	0.04
Other Race	0	0.28	0.67	0.48	0.75	0	0.10	0.47	7.32	25.5	1.38	0.22	2.36	0.52	0.88	4.16	3.82	0	3.66	1.93	1.29
Reporting Two or more Races	0	0.85	1.00	0.58	0.91	2.13	0.98	0.94	0.24	0.75	0.42	0.75	1.25	0.80	1.32	1.71	1.12	0.95	1.04	2.06	1.15
Total Hispanic Population	0.35	1.06	1.48	0.87	1.57	0	1.24	0.66	8.66	5.50	3.55	1.16	4.71	1.65	2.36	6.37	5.47	0.63	5.37	4.05	2.75

Source: CMPDD

2.4.8.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

The project area impacted by this alternative includes residential, commercial, schools, and hospitals, and the population is comprised of all races (minority and non-minority) and all income levels (low, middle and high). Without implementation of a federal flood control project, flooding would continue to affect all populations living in the Pearl River flood plain, with the northeast Jackson area being exposed to the potential for the greatest amount of economic damages. Under the No Action Alternative, while the northeast Jackson area currently faces the highest risk of realizing economic damages from flooding, the risks would not change throughout the project area when compared to existing conditions. Therefore, the No Action Alternative would not have a disproportionate adverse effect on minorities or low-income individuals/families.

2.5 NATURAL ENVIRONMENT

2.5.1 SOILS, WATER BODIES, AND PRIME AND UNIQUE LANDS

2.5.1.1 *HISTORIC AND EXISTING CONDITIONS*

From a geological standpoint, the Pearl River Watershed is not a contained unit because formations extend beyond topographic divides into the adjoining stream basins. Generally speaking, the formations at the surface tend to be sedimentary and range from Eocene to Recent. These formations dip in a southwest orientation throughout the northern three-fourths of the river watershed except where they are interrupted by structural features such as the Jackson Dome and other smaller salt domes.

The proposed Project Area is located within the Jackson Prairie physiographic province. As indicated by the *Geologic Map of Mississippi*, the geology of this area consists of outcrops of the Yazoo Clay Formation of the Jackson Group. The Yazoo Clay, named from exposures in the bluffs along the Yazoo River, outcrops along a northwest to southeast trending belt that extends from the Alabama state line to the edge of the Yazoo watershed in Yazoo County, Mississippi.

The Yazoo Clay consists of homogeneous clays throughout, with the exception of the upper 50-foot interval which contains several thin limestone and bentonitic clay beds. The uniformity of the Yazoo Clay across the state indicates the uniformity of the near shore marine conditions present during deposition of the clay in upper Eocene time (approximately 40 million years ago). Unweathered Yazoo Clay is blue-gray, slightly silty, fairly calcareous, massively bedded clay. Fresh Yazoo Clay weathers quickly to a dark olive-gray and then to a buff to tan clay. These color changes are irrespective of bedding. Alteration during weathering is accompanied by alternate swelling when wet and shrinking when dry so that bedding is soon obliterated. When the Yazoo Clay becomes wet or saturated, the swelling clay particles compress and further decrease the effective permeability of the Yazoo Clay. The Yazoo Clay is generally considered to be an impermeable formation and a barrier to contiguous groundwater aquifers or ponded surface waters.

Information obtained from the *Soil Survey of Hinds County, Mississippi* and the *Soil Survey of Rankin County, Mississippi* indicates that the three primary soil association units (General Soil Map Units) underlying the proposed Project Area consists of the Cascilla-Arkabutla and Tippo-Leverett-Guyton soil associations in Rankin County and the Cascilla-Bonn-Deerford soil association in Hinds County.

The Cascilla-Arkabutla soil association in Rankin County consists of the well-drained Cascilla soils that formed in silty alluviums near the low scarps and on the slightly higher elevations on natural levees of flood plains along the Pearl River. The Arkabutla soils are somewhat poorly drained and

formed in broad flats and in small depressions along the Pearl River. The Tippo-Leverett-Guyton soil association is also found in the Rankin County area. The Tippo soils consist of somewhat poorly-drained, nearly level soils that formed in silty alluvium and are typically found on low stream terraces and flood plains along the Pearl River. Leverett soils are deep, well-drained soils that formed in silty alluvium and are found on low stream terraces along the Pearl River as well. The Guyton soils consist of deep, poorly-drained, nearly level soils that formed in silty alluvium. These soils are typically found on low stream terraces and flood plains along the Pearl River as well.

The Cascilla-Bonn-Deerford soil association is found within the Hinds County portion of the Project Area. These soils are frequently flooded and found in the flood plains of the Pearl River. Bonn soils are typically found in broad, level areas and in depressions. The Deerford soils are generally found in the slightly higher areas of the broad flats.

Rainfall within the Project Area is generally considered to be abundant and well-distributed throughout the year. Snowfall within the Pearl River Watershed is generally a rare occurrence. Over time, there are generally seasonal variations in rainfall; the heaviest rains usually occur in the winter and spring, and lightest rains during the fall months. The average annual precipitation is about 55 inches of which 28% generally occurs in the winter, 28% in the spring, 26% in the summer and 18% in the fall. The period of greatest monthly precipitation normally occurs in March or July and the least in October. Of the total average annual rainfall, approximately 26 inches or 50% generally falls in the April to September time frame.

Historic records indicate that the average winter time temperature within the Project Area is 48°F. The average daily minimum temperature is approximately 37°F. To date, the lowest temperature of record was 7°F recorded in Jackson on January 30, 1996. In the summer months, the average temperature is approximately 80°F with an average daily maximum temperature of 91°F. The highest temperature recorded to date within the Project Area was 103°F recorded on July 16, 1980.

The proposed project is located within the Pearl River Drainage Watershed in the southern portion of the Jackson metropolitan area. The Pearl River is formed in Neshoba County, MS, by the confluence of the Nanawaya and Tallahaga Creeks. From its confluence, the river flows in a generally southwestern direction a distance of approximately 130 miles to the Jackson. The Ross Barnett Reservoir is located on the Pearl River just north of the Jackson metropolitan area and north of the Project Area. Bank heights through the Project Area average from 20 to 90 feet in height. Channel widths through the Project Area average approximately 400 feet in width.

The Pearl River Watershed contains a total of five major sub-basins. The proposed project is located in what is referred to as the Upper Middle Pearl sub-basin. Streams within the sub-basin generally have fast, deep flows for a short time after rain events and relatively shallow base flows.

Streams within the sub-basin have fair water quality. The two principal tributaries of the Pearl River located within the Project Area are Richland Creek and Squirrel Branch, both of which are transected by the proposed project. Other named streams that are transected by the project right-of-way route include Lynch Creek and Howard Creek. Through the Project Area, the Pearl River and the two primary tributaries are classified as Fish and Wildlife streams according to the *State of Mississippi Water Quality Criteria for Intrastate, Interstate and Coastal Waters*.

The highest recorded flood event on the Pearl River within the Study Area occurred in April 1979. In a two-day period from April 12-13, 1979, rainfall amounts measuring up to 19.6 inches were recorded within the headwaters area of the Pearl River Watershed. The resulting flood event had a recorded peak of approximately 128,000 cfs at the Jackson gage. The resulting peak river stage at the Jackson gage was recorded at 43.3 feet NGVD. The most recent flood event of note occurred in May 1983 at which time a peak flow of approximately 78,600 cfs with a peak river stage of approximately 39.5 feet NGVD was recorded at the Jackson gage. The frequencies of the 1979 and 1983 flood events at the Jackson gage were annual 0.5% and 2.86% chance exceedance flood events, respectively.

Water quality within the Project Area is considered to be good with localized impacts that at least temporarily impact the water quality of the riverine system at the point of occurrence. The primary land use within the Project Area is forestry with an increasing trend toward urbanization. Non-point source pollution attributed to the more developed portions of the Project Area is primarily associated with storm water runoff from the adjoining land surfaces. The *Mississippi Water Quality Report* prepared by the Mississippi Department of Environmental Quality (MDEQ) on a biennial basis pursuant to Section 305(b) of the *Clean Water Act*, assimilates and documents water quality within the Pearl River basin on a watershed basis. For the most recent Water Quality Assessment Report, the Pearl River and the associated tributaries have been determined to fully support all assessed uses.

Approximately 553 acres or 18.9% of the land within the Project Area is currently in agricultural use. An additional 249 acres or 8.5% are classified as hay fields (National Land Cover Database). This is the only readily available data that depicts actual acreages within the project boundary. Unique farmland is not located within the Project Area. Soils found in agricultural areas include: Tippo silt loam and Tippo Urban land complex. Coordination with the Natural Resources Conservation Service regarding prime farmland has been completed.

2.5.1.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

The Project Area is located within the Jackson metropolitan area and is therefore subjected to a high degree of residential, commercial, and industrial development within the general area. Because the Project Area is located within the Pearl River floodplain, however, the overall land use patterns within the area are not expected to change significantly during the anticipated

project life. The implementation of flood plain zoning restrictions and local experience with past flood events can minimize further encroachment into the floodplain area. Given the past and present growth trends in the Jackson Metropolitan Area, further urbanization is projected to claim in excess of 5% of the undeveloped areas during the project life. Without constraints on development, more significant encroachment into the floodplain area can be anticipated, especially along the eastern side of the Pearl River floodplain in Rankin County. For the most part, it is anticipated that land-use practices within the forestland habitats that now occupy the preponderance of the Project Area will not change significantly over the project life. It is projected that landowners within these areas will continue to allow forest succession to occur for the most part and that the majority of the area will continue to be utilized for timber production purposes. The degree of habitat diversity that now exists can be expected to remain in place within the area. It can also be anticipated that the advent of the U.S. Environmental Protection Agency (EPA) Storm Water Phase II Rule, which has established municipal storm water management programs within the Jackson metropolitan area, will result in a stabilizing effect on water quality within the Study Area.

2.5.2 WATER QUALITY AND WATER QUANTITY

2.5.2.1 *WATER QUALITY*

2.5.2.1.1 *HISTORIC AND EXISTING CONDITIONS*

Water quality data collected on the Pearl River and its tributaries from below the Ross Barnett Reservoir in Hinds County to the confluence of the Strong River in Simpson County is limited. Short-term, synoptic water quality studies were conducted by the MDEQ on the Pearl River in 2006, 2008, 2010, and 2012. However, only the 2006 study included monitoring stations located in the Study Area (Figure 2-21). There were also a few samples collected from tributaries of the Pearl River in the Jackson area in 2006. The 2008 and 2012 studies included stations that are downstream of the Study Area and the City of Jackson's WWTPs. The 2010 study focused on the Monticello area in sections of the Pearl River immediately upstream and downstream of the Georgia-Pacific Monticello Mill. There is one long-term monitoring station in the Study Area, located immediately below the Ross Barnett Reservoir Spillway. However, this station has not been regularly sampled since 1989. The next closest long-term station is at the Swinging Bridge in Byram. This station is below the Study Area and includes discharges from the City of Jackson's WWTPs (Figure 2-21).

Because available water quality data for the Study Area is sparse, additional water quality data was collected by the Flood Control District from the Study Area during July 2014 (Figure 2-21). Water quality samples, from five locations along the Pearl River and from three tributaries to the Pearl River within the Study Area, were collected during two sampling periods in July. Figure 2-

22 shows an example of the daily variation in dissolved oxygen that occurred in the Pearl River within the Study Area.

Data from monitoring stations within the Study Area was assembled for the years 1978 through 2014, and evaluated in Appendix D. This data is summarized and compared with Mississippi Water Quality Criteria in Appendix D.

Water quality is evaluated using state water quality standards. Water quality standards consist of two elements: (1) designated uses assigned to waterbodies, and (2) numeric or narrative criteria for water quality parameters designed to protect the designated uses. In Mississippi, designated uses are assigned based on waterbody classification. Table C-3 in Appendix D lists the classifications that apply to the Pearl River and its tributaries within the Study Area, along with the associated numeric criteria to protect the designated uses.

Figure 2-21, Pearl River water quality studies sampling sites

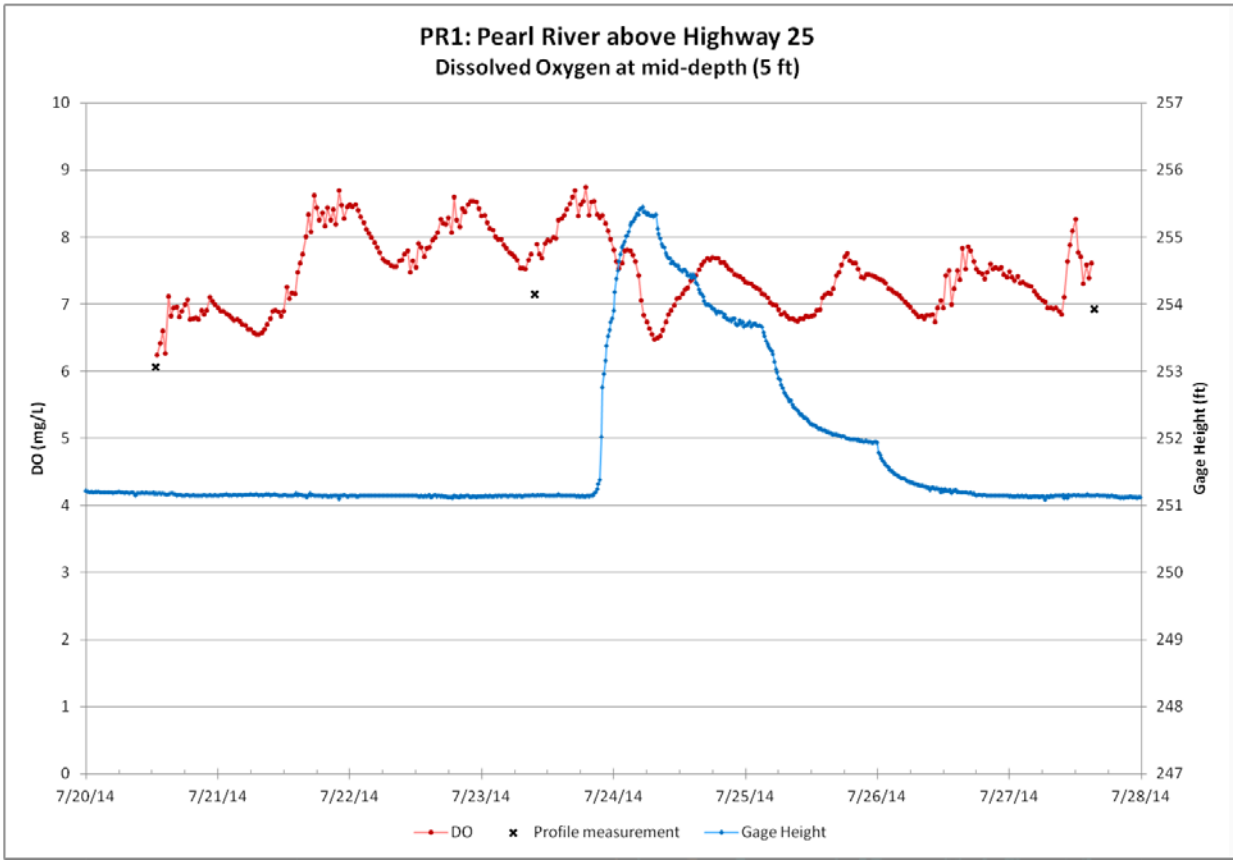

Figure 2-22, Example of diel variation in Pearl River DO during July 2014

Existing data show that the Pearl River near Jackson is meeting the water quality criteria for the classifications of Fish and Wildlife, Recreation, and Public Water Supply. As discussed in Appendix D, most sampling data for dissolved oxygen (DO), acidity (pH), and temperature showed that the measurements are within required ranges. Most DO measurements were well above the daily average criterion of 5.0 mg/L. However, there were some instances during the July 2014 data collection when DO levels measured immediately after storm events were below the criterion of 4.0 mg/L; these measurements were taken from the Pearl River upstream of the Jackson drinking water intake. Most pH and temperature measurements met the required criteria, but a few measurements of pH and temperature collected downstream of Jackson, in the segment from the Copiah County line to the confluence of Strong River, were slightly elevated. There are few available measurements for nutrients (total nitrogen and total phosphorous), chlorophyll-a, and transparency (i.e., turbidity). This limited data indicate that nutrients are not significantly elevated, and there is no indication that nutrients are negatively impacting water quality (e.g., increased chlorophyll-a, nuisance macrophyte growth, and depressed DO levels).

There are two significant National Pollutant Discharge Elimination System (NPDES)-permitted wastewater treatment facilities that discharge into the Pearl River downstream of the Study Area:

the Savanna Street WWTP- MS0024295 and the Trahon/Big Creek WWTP- MS0044059. In 2012, the City of Jackson entered into a consent decree with the EPA to address compliance with its wastewater collection system and wastewater treatment system. The O.B. Curtis Water Treatment Plant (NPDES Permit Number MS0046906) discharges in the FS/EIS reach. No violations of NPDES limits have been reported for this facility.

High levels of chlorine were measured in water samples collected at several Pearl River sites during the July 2014 water quality study. Chlorine levels in the Savanna Street and Trahon/Big Creek WWTP discharges reported for July 2014 were not yet publicly available. However, chlorine levels were reported as below detection in all previous discharge monitoring reports for which data is available (through April 2014). Chlorine values above detection limits are consistently reported in the discharge from the O.B. Curtis Water Treatment Plant. Note that although the NPDES permit for the O.B. Curtis Water Treatment Plant requires measurement and reporting of chlorine levels, it does not include numeric limits for chlorine.

There is also the possibility that an additional wastewater treatment facility serving west Rankin County will be built in the future and discharge into the Pearl River below the Project Area but within the Study Area. The waste load allocation (WLA) for this facility has been reserved in the recent nutrient total maximum daily load (TMDL) report developed for the Pearl River, but has not been removed from the Savanna Street WWTP allocation[3]. The current WLA for the Savanna Street WWTP is based on a critical low flow of 290 cfs[4]. It will be necessary to maintain a minimum flow of 290 cfs below the discharge points in order to support WLAs for Savanna Street and Trahon WWTPs. This flow is greater than the 112 mgd (approximately 174 cfs) minimum release specified in the Ross Barnett Reservoir permit.

MDEQ routinely assesses and reports on the condition of surface waters based on water quality data that meets the requirements for data quality specified in the State's Consolidated Assessment and Listing Methodology (CALM)[5]. MDEQ releases the results of water quality assessments on a routine basis in a report known as the §305(b) Report. While several segments of the Pearl River were assessed in 2008 and 2014, the Pearl River near Jackson was not assessed

[3] Total Maximum Daily Load for Total Nitrogen and Total Phosphorus for the Pearl River from Ross Barnett Reservoir to the Strong River, Hinds, Rankin, Simpson, and Copiah Counties, Pearl River Basin. Prepared by MDEQ, Office of Pollution Control, Modeling and TMDL Branch. March 2014. Finalized April 2015.

[4] From the MDEQ WLA file and personal communication with Greg Jackson, PE, BCEE, Chief, Modeling and TMDL Branch. April 25, 2014.

[5] Mississippi Consolidated Assessment and Listing Methodology 2012 Assessment and Listing Cycle, Data Requirements and Assessment and Listing Methodology to Fulfill the Requirements of Sections 305(b) and 303(d) of the Clean Water Act can be found online at: http://deq.state.ms.us/MDEQ.nsf/page/FS_SurfaceWaterQualityAssessments?OpenDocumenthttp://www.deq.state.ms.us/MDEQ.nsf/page/FS_SurfaceWaterQualityAssessments?OpenDocument.

during the 2010 or the 2012 cycle and is not mentioned in the respective §305(b) Reports. MDEQ completed their most recent §305(b) Report in 2016. Two reaches of the Pearl River within the Study Area were classified as not achieving the aquatic life support designated use or secondary contact use. However, a TMDL has been completed to address the impairment. These findings are generally consistent with the §305(b) Report released in 2014. Upstream of the Study Area, the Ross Barnett Reservoir was classified as eutrophic, consistent with all but two lakes addressed in the report and attaining the aquatic life support designated use.

For the 2008 report, the segment MSUMPRLR1E of the Pearl River, starting at the Ross Barnett Reservoir spillway and ending at the confluence with the Strong River, including the Study Area, was assessed. This segment is listed in the "evaluated" portion of the §305(b) Report for impairment due to nutrient pollution and organic enrichment/low DO. Placement in the evaluated portion of the report indicates that this segment of the Pearl River lacked sufficient monitoring data to meet the requirements given in CALM. "Evaluated" waters are included in the §305(b) Report based on anecdotal information gathered from responses to surveys conducted in the 1980s, and the assessments are not based on actual monitoring data.

A review of Section 303(d) Lists of Impaired Water Bodies, prepared by the MDEQ, indicates that segment MSUMPRLR1E of the Pearl River was initially placed on the 1996 §303(d) List of Impaired Waterbodies due to causes that include nutrients and organic enrichment/low dissolved oxygen. The segment remained on subsequent §303(d) Lists until a TMDL for total nitrogen and total phosphorous was completed in May 2009. The TMDL for total nitrogen and total phosphorous was updated in April 2014 and was approved by the EPA in a letter dated April 16, 2015. Both TMDL reports are based on limited water quality data for DO and nutrient concentrations. Furthermore, there is little information quantifying response parameters due to elevated nutrients (i.e., excess growth of algae or aquatic macrophytes, depressed/elevated DO levels, elevated chlorophyll-a, or decreased water clarity). The 2014 TMDL calls for a 70% reduction in Total Phosphorus (TP) and a 30% reduction in Total Nitrogen (TN) entering the river from both point and non-point sources.

The fact that the Pearl River listing is "evaluated" is significant when considering the water quality status of the River because the §303(d) listing and TMDL were not based on adequate monitoring data that indicated impaired water quality. The currently available water quality data do not meet the requirements for CALM[6], thus it is not possible to complete a rigorous assessment of the water quality status of the Pearl River near Jackson. However, a review of the water quality data collected between 2006-2012 shows that the river water quality typically meets the criteria

[6] CALM requires collection of samples during multiple sampling periods. For example, DO data must be collected over a minimum of three 24-hour sampling events distributed over a 2-year period. Toxicants require a minimum of 10 samples collected within a 3-year period.

for the parameters that are measured. In addition, there are no known fish kills or fish consumption advisories in the Pearl River from below the reservoir to the confluence of the Strong River.

In October 2013, MDEQ issued a temporary water advisory for the Pearl River from the Interstate 20 bridge to Rosemary Road in Terry, MS. This advisory was issued as a result of pump failures at the Savanna Street WWTP. MDEQ has been monitoring bacteria levels and water quality in this reach of the Pearl River to determine when to lift the advisory. As of April 2018, this advisory has not been lifted.

The entire Pearl River watershed consists of 8,760 sq. mi., of which 3,171 sq. mi. are upstream of the Jackson gage. Therefore, the water quality of the Pearl River in the Study Area is determined largely by the water quality of Ross Barnett Reservoir and the releases from the reservoir.

A watershed restoration and protection plan for the Ross Barnett Reservoir was finalized in 2011 (http://rezonate-ms.org/wp-content/uploads/2013/09/FINAL-Executive-Summary.pdf). This plan identified several water quality issues for the Ross Barnett Reservoir, including sediments and turbid water; nutrient pollution and algal blooms; as well as bacteria and pathogens. The plan recommends targeting activities to reduce these pollutants in the Pelahatchie River watershed. The Pelahatchie River enters Ross Barnett Reservoir just upstream of the dam.

2.5.2.1.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

The No Action Alternative would have no direct impacts on water quality and no changes in water quality are expected since most of the water entering the Project Area is from upstream of Ross Barnett Reservoir. Increased urbanization could degrade water quality of either local runoff or releases from Ross Barnett Reservoir. However, implementation of the existing Ross Barnett Watershed Management Plan and the TMDLs for nutrients could improve release water quality.

Figure 2-23, Looking upstream of the J. H. Fewell Water Treatment Plant weir

2.5.2.2 *HISTORICAL LOW WATER*

2.5.2.2.1 *HISTORIC AND EXISTING CONDITIONS*

Prior to the Ross Barnett Reservoir, the daily unregulated flow of the Pearl River at the Jackson gage had dropped below 80 cfs, 25 cfs of which was being withdrawn during the summer for consumption by the City of Jackson. In 1915, to insure a reliable source of water supply, the City of Jackson constructed a weir at the J. H. Fewell Water Treatment Plant located at RM 290.7 (Figure 2-23, Figure 2-24). Jackson's current water supply still draws on this weir, along with the O.B. Curtis Water Treatment Plant, which withdraws water from the reservoir. Additional encroachment on the minimum flows was not desirable due to increasing pollution concentrations, which adversely affect aquatic life and the attractiveness of the river further downstream.

Figure 2-24, A view across the J. H. Fewell Water Treatment Plant weir at the riprap on the east Pearl River bank immediately downstream

During the design of the Ross Barnett Reservoir, the six driest summers during the period of record, at that time from 1929 to 1956, were used to develop average monthly flows. For five of those six years, minimum flows ranged from 79 cfs to 92 cfs. To insure that additional flow is available for downstream use, the Ross Barnett Reservoir permit, issued by the Mississippi State Board of Water Commissioners on August 11, 1959, contains a provision stating "no water shall be appropriated or impounded under the authority at any time when the discharge from the reservoir is less than 112 million gallons of water per day." This flow approximates 170 cfs, which is more than twice the low flows prior to the construction of the reservoir. Furthermore, the permit declares "The District (PRVWSD), shall not interfere with the established minimum flow of the Pearl River if such flow is required to protect the rights of water users below, and the District (PRVWSD) shall deliver into the stream of the Pearl River below the dam such quantity of water as required by the Board of Commissioners." Minimal releases have continued by the Ross Barnett Reservoir and the reduction of low water elevation events are attributed to the change in daily flows post-construction of the reservoir, as highlighted in Table 2-8.

In the past, there has been much discussion regarding low flows in the lower portion of the Pearl River watershed. There is a perception that the Ross Barnett Reservoir has had an impact resulting in low flow/flow reduction in the Pearl River. However, the minimum released flows required by the reservoir's permit have yielded an average low flow volume downstream that is

greater than the average low flow volume measured prior to installation of the reservoir. As presented in Table 2-8, low flow stages in Jackson were lower prior to construction of the reservoir. A more detailed discussion of this data is included in Appendix C.

Table 2-8, Historical Low Water Elevations

YEAR	STAGE (Feet)
1896	0.30
1904	0.30
1911	0.20
1966	0.10
1966	0.30
1967	0.40
1969	0.50
1979	3.34
1980	3.70
1984	2.73
1990	2.85

2.5.2.2.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

The No Action Alternative would have no direct impacts on the existing flows because no additional measures would be developed or improved and operations would continue as they do at present. Watershed hydrology and hydraulics would remain unchanged when compared to existing conditions, except for an increase in runoff due to development within the watershed.

2.5.2.3 *PEARL RIVER TRIBUTARIES AND INTERIOR DRAINAGE*

2.5.2.3.1 *HISTORIC AND EXISTING CONDITIONS*

Several major tributaries exist within the evaluation area between RM 280 and RM 298 of the Pearl River. These tributaries convey flood water from urbanized areas within the Jackson metropolitan area: Richland Creek (RM 282.5), Lynch Creek (RM 286.3), Town Creek (RM 287.3), Eubanks Creek (RM 290.8), Prairie Branch (RM 291.9), Hog Creek (RM 294.5), Hanging Moss Creek (RM 295.5), and Purple Creek (RM 296.0). Directly connected to the Pearl River, these tributaries are the backwater flooding sources for the Pearl River. According to historical data, these streams typically experience flash flooding and peak approximately 3 days prior to the Pearl River peaks.

There are two existing pump stations, the West Bank and the East Bank pumping stations. The West Bank pumping station (Fairgrounds) is located at approximately RM 289.3, and the East Bank pumping station (Conway Slough) is located at RM 286.6. When the Pearl River reaches a stage of 19.0 ft on the Highway 80 gage, the gates area is closed and pumps are used until the river subsides below this stage.

2.5.2.3.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

The No Action Alternative would have no direct impacts on interior drainage because no additional measures would be developed or improved and operations would continue as they do at present. However, an increase in flow to these areas could be possible due to development within these individual watersheds if stormwater controls are not implemented.

2.5.2.4 *CHANNEL STABILITY (EROSION AND SEDIMENTATION)*

2.5.2.4.1 *HISTORIC AND EXISTING CONDITIONS*

Geomorphic Assessment

A limited geomorphic assessment was conducted for the Project Area. The primary focus of this FS/EIS was on the approximate 16-mile reach from the Ross Barnett Dam to a location downstream of Interstate 20 near Byram, MS. Components of this limited geomorphic assessment included field investigations, analysis of gage record, planform geometry, cross sectional geometry, and a preliminary assessment of sediment sources. A brief discussion of each of these is provided below.

Gage Record Analysis

Stage-discharge relationships were developed from the measured stage and discharge data at six USGS gages downstream of Ross Barnett Reservoir. Two gages, the Pearl River at Hwy 80 in Jackson, MS, and at Byram, MS, are in the vicinity of the Project Area. The Hwy 80 gage is located at Highway 80. The Byram gage is located about 14 miles downstream of Richland. The next nearest gage is the Rockport gage which is about 40 miles downstream from the Byram gage. The other three gages are located near Monticello, MS; Columbia, MS; and Bogalusa, LA.

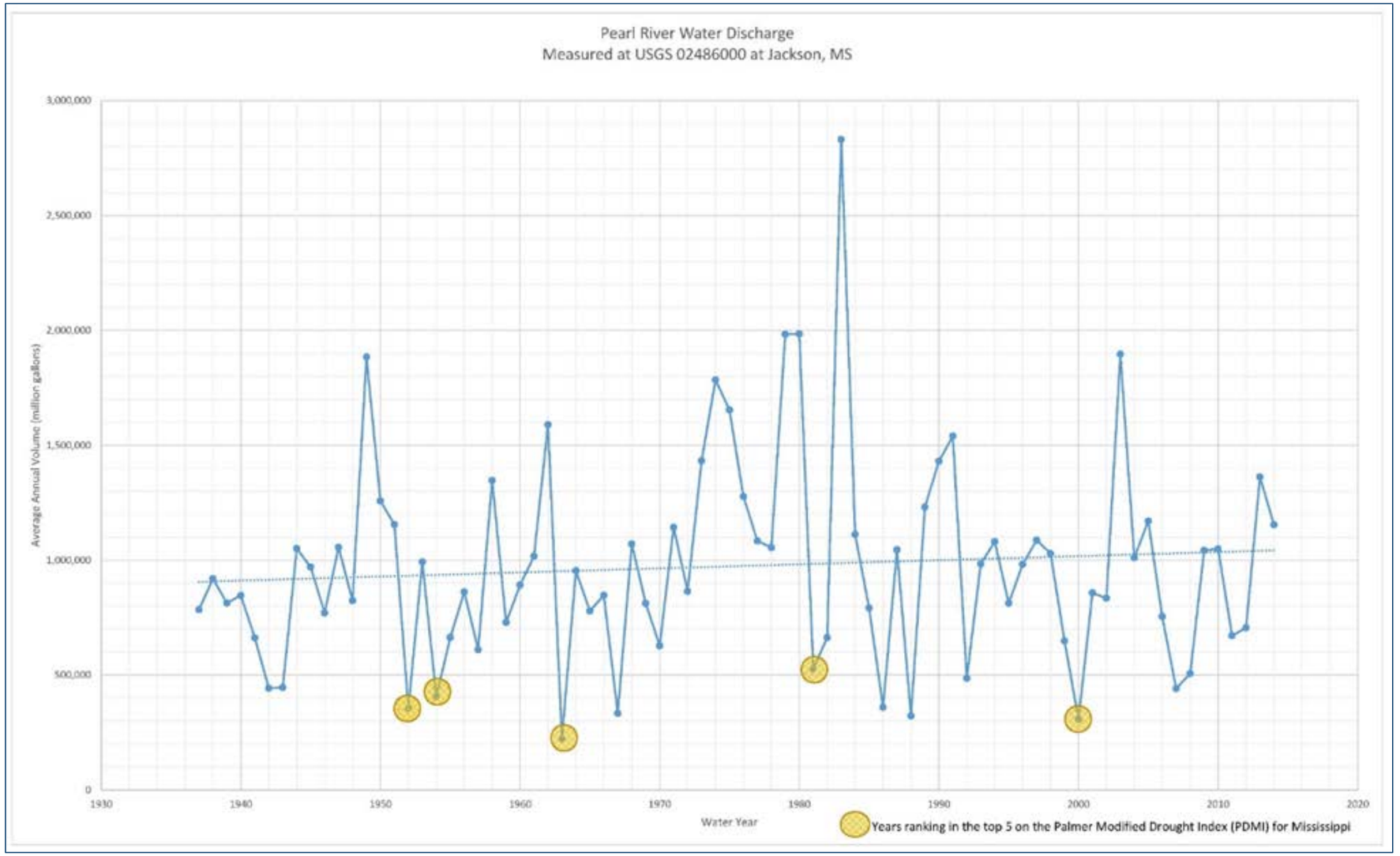

Figure 2-25, Jackson, MS: Mean Annual Water Volume (in Million Gallons)

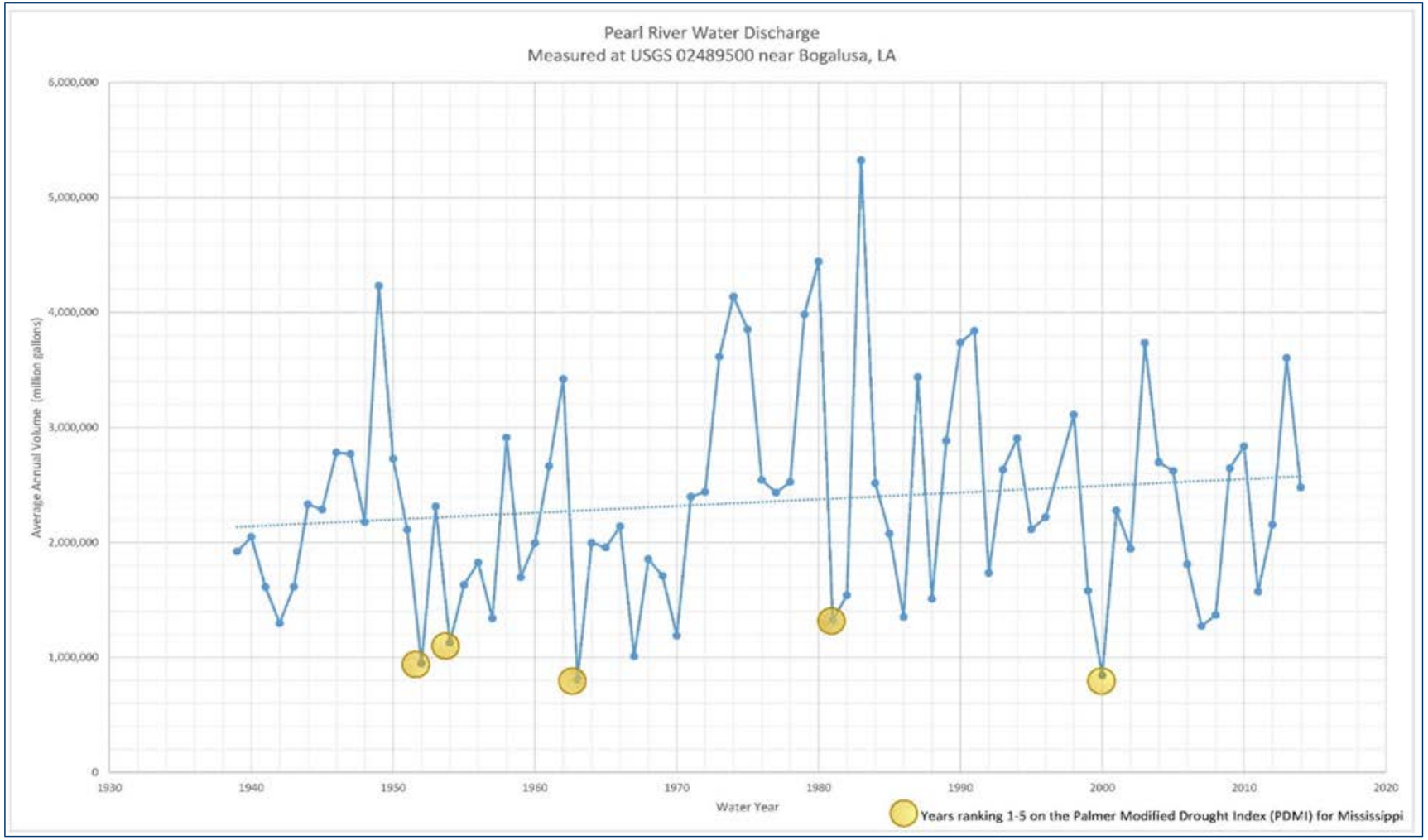

Figure 2-26, Bogalusa, LA: Mean Annual Water Volume (in Million Gallons)

The stage-discharge relationships at the Hwy 80 and the Byram gages have been very stable over the period of record for the data. The gage further downstream at Rockport has been relatively stable, with the exception of some very slight lowering of stages at the higher and lower flows. Based on these three gage records, it appears that no aggradation or degradation has been experienced by the channel system, from the vicinity of the Hwy 80 bridge downstream to Rockport, over the past 60 to 80 years. This state of dynamic equilibrium is remarkable given that the channel system has been subjected to numerous changes, such as the construction of the Ross Barnett Reservoir, land use changes, urbanization, and channel improvement projects.

Planform Geometry

Historical aerial photography was analyzed to identify areas of channel migration, and to assist in developing estimates of sediment supply from bank erosion. The channel banklines were traced for both time periods and then overlaid to determine areas of channel movement. Bankline comparisons were made for the reach from the Ross Barnett Reservoir downstream to near Byram, MS. Bank instability was only observed along about 6.5% of the 16-mile study reach. In summary, the channel erosion associated with meander migration is considered low to moderate in the study reach since the mid-1990s. A cursory inspection of earlier aerial photography did not reveal any significant channel changes.

Cross Sectional Geometry

One of the best methods for directly assessing historical channel response is to compare cross sectional surveys. This consists of comparing surveys at different time periods. Comparison of surveys can provide a good indication of the historical response of the channel. Cross sections have been surveyed at bridge crossings and there does not appear to be any significant degradation or aggradation areas within this reach.

Preliminary Assessment of Sediment Sources

A key component of a sediment impact assessment is the identification and quantification of major sediment sources within the Project Area. For this preliminary assessment, the major sediment sources were identified but a detailed quantification of the sediment delivery from these sources was determined to be beyond the scope of the FS/EIS. The primary sediment sources within the Study Area are from: (1) the Ross Barnett Reservoir; (2) channel erosion; (3) tributaries; and (4) the watershed. A brief discussion of each of these sediment sources can be found below.

Sediment Supply from Ross Barnett Reservoir

The Ross Barnett Reservoir acts as a sediment trap for the approximate 3,000 sq. mi. of the Pearl River Watershed. A data search revealed no records of sediment measurements

at the dam that could be used to develop an estimate of the size and quantity of sediment that passes through the dam. Field observations immediately downstream (within 2,000 feet) of the dam indicated what appeared to be fresh deposits of fine to medium sands along the upper banks and floodplain. As there are no tributaries or eroding stream banks in this area, a likely source of this material is from the reservoir area. Although it appears there may be some coarser sediments (sands) that are transported through the reservoir, these sediment loads are thought to be relatively small, particularly when compared to the pre-dam sediment quantities.

Channel Erosion

In many streams, a significant source of sediment is derived from the erosion of the channel bed and banks. As discussed, there are no indications of any significant active bed degradation in the study reach, and therefore, the channel bed is not considered to be a significant source of sediment. The other potential source of sediment from within the channel is eroding stream banks. Areas of significant bank erosion within the Study Area were identified using comparative aerial photography. In an effort to determine if the eroding stream banks are a significant sediment source, an estimate was developed of the volume of material eroded from the bank erosion sites. The estimated total rate of erosion from the eight sites is about 14,900 yds3/year. Of this total, about 9,600 yds3/year is fines (silts and clay) and 5,300 yds3/year is sands.

Tributary Inputs of Sediment

Another potential source of sediment supply for the study reach are the numerous tributaries that enter between the dam and the proposed weir location. These tributaries include Richland Creek, Purple Creek, Hanging Moss Creek, Hog Creek, Prairie Branch, Eubanks Creek, Town Creek, and Lynch Creek. For this assessment, only a limited investigation of the tributaries was conducted. Based on this limited field investigation, there were no areas of significant channel instability observed. It was also noted that a large number of the tributaries have been armored. Based on this assessment, it does not appear that the tributaries are supplying excessive amounts of sediments (particularly coarse sediments) to the Study Area.

Watershed

The watershed for the Pearl River in the Study Area is a combination of forest lands and urban areas; therefore, the sediment yield from this area is not expected to be excessive. A detailed analysis of the sediment delivery from the watershed was not conducted. However, a general estimate of the sediment delivery was made based on data from Denby et al (1979). Denby developed estimates of sediment yields for various land use

types (open land and forest lands) in north Mississippi. The Denby data sets did not include any urban areas similar to our Study Area. For this preliminary assessment, the estimated sediment yield from the watershed is estimated to be about 16,700 yds^3/year. It is anticipated that the majority of this load will be fine sediments (silts and clays).

2.5.2.4.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

The No Action Alternative would have no direct impacts on channel stability because no additional measures would be developed or improved and operations would continue as they do currently. However, continued channel migration near the existing landfills located at RM 285.5 and RM 288.0 could impact water quality due to impingement of unprotected areas as will be discussed in Section 2.5.13. Potential impacts of erosion at these locations include solid waste located in these areas entering the Pearl River. Watershed hydrology and hydraulics would remain unchanged when compared to existing conditions, except for an increase in runoff due to development within the watershed.

2.5.3 VEGETATIVE RESOURCES

2.5.3.1 *HISTORIC AND EXISTING CONDITIONS*

The Pearl River Watershed lies within what is referred to as the East Gulf Coastal Plain. The East Gulf Coast Plain is divided into four distinct districts or regions. The proposed project lies within the Jackson Prairie topographic region. The Jackson Prairie Belt is one of two physiographic regions in Mississippi containing prairies and is known as a "Blackland Prairie". One of ten topographic regions in the state of Mississippi, the Jackson Prairie Belt extends across the central portion of the state from the edge of the Loess Bluff Region to the eastern border of the state. The Jackson Prairie Belt is characterized by gently rolling terrain with black, fertile soils. More specifically, the Project Area contains gently rolling terrain with elevations that range from approximately 280 feet NGVD to approximately 220 feet NGVD.

The Pearl River Watershed is broadly described as being located within what is referred to as the deciduous forest formation. Within this formation, the associated climax vegetation is typically defined as the Oak-Gum-Cypress complex. The primary habitat type found within the watershed and particularly within the Project Area is characterized as bottomland hardwood habitat.

Within the overall bottomland hardwood habitat types, there are occurrences of bald cypress/tupelo gum brake areas that are fairly well characterized as having persistent water conditions. There are also other open water areas found within the predominant bottomland hardwood habitat that are characterized as old lake areas, sloughs, and other open water bodies. In addition, there are areas found within the Project Area that have been significantly disturbed

in the past. These disturbed sites contain a preponderance of black willow regeneration and other pioneer species that typically regenerate within similarly disturbed sites.

The primary overstory components found within the predominant mixed bottomland hardwood forestland include water oak, willow oak, Nuttall oak, Shumard oak, cherrybark oak, sweetgum, bald cypress, water tupelo gum, red maple, green ash, sugarberry (also known as hackberry), persimmon, and sycamore. There are also occurrences of both loblolly pine and shortleaf pine found throughout the bottomland hardwood habitat type. It is also important to note that the majority of the pine components found throughout the bottomland hardwood habitat type occur along ridge areas, in close proximity to the top bank area of the river.

In addition to the predominant bottomland hardwood habitat types, the Pearl River Watershed also contains significant pockets of upland habitats. Throughout the Project Area, upland forestland and open field habitat types are known to occur. The predominant timber types found within the upland forestland habitats generally contain pine timber stands, as well as mixed pine and hardwood stands. The presence of these upland ridge areas, including the forestland and open field habitats, contribute to the diversity within the typical bottomland hardwood ecosystems found throughout the Pearl River Watershed.

For the most part, the Project Area is primarily a bottomland hardwood forest with occasional occurrences of the other referenced habitat types interspersed throughout. One additional habitat type is located within the lower portions of the Project Area generally south of the Interstate 55 Bridge crossing on the Pearl River. This habitat type is somewhat unique because this portion of the Project Area is maintained as a floodway for the existing flood control features (levees). Most of the overstory component was removed from this area, and the vegetation within the area is controlled through various methods, which include the use of herbicides. Invasive species, including Chinese tallow and Chinese privet, compete with the natural flora. These species provide very little wildlife value and can eventually proliferate creating a monoculture, limiting species diversity and further limiting food resources.

2.5.3.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

The land-use activities within the Study Area are expected to change little during the anticipated project life. Flood plain zoning restrictions and local experience with past flooding events are anticipated to minimize further encroachment into the flood plain. Urbanization is projected to claim approximately 5% of undeveloped areas during the project life. Current land-use practices on woodland areas are anticipated to continue, with landowners allowing forest succession to occur for future timber production. Because of the anticipated consistencies in vegetative cover types, the wildlife populations on these lands are projected to remain stable. Furthermore, the existing federal and state water quality requirements are expected to have a stabilizing effect on

water quality in the Study Area. Any future changes to the water quality requirements would be anticipated to also provide the same level of water quality protection within the Study Area.

The vegetative components and habitat types found within the Study Area would likely remain the same without the project. Some conversion of open fields, farmland, and forestland to residential and commercial development would be anticipated, since the Project Area is located in one of the fastest growing metropolitan areas within the state. However, as noted, flood plain zoning restrictions and the occurrence of past flood events would significantly curtail the development potential within the Project Area.

Historically, the Project Area has primarily been affected by headwater flooding from the Pearl River. The headwater flooding has been caused by unusually heavy and intense rainfall events over the upper Pearl River Watershed, primarily north of the Ross Barnett Reservoir. The lack of flood control features in the upper watershed and the inability of the Ross Barnett Reservoir to provide any significant flood control within the Project Area contribute to the problem.

2.5.4 WILDLIFE RESOURCES

2.5.4.1 *HISTORIC AND EXISTING CONDITIONS*

The Pearl River Watershed as a whole supports a fairly diverse population of varied wildlife species. Though the Project Area is located within the Jackson metropolitan area, the floodplain area along the river continues to support wildlife. Most of the common game and non-game wildlife species native to the state of Mississippi can be found to differing degrees throughout the Project Area. Some of the more common mammal species found throughout the Project Area include white-tailed deer, swamp and cottontail rabbits, gray and red phase fox squirrels, coyotes, armadillos, bobcats, nutria, beavers, skunks, opossums, deer mice, raccoons, and cotton rats. A more recent phenomenon that has occurred within the proposed Project Area is the introduction of feral (wild) hogs, which are considered to be an invasive species. The feral hogs have been recently observed within the more southern portions of the Project Area, and it can be assumed that they will continue to migrate in a northerly direction throughout the project area.

There are also numerous bird species found throughout the area including common species such as blue birds, blue jays, American robin, indigo bunting, and several other song bird species. The area also occasionally hosts populations of eastern wild turkeys, which is an important game bird species found in the state. In addition, the river channel, lakes, and sloughs located within the area support significant populations of migratory waterfowl on a seasonal basis including wood ducks, mallard ducks, and other migratory species such as mourning doves. The river watershed also supports populations of many common reptile and amphibian species including alligator

snapping turtles, box turtles, copperhead moccasins, cottonmouth moccasins, and other common species.

2.5.4.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

Due to the ever increasing transition to a growing urban environment, overall suitable wildlife habitats are constantly being reduced within the Project Area. As urban growth continues in the Study Area, suitable wildlife habitat areas may be further compromised or reduced unless preservation measures are undertaken. Habitat conservation initiatives can be implemented to protect and enhance wildlife habitat with project alternatives.

2.5.5 AQUATIC AND FISHERIES RESOURCES

2.5.5.1 *HISTORIC AND EXISTING CONDITIONS*

The Pearl River and its major tributaries are considered important fisheries within the state of Mississippi. For the most part, the fishery resources within the watershed as a whole are considered to be of high quality and a testament to the overall health and water quality conditions within the river system. Though constructed primarily for surface water supply purposes, the Ross Barnett Reservoir located just to the north of the Project Area is considered a high quality fishery and is intensively managed for sport fisheries purposes. The Ross Barnett Reservoir is extensively utilized for recreational fishing by citizens of the Jackson metropolitan area and other parts of the state.

The portion of the Pearl River and the adjacent and interconnected water bodies and streams still support fisheries populations, according to the most recent surveys and studies. Though the fishery resources within the Project Area are not utilized for recreational fishing purposes to the same degree as those found within the Ross Barnett Reservoir, they still provide sport fishing opportunities to residents within these areas. The most heavily utilized segment of the Pearl River is the portion located just to the south of the Ross Barnett Reservoir dam. Many residents take advantage of the fishing opportunities below the Reservoir associated with peak water releases. In addition, Mayes Lake, located within the Mississippi Department of Wildlife, Fisheries, and Parks' (MDWFP) LeFleur's Bluff State Park, and Crystal Lake, located to the south of the Mayes Lake area, are both utilized for recreational fishing purposes and provide fisheries habitats within the area.

The Pearl River, Mayes Lake, and Crystal Lake all contain populations of the most common native freshwater fish species found in the state of Mississippi. Common fish species found within the Pearl River and its major tributaries and other water bodies include largemouth bass, white bass, bluegill, red ear sunfish, white crappie, black crappie, channel catfish, blue catfish, bowfin, buffalo, carp, alligator gar, spotted gar, and several species of minnows. In addition, the United

States Fish and Wildlife Service (USFWS) has designated the Pearl River from the mouth of the river to the Ross Barnett Reservoir dam as critical habitat for the Gulf sturgeon, a listed threatened species.

2.5.5.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

Due to the increased urban environment, suitable habitats for many fish and benthic organisms are being reduced. Additionally, the quality of the fisheries habitats within the Pearl River through the Project Area has been significantly degraded due to siltation and other adverse impacts associated with past flood control projects completed within the area. As urban growth continues in the Study Area, the habitats of fish and other aquatic organisms may be further reduced, unless preservation measures are undertaken by local interests.

2.5.6 ESSENTIAL FISH HABITAT (EFH)

2.5.6.1 *HISTORIC AND EXISTING CONDITIONS*

Essential Fish Habitat (EFH) is defined by the Magnuson-Stevens Fishery Conservation and Management Act as those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity. The Act and the resultant regulations provide for the implementation of management processes and consultation procedures for those fish and seafood species and their habitats within the coastal waters of the U.S. The EFH is designated for species managed in Fishery Management Plans under the Act. The National Marine Fisheries Service (NMFS) requires that the EFH be described and identified for each federally managed species at all life stages for which information is available and must be described and identified in the Fishery Management Plans.

As noted, the stretch of the Pearl River through the Project Area includes a historic spawning habitat for the threatened Gulf sturgeon (*Acipenser oxyrhynchus desotoi*). In addition, the USFWS and the NMFS identified a total of fourteen Critical Habitat Units. Of these, Critical Habitat Unit 1 includes the main stem of the Pearl River from the spillway of the Ross Barnett Reservoir continuing downstream through the Project Area to the mouth of the Pearl River. From a historical perspective, the last documented sighting of the Gulf sturgeon within the Project Area was in 1984. Based upon the documented records, no other documented sightings within the Project Area or in proximity to the Project Area have occurred since 1984.

Though the Project Area is included within the Critical Habitat designation for the Gulf sturgeon, the project area does not, by definition, include any Essential Fish Habitat. Given this, no adverse effects to Essential Fish Habitat would be anticipated.

2.5.6.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

The Pearl River within the Project Area was included in the historic range for the Gulf sturgeon. However, as noted, no designated Essential Fish Habitat (EFH) is present within the Project Area. As further noted, the Project Area is within the USFWS designated Critical Habitat for the Gulf Sturgeon. However, long standing limitations for spawning migration for the Gulf sturgeon associated with the two existing weirs within the lower segments of both the East and West Pearl Rivers have limited the migration opportunities for the Gulf sturgeon to the upper Pearl River and specifically within the Project Area. The Pools Bluff Sill is located at RM 48.7 of the West Pearl River and the Bogue Chitto Sill is located at RM 44.0. Wilson Slough at Walkiah Bluff is located 48 miles above the mouth of the Pearl River. Furthermore, a weir located at RM 290.7 further restricts migration through the Project Area. The weirs on the lower Pearl River have been in place since the 1930s, while the weir at RM 290.7 has been in place since the 1920s. The most recent studies conducted revealed that it is not likely that the Gulf sturgeon migrate north of the two lower weirs to the upper reaches of the river and specifically within the Project Area and beyond. Corrective measures, including the potential removal of the lower weirs to provide free migration of the species would be needed to provide for the historic spawning habitat utilization by the species.

2.5.7 THREATENED AND ENDANGERED SPECIES

2.5.7.1 *HISTORIC AND EXISTING CONDITIONS*

The MDWFP Museum of Natural Science maintains what is referred to as The Natural Heritage Database. This database contains a continuously updated inventory of plant and animal species and representative natural communities within the state. The database is utilized to document the occurrence and status of rare plant and animal species and other elements of natural diversity. The natural database includes a total of 22 plant species and 38 animal species that are known to occur in the areas of Hinds and Rankin Counties. However, many of these species of special concern are not known to inhabit the immediate Project Area but are known to occur in other portions of the two counties. Mississippi does not have a state 'threatened and endangered species' program.

The stretch of the Pearl River through the Project Area includes two threatened aquatic species as listed by the USFWS. The listed species include the threatened Gulf sturgeon (*Acipenser oxyrhynchus desotoi*) and the threatened ringed sawback (or ringed map) turtle (*Graptemys oculifera*). The portion of the Pearl River that runs from the Ross Barnett Reservoir through the Study Area and southward to the mouth has been designated as critical habitat for the Gulf sturgeon by the USFWS. In addition, a recovery plan for the ringed sawback turtle is currently under development and is not scheduled for completion until 2020.

The Gulf sturgeon is an anadromous fish (ascending rivers from the sea for breeding) that have historically inhabited coastal rivers from the Mississippi River in Louisiana to the Tampa Bay in Florida. The Gulf sturgeon is actually one of two geographically dispersed subspecies of the Atlantic sturgeon (*Acipenser oxyrhynchus*). The USFWS and the NMFS identified a total of fourteen Critical Habitat Units, and Critical Habitat Unit 1 includes the main stem of the Pearl River from the spillway of the Ross Barnett Reservoir continuing downstream through the Project Area to the mouth of the Pearl River.

From a historical perspective, the last recorded sighting of a Gulf sturgeon within the proposed Project Area occurred in 1984, when a 160-pound female was caught in the Study Area. The USFWS donated a Gulf sturgeon caught in the Pearl River at Monticello to the Mississippi Museum of Natural Science in 1982. In 1976, the MDWFP measured and photographed a Gulf sturgeon that was approximately 7.25 feet in length and weighed approximately 263 pounds. The fish was supposedly caught by a fisherman just below the Ross Barnett Reservoir dam. Based upon documented records, no other sightings within the Project Area or in proximity to the Project Area have occurred since 1984.

It is also important to note that the USFWS has conducted very limited study efforts as it relates to Gulf sturgeon utilization of the Pearl River since the Critical Habitat designation was implemented. Based upon the most recent research efforts, it appears that the Gulf sturgeon populations utilizing the Pearl River for spawning are not moving north of the two weirs located on the lower part of the river. There is no evidence to suggest active spawning migrations are taking place beyond the lower weir structures and that migrating populations are entering the Project Area at this time.

The ringed sawback turtle is a small narrow-headed turtle with laterally compressed, black, spine-like vertebral projections and a slightly serrated posterior carapacial margin. Habitat for the ringed sawback turtle is typically riverine with a moderate current and numerous basking logs. Populations are typically most abundant in areas of the river that have moderate-to-fast currents with deep water and sand and gravel bottoms.

The ringed sawback turtle was designated as a federally threatened species in 1986 because it is endemic to the Pearl River and its tributaries in the States of Mississippi and Louisiana. Studies have shown that populations exist within the Pearl River from the Neshoba County, Mississippi, headwaters southward downstream through St. Tammany Parish, Louisiana. To date, the highest densities of turtle populations have been documented above the Ross Barnett Reservoir and below the Jackson metropolitan area in the general vicinity of the Study Area, but not within the Project Area. No critical habitat has been designated for this turtle.

The American bald eagle (*Haliaeetus leucocephalus*) is known to frequent portions of the Pearl River Watershed. Active nesting sites have historically been present to the north of the Project

Area around the Ross Barnett Reservoir. On June 28, 2007, the USFWS removed the bald eagle from the threatened and endangered listing. However, the bald eagle is still protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. Management plans prepared by the USFWS after the delisting require that, for any proposed project area, care is used when any actions that may affect active nesting sites are being taken. Given this, survey efforts and coordination completed with the USFWS in August 2009 were focused on determining bald eagle activity within the Project Area. No occurrences of any bald eagles or active nesting sites were noted in the Project Area during the field surveys conducted in 2013 and 2014 or during follow-up site visits conducted within the Project Area during 2015. In 2017, the MDWFP documented one new active nest site adjacent to the southern portion of the Project Area.

The Louisiana black bear (*Ursus americanus luteolus*) is one of sixteen recognized subspecies of the American black bear (*Ursus americanus*) and has been listed as a threatened species for quite some time. The Louisiana black bear is native to the state of Mississippi and could potentially inhabit portions of the proposed Project Area. To date, there have been no known sightings of the black bear within the Project Area or in close proximity to the Project Area. On March 10, 2016, the USFWS removed the Louisiana black bear from the list of Threatened and Endangered Wildlife under the ESA due to the recovery of the populations throughout the range. Since the original listing, the population size has doubled over the original population at the time of listing. Through the partnerships with state and federal agencies, non-governmental agencies, and many private landowners, a significant increase in black bear habitat has occured during the listed period.

Since the delisting took place, the USFWS in coordination with the Louisiana Department of Wildlife and Fisheries has developed a draft post-listing monitoring plan that will provide guidance for monitoring the black bear throughout its range. The implementation of the post-listing monitoring plan will provide both population monitoring and habitat based monitoring that will provide ongoing information to help prevent any decline in the populations.

On January 15, 2015, the USFWS published the proposed rule under Section 4(d) of the Endangered Species Act proposing to list the Northern Long-eared Bat (*Myotis septentrionalis*) as a threatened species. The final listing and interim rule went into effect on May 4, 2015. The Northern Long-eared Bat (NLEB) is one of the species of bats that have been most impacted by the spread of the white-nose syndrome disease and has experienced significant declines in populations because of the spread of the disease. The Interim 4(d) Rule in effect provides protection for the NLEB as a threatened species under the Endangered Species Act (ESA) upon the effective date of the interim rule.

The NLEB individuals are typically approximately 3.0 to 3.7 inches in length with a wingspan of approximately 9.0 to 10.0 inches. The bat is distinguished by its long ears, particularly when

compared to the other bats in the same genus, Myotis. The primary diet for the NLEB consists of insects including moths, flies, leafhoppers, caddisflies and beetles. They are most active at dusk and typically feed within the understory of forested areas. The NLEB catches the insects while in flight using echolocation or by using their gleaning behavior to catch motionless insects while they are on vegetation.

The NLEB's range includes much of the eastern and north-central portions of the United States and all of the Canadian provinces from the Atlantic Coast west to the southern Northwest Territories and eastern British Columbia. The species' range within the United States includes all or portions of 37 states, including the state of Mississippi.

As noted, the primary threat to the NLEB is the white-nose syndrome. The disease is now known to have spread to 28 of the 37 states that are included within the species range and includes locations within the state of Mississippi. Though the white-nose syndrome is the primary threat, other land use activities are considered secondary threats by the USFWS including the human disturbance in roosts and hibernation areas, forest management practices, forest habitat modifications including development activities and wind power development.

As a part of the Interim 4(d) Rule, the USFWS has identified what is referred to as the White-Nose Syndrome Buffer Zone that includes all areas within 150 miles of the boundaries of U.S. counties or Canadian districts where the fungus has previously been detected. The established buffer zone includes both Hinds and Rankin Counties including the Project Area.

The USFWS has also identified land use activities within the buffer zone that may adversely affect the summer habitat for the NLEB including commercial and residential development, transportation and energy rights-of-way development and other land use activities that would permanently remove habitat, particularly the preferred forestland habitats that the NLEB utilize for roosting, nesting and feeding during the summer months. Though the extent of the NLEB presence within the proposed Project Area is unknown at this time, the Interim 4(d) Rule implementation and the specific inclusion of the Project Area within the buffer zone could result in potential adverse effects on the NLEB.

As noted within the Interim 4(d) Rule, many factors dictate whether or not a wooded area provides NLEB habitat or whether the bats are utilizing an area. At this point, the USFWS does not have survey data that would indicate the migration patterns for the NLEB. More specifically, little is known whether the available summertime woodland habitat present within the Project Area is being utilized by the NLEB. The USFWS initiated summertime surveys within the designated buffer zone counties beginning in June 2015. As noted, however, no existing data is available that would indicate that the NLEB currently utilizes the Project Area during the summer migration.

The most current USFWS guidance is based upon the effective date of the Final 4(d) rule, February 16, 2016. Based upon the guidance, any incidental take of the NLEB associated with the project in Hinds and Rankin Counties would be considered incidental take resulting from otherwise lawful activities and would not be prohibited under the Endangered Species Act. In addition, the project is well out of range of the one known hibernaculum in Tishomingo County, Mississippi. Furthermore, the project will not impact or occur near any known maternity roost trees since currently, there are no known maternity roost trees within the state.

Wood storks (*Mycteria Americana*) are large, long-legged wading birds that primarily occur in freshwater wetlands, including ponds, bayheads, flooded pastures, oxbow lakes and ditches. Their nesting generally occurs in baldcypress trees in swamps. They apparently nest during periods of receding water which usually happens during the winter and spring within its breeding range. The Wood storks are typically colonial nesters and formerly occurred in colonies of up to 10,000 pairs. They tend to feed in fresh, brackish or saltwater habitats both by day and at night.

The USFWS originally classified the Wood stork as Endangered under the ESA on February 28, 1984, only within the states of South Carolina, Florida, and Georgia where the last known breeding populations were known to occur. The USFWS reclassified the Wood stork as Threatened on June 30, 2014, and added the states of Alabama, North Carolina, and Mississippi as additional states with breeding populations. Observations of the Wood stork within Mississippi have primarily been limited to areas along the Mississippi River but have been observed more frequently in areas in the eastern edge of the state. Based upon the observations, the USFWS Jackson Field Office added the Wood stork to the Mississippi List of Federally Threatened and Endangered Species in June 2017 under the premise that they could occur in almost any location that has sloughs or swamps to provide feeding habitat.

At present, no data exists of observations of Wood storks within the Project Area. However, slough and swamp habitats that could be utilized for feeding and/or nesting habitat does occur within the Project Area.

On October 20, 2017, the Final Rule establishing the Pearl Darter (*Percina aurora*) with threatened status and adding it to the List of Endangered and Threatened Wildlife under the Endangered Species Act of 1973 (ESA) went into effect.

The Pearl Darter is a small fish historically known to exist within localized sites within both the Pearl and Pascagoula River drainages in both Mississippi and Louisiana. Based upon the most recent survey information, populations still exist within portions of the Pascagoula River drainage basin but no known occurrences of the fish have been recorded for over 40 years within the Pearl River drainages, leaving USFWS to conclude that the Pearl Darter is no longer present within the Pearl River system. Past records of survey information indicate even when the fish were present in the Pearl River system, it was within a zone from St. Tammany Parish, Louisiana, northward to

Simpson County, Mississippi, and not within the project Study Area. The Final Rule further provides protection for the existing populations within the Pascagoula River drainages. The Pearl River system was not included since the species is thought to have been extirpated from the drainage system, a determination that has been validated by more recent survey results.

No federally listed plants or designated critical habitats are known to exist within the general vicinity of the Project Area. In addition, no federally listed plant species were observed during field surveys conducted in 2013 and 2014 and during follow up site assessments conducted in 2015.

Coordination with the USFWS Jackson, Mississippi Field Office have been initiated and are ongoing relative to the Fish and Wildlife Coordination Act review. In addition, Section 7 consultation with the USFWS under the ESA has likewise been initiated. The Biological Assessment (BA) has been completed for the potentially affected listed species that are historically known to be present within the project Study Area. The Integrated Draft FS/EIS and BA information has been provided to the USFWS for review and comment relative to the Fish and Wildlife Coordination Act and for development of the associated USFWS Biological Opinion under the Section 7 consultation. Both review processes are underway and coordination and consultation activities with the USFWS are ongoing. A copy of the BA will be included in Appendix D: Environmental upon receipt of input from the USFWS.

2.5.7.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

The historic aquatic habitat for both the listed aquatic species within the Project Area may continue to decline as a result of ongoing urbanization, siltation, and changing river conditions. The continued pattern of urbanization within the Project Area may also lead to a decline in the available habitat for the Northern Long-eared Bat. Implementation of plans to protect and enhance existing habitat may be warranted if these species are to continue to exist within the Project Area.

2.5.8 WETLANDS AND "OTHER WATERS OF THE U.S."

2.5.8.1 *HISTORIC AND EXISTING CONDITIONS*

As previously noted, the proposed Project Area is located within the Pearl River Basin and within the Jackson Metropolitan Statistical Area (MSA). It encompasses the Pearl River channel and tributaries and the adjacent riparian areas, most of which were historically bottomland hardwood forestland habitat types. In addition, there are occurrences of interspersed upland habitats. Given the juxtaposition of the Project Area within the watershed, a significant amount of jurisdictional wetlands and "other waters of the U.S." are present.

An updated wetlands delineation and determination was completed on the proposed Project Area in 2014 defining the extent of the jurisdictional wetlands and "other waters of the U.S." that are present within the full extent of the Project Area. It further defines the extent of the impacts to the jurisdictional wetlands and "other waters of the U.S." associated with the implementation of both Alternative B and Alternative C, the proposed action alternatives evaluated.

The updated Wetlands Delineation and Determination Report was submitted to the USACE Vicksburg District Regulatory Branch, Enforcement Section, for review and evaluation. The USACE Vicksburg District Regulatory Branch, Enforcement Section issued a Preliminary Jurisdictional Determination concurring with the findings of the submitted wetlands delineation and determination report covering the project area. Copies of Wetlands Delineation and Determination Report and the subsequent Preliminary Jurisdictional Determination (PJD) are included in Appendix D.

2.5.8.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

The historic predominant bottomland hardwood habitats and the associated jurisdictional wetlands and "other waters of the U.S." within the Project Area may continue to decline as a result of ongoing urbanization, siltation, and changing river conditions. Significant impacts to the historic jurisdictional wetland habitats have occurred over time as a result of the ongoing development activities within the Project Area. In addition, significant impacts to the Pearl River channel itself have also occurred in connection with the past flood control projects that have taken place within the Project Area. Restoration efforts would have to be implemented to replace the historic habitats and the historic conditions on the Pearl River.

2.5.9 CULTURAL AND HISTORIC RESOURCES

2.5.9.1 *HISTORIC AND EXISTING CONDITIONS*

A Phase I Cultural Resources Survey was completed on the Jackson MSA in 2006. Sixty-one archeological/historical sites were assessed within the Study Area. Six of those sites have been determined to be either potentially eligible for listing in the National Register of Historic Places (NRHP) or have been listed in the NRHP. The findings of the Phase I Cultural Resources Survey were coordinated with the Mississippi Department of Archives and History (MDAH) which conducted a review and provided comments in January 2007. As a result of the 2007 MDAH review, recommendations for avoidance of specific known or suspected eligible locations were provided, along with recommendations for further studies and potential mitigation or full salvage excavation for specific locations prior to the initiation of any disturbance activities. The revised action alternatives were developed in a manner to insure that the MDAH recommendations could be followed. Upon development of the revised action alternatives, MDAH again reviewed the proposed plans and provided comments and recommendations. Based on the current

review, MDAH has determined that a total of six sites are potentially eligible for the NHRP and one NHRP listed site are in the project area. Coordination with MDAH is ongoing.

In addition to coordination with MDAH, efforts to coordinate with local tribes were undertaken (correspondence has been included in Appendix F). During the initial phases of this study, the tribes did not elect to comment. The USACE Vicksburg District agreed to assist with Section 106 coordination with the tribes upon completion of the MDAH review. Consultation with the USACE Vicksburg District is ongoing.

2.5.9.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

Cultural and historic resources may be compromised depending on their location and the severity of future floods. Previous floods have already caused damage to existing historic structures. The frequency of impacts may increase as a result of the lack of flood protection measures.

2.5.10 RECREATIONAL RESOURCES

2.5.10.1 *HISTORIC AND EXISTING CONDITIONS*

Recreation within the Pearl River Watershed as a whole covers the full range of outdoor activities. Recreation within the watershed encompasses both public and private development including city and community parks, state parks, and park areas maintained by the PRVWSD and the Pearl River Basin Development District. There are also other recreational areas within the watershed that include state wildlife management areas, National Forests, and other water-based recreational areas found along the Pearl River, its tributaries, and adjacent lakes. The primary outdoor recreational activities found within the Project Area include consumptive activities such as fishing and, to a limited degree, hunting. The primary non-consumptive recreational opportunities include hiking, canoeing, boating, outdoor photography, bike and ATV riding, and observing nature. The MDWFP LeFleur's Bluff State Park is also located within the Project Area. The LeFleur's Bluff Park area was developed to a degree as an urban park setting, which includes non-consumptive recreational opportunities such as golf, picnicking, and hiking. The park facility also includes playgrounds for area children and is home to the MDWFP Museum of Natural Science. The Museum of Natural Science includes both indoor and outdoor interpretive features. LeFleur's Bluff State Park also includes the Mayes Lake area, which consists of several ponds, as well as camping facilities. The Mississippi Children's Museum is also located adjacent to the Museum of Natural Science. The Crystal Lake area is located in the more southern portion of the Project Area and includes recreational activities such as fishing. In addition, the City of Flowood maintains a park area that provides opportunities such as picnicking, nature study, walking, and bike riding.

It should also be noted that public access, primarily to the Pearl River itself, is significantly limited throughout the Study Area and especially within the proposed Project Area. The majority of the land included within the Project Area is under private ownership and access to the river is controlled and limited due to the ownership patterns within the area. In addition, public boat ramps on the Pearl River are limited to two locations, one at Lefleur's Bluff State Park and another at the Ross Barnett Reservoir Dam. Also, the existing weir at the City of Jackson's Waterworks (RM 290.7) prevents access to more than half of the river miles of the Project Area from the available public boat ramp locations.

2.5.10.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

There is a need to provide the local citizens of the Study Area opportunities to participate in additional non-consumptive uses of the area's natural resources such as hiking, picnicking, nature photography, bird watching, canoeing, nature trails, etc. Additionally, better public access to the Pearl River within the Project Area is needed to improve both consumptive and non-consumptive recreational activities such as fishing and boating. Such recreational areas could be developed in conjunction with the selected plan for providing flood protection to the area.

2.5.11 AESTHETICS AND VISUAL RESOURCES

2.5.11.1 *HISTORIC AND EXISTING CONDITIONS*

As noted, the proposed Project Area is located within the Jackson MSA and has been subjected to a significant amount of associated development activities over time. Review of historical aerial photography depicts the substantial urbanization that has taken place within the Project Area, particularly on the west side of the Pearl River. This urbanization is largely due to growth within the cities of Jackson and Flowood over the past 20 years.

Primary transportation corridors transecting or adjacent to the proposed Project Area include MS Hwy 25 (Lakeland Drive), transecting the northern portion of the Project Area; Interstate 55, on the west side; and Interstate 20, transecting the more southern portion of the Project Area. Primary viewsheds for the Project Area exist along these primary transportation routes. As such, the substantial development activities and the overall pattern of urbanization within the Project Area has changed the viewscapes over time from what was a primary bottomland hardwood riparian habitat to a more urban viewshed. Additional impacts to the Pearl River viewsheds associated with the past flood control efforts have also significantly impacted the historical aesthetic and visual resources within the Project Area.

2.5.11.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

Given the Project Area, juxtaposition within the Jackson MSA, and the likelihood of continued development activities and urbanization, additional impacts to the aesthetics and visual

resources within the Project Area can be anticipated. The aesthetics and visual resources will change or will likely be dictated by the future land use, the potential maintenance activities associated with the existing flood control projects, and the overall focus on urbanization with continued development and growth within the Project Area.

2.5.12 NOISE

2.5.12.1 *HISTORIC AND EXISTING CONDITIONS*

Noise issues within the Project Area are strictly related to the juxtaposition of the project to the Jackson MSA. As an urban area, the majority of the noise sources are associated with the daily normal urban activities including air, railroad, and automobile traffic. There are also many contributing activities: construction, particularly road and highway construction; ongoing development activities; and industrial activities, particularly within the eastern and more southern portions of the Project Area. Noise generation within the proposed Project Area will be primarily limited to the contribution from automobile traffic along Interstate Highways 55 and 20 and MS Highway 25, including bridge crossings. Traffic is the only known significant source of excessive noise that can be identified within the Project Area.

2.5.12.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

As urban growth continues into the Study Area, the construction of new roads and residential and commercial development noise levels can increase over time. Other anticipated future noise impacts because of urbanization include an increase in the level of noise associated with increased traffic and the duration of the peak noise levels due to the increased volumes of traffic.

2.5.13 AIR QUALITY

2.5.13.1 *HISTORIC AND EXISTING CONDITIONS*

The federal Clean Air Act, as amended, established procedures for improving air quality conditions, including establishment of National Ambient Air Quality Standards. The Air Quality Standards are based on six constituents of concern including carbon monoxide, nitrogen dioxide, ozone, particulate matter, sulfur dioxide, and lead. A system of monitoring is established across the nation to measure levels of these constituents, and if an area is found to exceed allowable levels, the area is considered in "nonattainment" and local officials are required to develop a plan for achieving air quality that meets the standards.

The proposed Project Area and, particularly, the Jackson MSA is not a designated "nonattainment" area as it relates to the Clean Air Act, Air Quality Standards. As a result, any of the proposed actions would not require new source permitting by the MDEQ or directly result in additional volumes of constituents of concern. The only potential increase in constituents of

concern would be potential increases of particulate matter in the form of dust during construction activities only.

2.5.13.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

As noted, continued urban growth within the proposed Project Area can be anticipated given the ongoing trends within the Jackson MSA. As such, increases in population and associated increases in traffic patterns would be anticipated. As a result, increases in some constituents of concern relating to air quality can be anticipated. However, the anticipated increases in traffic would not likely result in significant increases in emissions or an overall increase in constituents of concern that will likely lead to a "nonattainment" designation for the Project Area within the foreseeable future.

2.5.14 HAZARDOUS, TOXIC, AND RADIOLOGICAL WASTE (HTRW)

The Pearl River Watershed within the proposed Project Area contains a number of historical sites of concern in regard to HTRW. These sites include two former municipal sanitary landfills and one former industrial facility site. The sites are generally located on upland areas adjacent to and within the floodplain of the Pearl River. Some of these sites have current and direct impacts on the water quality and aesthetics of the Pearl River. Each proposed project alternative has a different set of impacts on these sites. In turn, each site has potential environmental and human health impacts on each of the alternatives. The sites of concern include:

- former Gulf States Creosote Wood Treatment Facility;
- unpermitted Lefleur's Landfill (Jefferson Street Landfill); and
- unpermitted Gallatin Street Landfill.

Each site is presented below and summarized. Detailed information and site evaluations are presented in Appendix C. Section 4.5.14 addresses a summary of the direct and indirect impacts of the HTRW sites for each of the alternative projects. Other HTRW sites adjacent to the proposed Project Area were identified, reviewed, and determined to have no identifiable impact on the proposed project alternatives.

2.5.14.1 *HISTORIC AND EXISTING CONDITIONS*

2.5.14.1.1 *GULF STATES CREOSOTE COMPANY SITE*

The former Gulf States Creosote Company Site was a chemical wood treating facility which covered approximately 141 acres. The site is located in the northeastern portion of the proposed Project Area on the eastern side of the Pearl River watershed and west of Highway 468 in Flowood, Rankin County. The facility operated from approximately the 1930s to the 1950s treating wood timbers with creosote in tanks or vats for the production of railroad ties. As typical of historical chemical wood treating operations, creosote residuals were released to soils,

drainage ways, and groundwater at the site. Creosote residuals were disposed or released to backwater sloughs of the Pearl River adjacent to the west side of the site. Creosote residuals continue to exist in sediments in the slough and potentially in groundwater beneath the former facility treatment area adjacent to the slough. The former Gulf States Creosote Company Site and the slough areas are currently owned by various private owners.

2.5.14.1.2 *LEFLEUR'S LANDING SITE*

The former Lefleur's Landing Site (also known as the Jefferson Street Landfill site) is owned by the City of Jackson and was historically used for a municipal sanitary landfill, an incinerator, a maintenance shop, fuel distribution (with multiple underground fuel storage tanks), animal control, a testing laboratory, an asphalt plant, a paint shop, and law enforcement activities during the period of the early 1900s to present year. The site is located within the City of Jackson corporate limits on the east side of Jefferson Street with its southern border along the Pearl River. The majority of the site is located within the annual 1% chance exceedance floodplain of the Pearl River. The landfill covers an area of approximately 70% of the 45 acres of the site. The landfill was used from the early 1900s to 1970. Although a soil cover was placed over the landfill when it was closed, residual inert wastes may be seen exposed in various locations on the site, particularly along the southern edges adjacent to the Pearl River. The landfill was not constructed with an impermeable liner system and groundwater likely interacts with the landfill materials. There may be leaching of chemicals into the groundwater and potentially into the Pearl River. Floodwaters from the Pearl River have eroded the southern boundary of the landfill, exposing waste residuals to enter the Pearl River during flooding periods. Historical remedial investigations of the site indicate detection of various chemicals of concern in soils and groundwater. Further investigation of potential environmental conditions and impacts should be performed, and determination of remedial actions needed at the site.

2.5.14.1.3 *GALLATIN STREET LANDFILL SITE*

The former Gallatin Street Landfill is owned by the City of Jackson and was used as a municipal sanitary landfill for a period of approximately 10 years in the 1970s. The landfill was closed in 1979. The landfill site covers approximately 117 acres and is located on the banks of the Pearl River at the southern end of Gallatin Street. The Pearl River forms three sides of the site. Half of the site is now covered with scrub bushes and trees with the other half covered by open scrub grasses and bushes. Although the landfill was covered with a layer of soil, residual solid wastes may be exposed in various locations around the site. No formal liner, leachate collection, or engineered cap was installed at this landfill. Historical erosion of the landfill along the Pearl River resulted in a project to reinforce the banks of the landfill with large rip rap along the northeastern portion of the landfill. The northern end of this rip rap has experienced erosion resulting in the exposure of landfill materials and a stormwater pipe, which is subject to potential collapse. The

southern and eastern portions of the site have historically become submerged during annual flooding of the river. Since this landfill was not constructed with an impermeable liner system, groundwater likely interacts with the landfill materials and may be leaching chemicals into the groundwater and potentially into the Pearl River. Evidence of residual inert landfill wastes may be observed in various locations along the bank of the landfill on the eastern and south sides.

2.5.14.1.4 *OTHER HTRW SITES*

Other HTRW sites adjacent to the proposed Project Area include the former Rival Crockpot site, the former Sonford Products Wood Treatment and Sawmill, a former landfill area and Jackson's major sewer interceptor near Eubanks Creek, and three current automotive salvage yards. These sites have been preliminarily reviewed for impacts to the proposed project alternatives. Reports, documentation, or other readily available information was not found in regard to known or current HTRW releases from these sites that could impact the project alternatives, nor will the project alternatives have impacts on these sites. However, further investigations of these sites should be performed prior to implementation of a proposed project.

2.5.14.2 *FUTURE WITHOUT PROJECT CONDITIONS (NO ACTION ALTERNATIVE)*

Without a project, the future conditions will be the same as the current conditions with regard to the HTRW sites. No federal, state, or local actions are currently planned to address the environmental conditions that exist at the sites identified above. Therefore, the creosote slough located at the former Gulf States Creosote Company facility will continue to represent a potential source of release of toxic chemicals into the Pearl River and its watershed area during periods of flooding. The two former landfills will continue to represent a potential threat of the release of chemicals to the groundwater and to the Pearl River, as well as a potential threat of the release of debris and waste residuals from erosion and exposure to floodwaters.

2.6 CUMULATIVE IMPACTS FOR FUTURE WITHOUT PROJECT CONDITIONS

The President's Council on Environmental Quality (CEQ) defines cumulative impacts as those impacts on the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. In this case, the cumulative impacts are the incremental direct and indirect impacts of not implementing a flood risk management system on both natural and human resources. Described in the previous sections, a limited list of resources affected by the cumulative impact of not implementing flood risk management include impacts on:

- over 500,000 residents of the 3 counties included in the ROI;

- over 200,000 jobs located within the ROI;
- transportation infrastructure;
- public safety facilities;
- health care facilities;
- community cohesion;
- damage to and loss of cultural and historic resources; and
- exposure of HTRW sites and pollution threat due to chemical leakage and the erosion and exposure of debris.

Historically, the Project Area has primarily been affected by headwater flooding from the Pearl River. The headwater flooding has been caused by unusually heavy and intense rainfall events over the upper Pearl River Watershed, primarily north of the Ross Barnett Reservoir.

During the 1979 Flood, there were approximately 1,935 houses and 775 businesses flooded. The damages to the affected properties were especially severe since the river was above flood stage from 10 to 14 days throughout the area. The flood waters caused serious disruptions to area transportation and communications and affected the area for weeks. Many of the flood victims interviewed reported that it took from 6 months to a year for things to get back to normal.

The total physical property damage caused by the 1979 Flood was estimated at $233 million. If the same flood event happened today, the total damage would exceed $1 billion. Although the 1979 Flood was considered devastating, it should be noted that the flood damage could have been much worse but for several well-executed emergency flood response activities. The Ross Barnett Reservoir was utilized for the flood response even though it was not designed for flood control purposes. In addition, the federal flood control levees in Jackson were designed for an annual 1% chance exceedance flood event flow of 103,000 cfs, significantly less than the peak flow of 128,000 cfs that was experienced. The Fairground levee on the west side of the river was flanked on the north end, and was later overtopped, thereby flooding the area behind the levee. However, the East Jackson levee held because of a monumental sandbagging effort when the flood waters were lapping at the top of the levee.

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3.0 PLAN FORMULATION

This section provides information on the Pearl River Flood Risk Management Study plan formulation. More detailed information is in Appendix A including tables and maps used in the development of screening and evaluation of management measures and alternative plans.

The Study Area includes parts of Hinds and Rankin counties. Major tributaries of the Pearl River within the Project Area include Caney, Eubanks, Hanging Moss, Hog, Lynch, Prairie Branch, Purple, Richland, and Town Creeks. The Study Area is primarily affected by headwater flooding caused by the Pearl River. Headwater flooding is caused by unusually heavy and intense rainfall over the upper Pearl River Watershed. Although the Study Area is located primarily within the boundaries described, additional areas downstream were included to ensure any potential downstream impacts of the proposed project alternatives were fully considered.

As the plan formulation was resumed, existing data was used to the fullest extent possible with much more new data being collected and used in the re-scoping and plan formulation process. A list of major items that were updated or gathered and utilized is listed in Table 3-1.

Table 3-1, Additional Data Resources

New Data or Resource	Associated Task
Re-Scoping meetings	Public Involvement
Planning Charette	Re-Scoping/Plan Formulation
Agency Meetings	Plan Formulation
Finish Floor Surveys (mobile LiDAR)	Economics
Updated Tax Parcel Information	Economics
Bridge (channel surveys and updated LiDAR)	Engineering
Updated Hydraulic Models	Engineering
Preliminary Geomorphic Assessment	Engineering
Water Quality Investigations and Modeling	Engineering
Solid Waste (landfill) Investigations	Environmental
Detailed Wetland and Habitat Assessments	Environmental

The study goals, objectives, and constraints are identified in Sections 1.5 and 3.2 of the integrated draft report. They are included as a point of reference for understanding details of the screening process.

Table 3-2, Objectives and Constraints

Objectives	Constraints
Reduce Pearl River estimated annual flood risk in the Jackson MSA of Rankin and Hinds Counties through the year 2065.	Avoid adverse impacts to flood elevations upstream or downstream of the Study Area.
Reduce damage and loss of transportation routes with Average Daily Traffic (ADT) Counts of 10,000 or higher and also routes to critical care facilities.	Avoid adverse impacts to the water supply being provided by the existing withdrawal at RM 290.7.
Reduce the flood risk of critical infrastructure, specifically the Savanna Street Jackson Wastewater Treatment Facility.	Avoid the existing wetland mitigation area within the project boundaries when possible.
Integrate environmental design features into flood risk management features to conserve or improve natural resources.	Avoid adversely effecting minimal flow releases from the Ross Barnett Reservoir

3.1 PRIOR STUDIES

Although all prior reports are important and relevant, only more recent studies and authorizations conducted after 1986 are listed. Recent studies/reports to this area are listed below:

1. USACE-MVK completed a reconnaissance study on the Pearl River Watershed in June 1990. This plan recommended approximately 24 miles of new levees and increasing the elevation of approximately 11 miles of existing levees;
2. September 1991 Feasibility Cost-Sharing Agreement with the USACE. The resulting recommended plan documented in January 1996 draft report was a comprehensive levee system to provide protection from the 1979 Flood;
3. In 1996, local interests proposed the LeFleur Lakes Flood Control Plan, consisting of upper and lower lakes along the Pearl River south of the Ross Barnett Reservoir, as an alternative to the comprehensive levee plan;
4. In February 2007, a Preliminary Feasibility Study and Draft Environmental Impact Statement for the Pearl River Watershed was presented;
5. Section, 3104 of WRDA 2007 Pearl River Basin, Mississippi. Authorizing construction of the NED plan, locally preferred plan, or a combination thereof, if environmentally acceptable and technically feasible;
6. March 2012 Preliminary Hydraulic and Hydrologic Report for a channel improvement concept.

3.2 PLANNING CONSTRAINTS

Planning constraints have been determined for the area based on prior study documentation and updated information from recent data collection. Although many obstacles and challenges are addressed in this FS/EIS, these constraints have been developed based on prior and updated information of the Project Area. Within these constraints, alternatives for the FS/EIS were developed to fully update the analysis of previously proposed levee plans and channel improvement plans, and analyze other reasonable alternatives to provide a comprehensive plan for flood control.

3.3 SCREENING CRITERIA

Screening criteria, presented below, were used to assess the overall characteristics of each alternative during the Initial Array of Alternatives. Alternatives were screened and scored by the study team based on the criteria in Table 3.3. ER 1105-2-100 also states that "appropriate mitigation of adverse effects shall be an integral component of each alternative plan." Accordingly, planning considerations such as impacts to threatened and endangered species and avoidance of known cultural resource sites were used as additional considerations (Table 3.4).

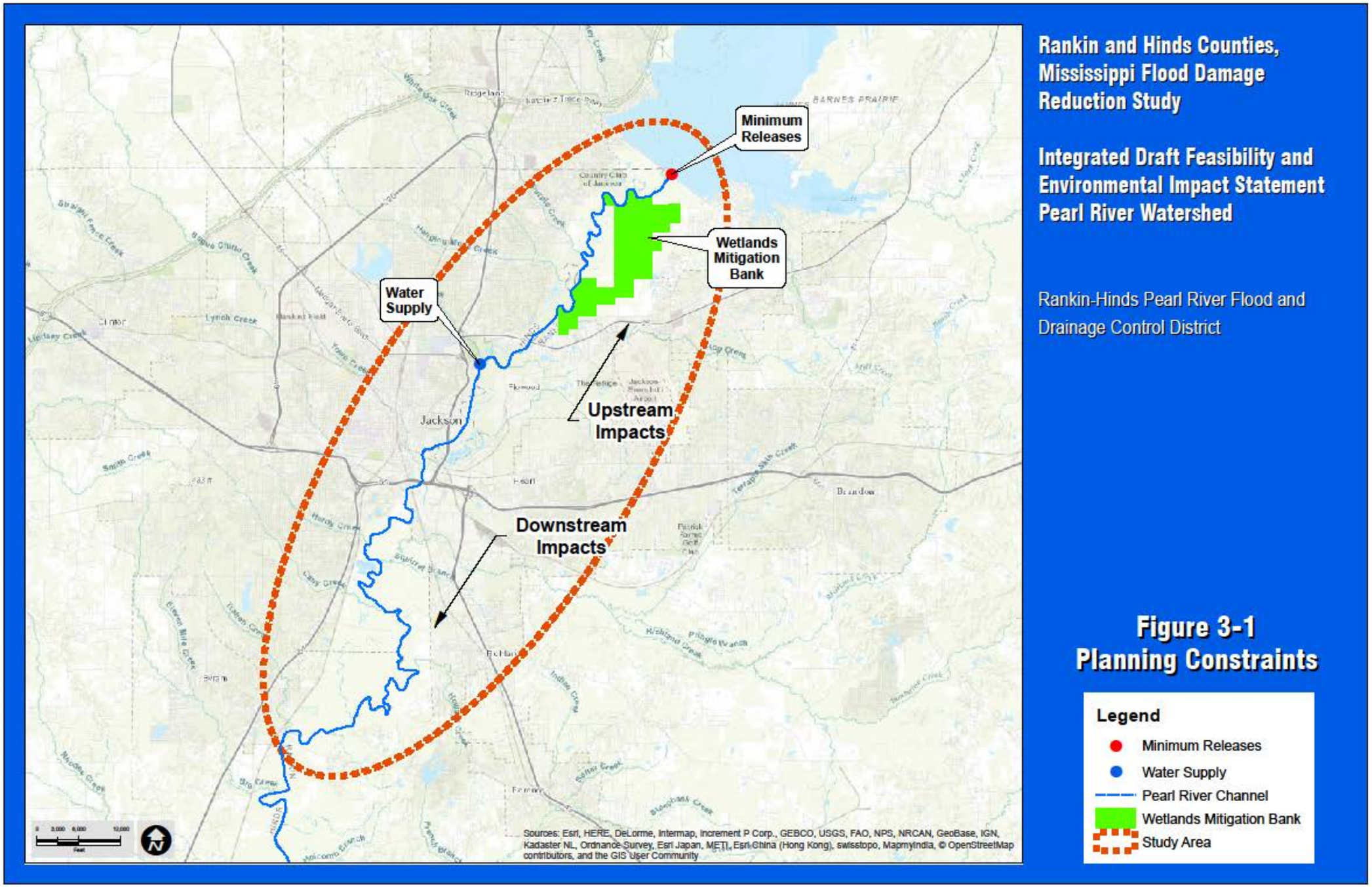
To determine if the plans were viable for further evaluation, each plan was assessed on how well it met the project objectives and avoided constraints. A summary of each plan is discussed in the following sections. Discussion of plans with similar features have been grouped together for discussion purposes.

Table 3-3, Alternative Screening Criteria

Criterion	Definition	Description
Effectiveness	The extent to which the alternative plans contribute to achieving the planning objectives.	Whether the alternative would provide acceptable level of flood reduction benefits for the Jackson Metro Area. o Must provide flood risk management benefits o Reduce transportation impact risk o Reduce other infrastructure risk o Provide environmental design features for habitat conservation
Completeness	The extent to which the alternative plans provide and account for all necessary investments or other actions to ensure the realization of the planning objectives, including actions by other Federal and non-Federal entities.	To what degree does the alternative provide and account for the realization of the project's objectives? Are all of the objectives met or will additional actions be required?
Acceptability	The extent to which the alternative plans are acceptable in terms of applicable laws, regulations, and public policies.	Whether there are significant outstanding technical, social, legal or institutional issues that affect the ability to implement the alternative (implementable) and potential effects on community cohesion and compliance with policy. o Avoid when possible landowner conflicts. o Project acceptability to local sponsor, municipalities, and resource agencies. o Can plan be implemented and is it technically feasible?
Efficiency	The extent to which an alternative plan is the most cost effective means of achieving the objectives.	The first cost of the project, costs of local operations and maintenance, and long-term residual costs, including the ability to fund and recover project costs. o What is the cost of implementing an alternative which provides the same level of flood risk management benefit?

Table 3-4, Additional Screening Criteria

Criterion	Description
Environmental Effects	Direct and indirect effects of environmental resources, natural resources, and cultural resources. Possible environmental impacts to: o Water quality and minimum flows o Wetlands o Threatened and Endangered Species
Social Effects	Direct and indirect effects on socio-economic resources such as transportation, regional growth, public safety, employment, recreation, public facilities, and public services. Benefits of reduced flood risk must be shared by all socio-economic classes



Rankin and Hinds Counties, Mississippi Flood Damage Reduction Study

Integrated Draft Feasibility and Environmental Impact Statement Pearl River Watershed

Rankin-Hinds Pearl River Flood and Drainage Control District

Figure 3-1
Planning Constraints

Legend
- Minimum Releases
- Water Supply
- Pearl River Channel
- Wetlands Mitigation Bank
- Study Area

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3.4 MANAGEMENT MEASURES CONSIDERED AND SCREENED (NEPA REQUIRED)

Management measures were considered for the FS/EIS included non-structural and structural measures. A non-structural measure is an activity that can be implemented at a specific location to address planning objectives. They can be used individually or combined with other management measures to form alternative plans. Measures were developed to address problems and to capitalize upon opportunities. They were derived from a variety of sources that include prior studies, FS/EIS team input, local sponsor, and public involvement.

The FS/EIS considered structural and non-structural measures to provide flood risk management and maximize project benefits. All measures were screened for capability to meet objectives and avoid constraints, for engineering and economic feasibility, and for the level of flood risk management. Measures that warranted continued consideration were assembled into alternative plans.

3.4.1 NON-STRUCTURAL MEASURES

Several non-structural alternatives were considered in evaluating future possible actions in the Jackson metropolitan area.

1. **Relocating structures (Full acquisition buy out)** allows for moving structures as part of the project and buying the land upon which the structures were located. Full acquisition buy out is a suitable alternative when structures can be relocated from high-risk flood zones to areas completely out of the floodplain.
   There are a large number of structures located within this flood prone area (over 3,100 plus more behind existing levees). A significant number of structures are located in multiple commercial areas including downtown Jackson. In addition to satisfying the needs of the district's residents, commercial and retail businesses located in the CBD fulfill requirements essential for operation of the seat of the state's government. A location within the CBD is vital for many of these businesses to successfully meet their business objectives, and sustaining these businesses would be difficult if they had to relocate to another area.
2. **Relocating structures (Limited acquisition buy out)** allows for moving structures as part of the project and buying the land upon which the structures were located. Development of relocation sites where structures could be moved, purchased, or demolished to achieve the planning objectives and retain such aspects as community tax base, neighborhood cohesion, etc. were investigated as part of other project alternatives.

3. **Elevating structures** requires lifting the structure above a particular flood event. Due to most structures in the area constructed with slab-on-grade foundations, elevating structures is very difficult. Most structures located in downtown Jackson could not be elevated because of either the engineering limitations of the structure or this measure being cost prohibitive.
4. **Flood proofing** the structure which can be done to residential structures as well as other types of structures. As a stand-alone project, all construction materials and finishing materials need to be water resistant or "dry" flood proofing must be done. If implemented, this measure achieves flood risk management; however; it is not recognized by the National Flood Insurance Program (NFIP) for any flood insurance premium rate reduction if applied to residential property.
5. **Flood Warning, Preparedness, and Evacuation Plan** measures are applicable to the metropolitan area, and already in place for flood events with coordination between emergency operation personnel. The communities in the area have already developed emergency operation plans for floods, and those plans are updated during and after flood events.
6. **Flood Insurance** measures are already in place as per the NFIP and can help to rebuild after a flood. However, flood insurance does not prevent the flood from occurring, and flooding would still have tremendous initial and residual impacts on public safety and infrastructure. In addition, the recent rise in insurance premiums for this area makes this a very ineffective way to reduce risk. Premiums due to recent NFIP changes are causing rates to increase over 400% in some portions of the Study Area and throughout the nation.
7. **Flood Plain Ordinances** are already in place for the Study Area. However, updated ordinances should be considered and consistent throughout the area for better public awareness and education of the hazards of building in flood prone areas.

Non Structural Measure carried forward for consideration

1. *Full acquisition/Buy-out;*
2. *Limited acquisition /Buy-out;*
3. *Flood Insurance;*
4. *Update Flood Plain Ordinance to be consistent throughout Project Area.*

3.4.2 STRUCTURAL MEASURES

Several structural alternatives were considered in evaluating future possible actions for flood risk management in the Jackson metropolitan area.

1. **Flood storage** involves both preserving natural floodplain areas and also constructing dams or other water retention facilities to detain water during flood events. Flood storage concepts include large dams or smaller distributed storage sites throughout the watershed. These facilities would need to be located in the Pearl River watershed upstream of the Jackson metropolitan area.
2. **Conveyance Improvements** consist of clearing vegetation along the channel and in overbank areas to improve conveyance and reduce flood levels due to reduction in friction. Conveyance improvements have been implemented in some portions of the Study Area over the last 30 years. There is one area of approximately 250 acres downstream of Interstate 55 that is still maintained by chemical spraying to minimize vegetation and to maintain conveyance through the area.
3. **Channel Improvements** consist of excavating areas along the Pearl River, including cutoffs where necessary, to improve conveyance. This includes widening the existing channel to improve channel capacity and cutoffs, similar to those in the existing levee plan that is in place from approximately RM 285 to RM 291.
4. **Levees and Floodwalls** measure consists of building new levees and expanding the existing levees. Approximately 13.5 miles of levees now protect portions of the Jackson metropolitan area. Much of the area is unprotected, as previously discussed. In some areas, floodwalls would be needed due to right-of-way restrictions.
5. **River Training Structure** measures were screened to insure planning objectives could be met with other structural measures. River training structures as a stand-alone feature were not considered due to not meeting the objectives without other structural measures. However, they did help in the plan development to meet goals, objectives, and adhere to planning constraints.

Structural Measures carried forward for consideration

1. Flood storage
2. Conveyance Improvements
3. Bridge Improvements
4. Channel Improvements
5. Levees/ Floodwalls and Pumps
6. River Training Structures

3.5 INITIAL ARRAY OF ALTERNATIVES (NEPA REQUIRED)

Structural Measures were combined into an initial array of **16 plans**. Maps, details of each initial plan, and brief descriptions are included in Appendix A. Many of these alternatives are similar to plans or variations that have been studied before, therefore much data was available to review and develop the screening criteria. Figure 3-2 provides river miles for reference. Previous studies have referenced the LeFleur Lakes plan that included two weirs and channel excavation from RM

284 to RM 301. Although a previous alternative, this alternative would have significant impacts on planning constraints. For the purpose of this plan formulation, the LeFleur Lakes plan was no longer considered due to the large impact to the mitigation area planning constraint. Although 16 plans are included below as the initial array, multiple combinations or variations of these plans were used to develop this array.

1. FLOOD STORAGE

Plan 1: Flood storage upstream of the Ross Barnett Reservoir.

Plan 2: Flood storage within the Project Area.

2. CONVEYANCE IMPROVEMENTS

Plan 3: Bridge improvements and conveyance improvements within bridge areas.

Plan 4: Conveyance improvements throughout the study reach (RM 284 to RM 302). This would include from south of Richland and continuing upstream to the Ross Barnett Reservoir.

Plan 5: Combined conveyance improvements and bridge improvements. This would include not only conveyance improvements through the reach, but also Railroad Bridge improvements.

3. CHANNEL IMPROVEMENTS

Plan 6: Channel improvements from RM 284 to RM 291. These channel improvements would be within the channelized reach up to approximately the existing weir located at RM 290.7 and include a "subsequent channel" for high flow conveyance.

Plan 7: Channel improvements from RM 284 to RM 294. These improvements would extend approximately 3 miles upstream of Plan 6 and upstream of MS Hwy 25. Also, they would include a "subsequent channel" for high flow conveyance.

Plan 8: Channel improvements with weir RM 284.0 to RM 294.0. This plan modifies the channel improvements from Plan 7 and relocates the existing weir to RM 284.0 to insure water supply.

4. LEVEES, FLOODWALLS, AND PUMPS

Plan 9: Provide for additional levees in unprotected areas. Levees with this plan are included for unprotected areas only, with none of the required additional levee upgrades, which include gates and pumps.

Plan 10: This plan is the same as Plan 9 but also increases the protection for existing areas already protected by levees by upgrading existing levee elevations.

Plan 11: This plan is the same as Plan 10 with additional conveyance improvements upstream from RM 294 to RM 302 so that induced flooding is not created from new levee measures (Old Levee Plan).

Plan 12: This plan is the same as Plan 11 minus the Richland Levee and South Jackson Levee.

Plan 13: This plan is the same as Plan 12 with the addition of pumps and gates which have been placed behind levee structures for adequate dewatering of the Pearl River tributaries.

5. CHANNEL IMPROVEMENTS AND WEIR

Plan 14: Channel improvements with weir. This plan is the same as plan 8 with the existing weir structure relocated to mile 284.0 to insure water supply and adding a levee around the existing wastewater treatment plant.

Plan 15: Channel, weir, and gate improvements. This plan is the same as plan 14 with added gate operations to the weir for low-flow conditions

Plan 16: Channel, weir, and gate improvements to RM 295. This plan is the same as plan 15, however the channel improvements will extend to RM 295.

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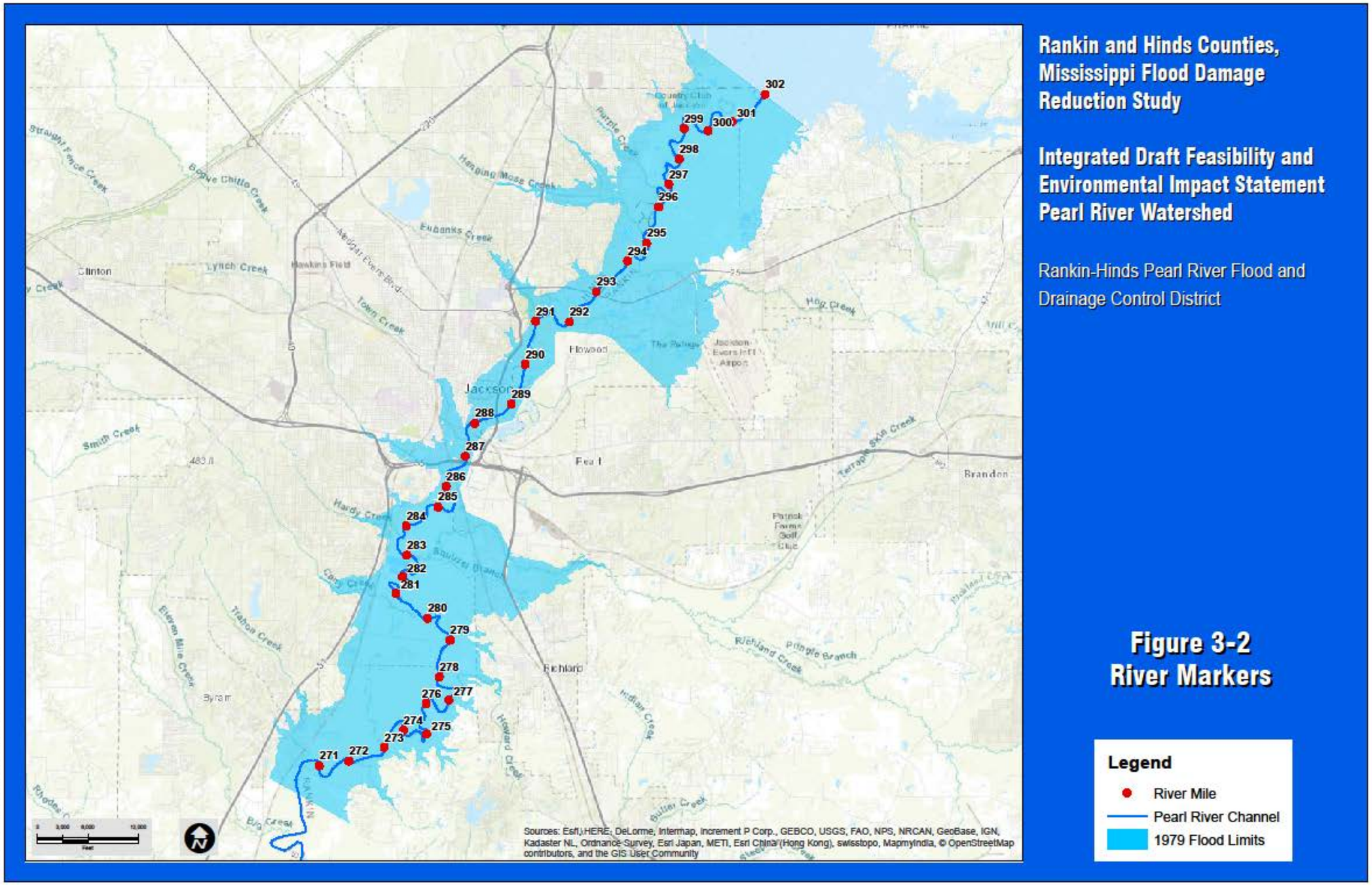

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Rankin-Hinds Pearl River Flood and Drainage Control District

Figure 3-2
River Markers

Legend
- River Mile
- Pearl River Channel
- 1979 Flood Limits

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3.6 FINAL ARRAY OF ALTERNATIVES (NEPA REQUIRED)

The final array of alternatives carried forward for consideration included the No Action Alterative, Alternative A (non-structural), Alternative B (Plan 13), and Alternative C (Plan 15). Details of each alternative are included in Appendix A. In addition, based on economic reaches, some levees segments were removed at this time due to a lack of economic justification.

Flood events that have a 50%, 20%, 10%, 4%, 2%, 1%, 0.5%, and 0.2% annual chance exceedance were selected for hydrologic and hydraulic analysis and for economic considerations. The design event was the annual 1% chance exceedance event. In addition, special consideration was given to the annual 0.5% chance exceedance event, as it corresponds to the 1979 flood of record. While changes to the climate were considered, the current USACE policy (Engineering and Construction Bulletin 2016-25) states that "projections of climate changes and their associated impacts to local-scale hydrology that may occur in the future can be highly uncertain" and there is "no consensus how extreme storms will evolve in the future." Therefore, flood events of large magnitude, such as the annual 0.2% chance exceedance event, were used for analysis but no quantitative adjustments to the flood magnitudes were made.

3.6.1 NO ACTION (FUTURE WITHOUT-PROJECT CONDITION)

Under the No Action Alternative, no flood risk management would occur. The area would continue to experience flooding caused by the headwaters of the Pearl River. As already presented in Section 1, impacts to structures, infrastructure, transportation, and the existing WWTP will continue to be great and will possibly increase due to urban development.

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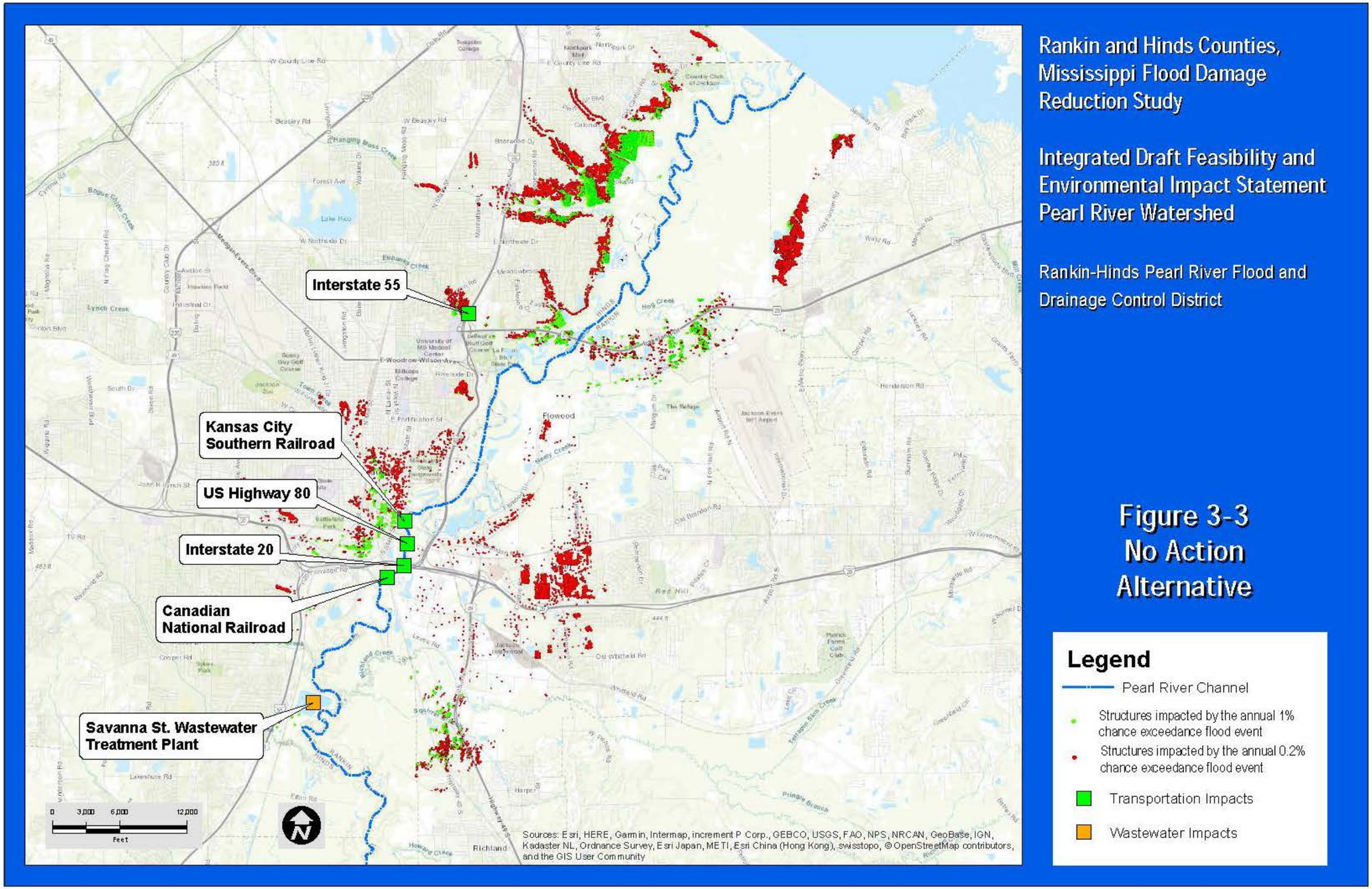
Interstate 55
Kansas City Southern Railroad
US Highway 80
Interstate 20
Canadian National Railroad
Savanna St. Wastewater Treatment Plant
Rankin and Hinds Counties, Mississippi Flood Damage Reduction Study
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Rankin-Hinds Pearl River Flood and Drainage Control District
Figure 3-3
No Action Alternative
Legend
Pearl River Channel
Structures impacted by the annual 1% chance exceedance flood event
Structures impacted by the annual 0.2% chance exceedance flood event
Transportation Impacts
Wastewater Impacts
0 3,000 6,000 12,000
Feet
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

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3.6.2 ALTERNATIVE A (NON-STRUCTURAL)

The measure of relocating structures (buy out) allows for removing structures as part of the project and buying the land upon which the structures were located. The total number of structures to be relocated in this alternative would be in excess of 2,000, including residential structures, commercial structures, government and public buildings, schools, and hospitals. This does not include structures behind existing levees, although there is some probability that damage and risk in these areas will still exist. Figure 3-4 presents the location of structures impacted and that were considered in Alternative A.

As can be seen in Figure 3-4, many structures that impact quality-of-life and community cohesion are impacted in multiple sections within the Study Area. In addition to community impacts, major transportation routes, airports, and rail lines would still be impacted causing congestion and transportation impacts. Furthermore, risk would not be improved to existing structures being protected by existing levees, and no risk management improvement would be realized at the $300 million WWTP plant that serves the area. The estimated cost for removal of the structures alone would surpass $2.0 billion. The cost of this alternative far exceeds economic justification; additionally, it does not meet the stated goals and objectives. Therefore, reference to this alternative in future discussions will be limited.

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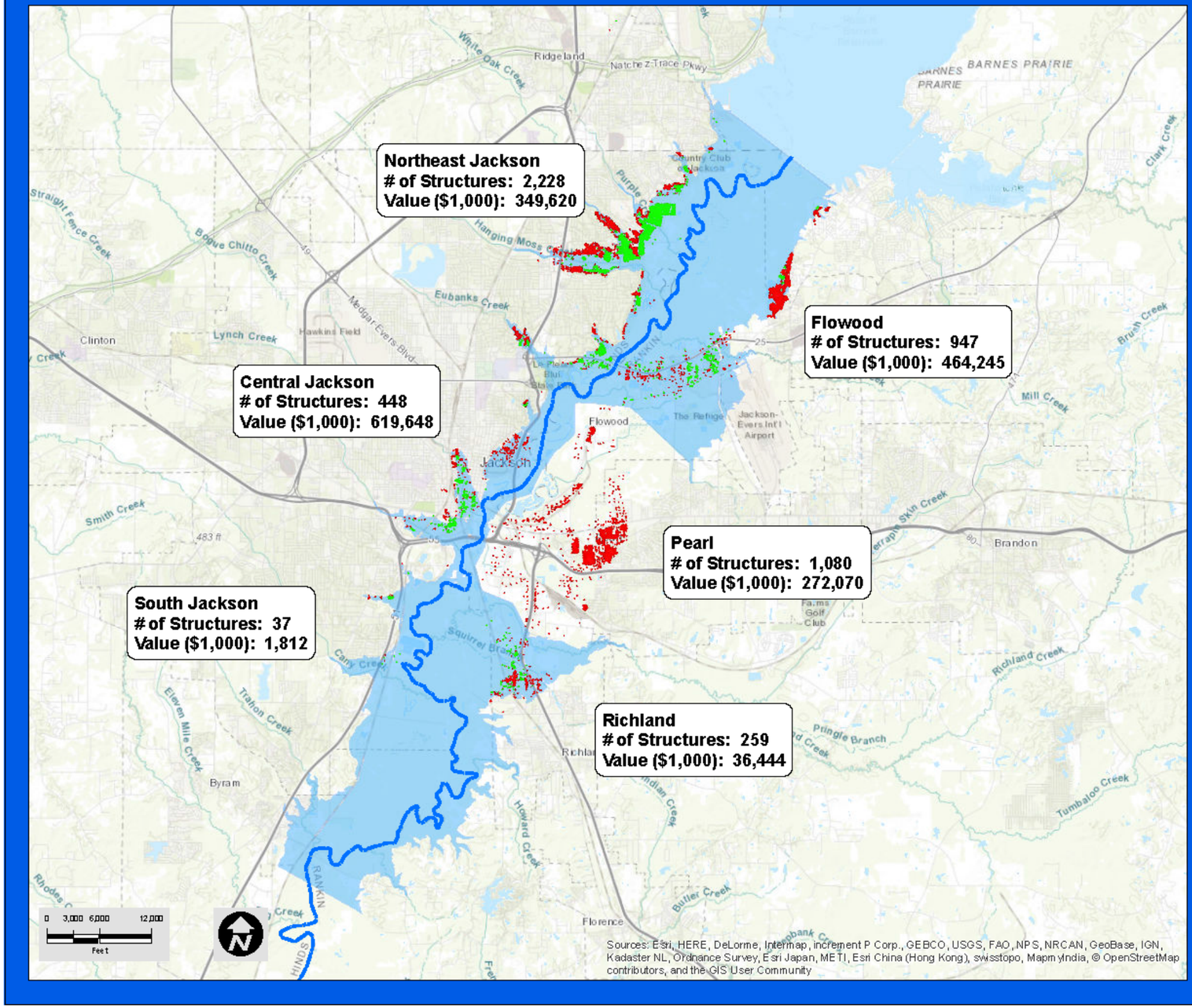

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Figure 3-4
Alternative A
Non-Structural

Legend

- Impacted by the annual 1% chance exceedance flood event
- Impacted by the annual 0.2% chance exceedance flood event
- Pearl River Channel
- 1979 Flood Event

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3.6.3 ALTERNATIVE B (LEVEE PLAN)

Approximately 13.5 miles of levees currently protect portions of the Jackson metropolitan area; however, much of the Jackson metropolitan area is unprotected, as previously discussed. This alternative consists of building new levees and expanding the existing levees and pumps. In some areas, floodwalls are needed due to right-of-way restrictions. Significant conveyance improvements would be constructed from RM 292 to RM 302 on the west bank to reduce flooding induced by new levees and reduce any impacts to the outlet structure of the Ross Barnett Reservoir. A summary of major features of Alterative B are presented in Table 3-5. A more detailed listing is included in Appendix C.

Additional levees would improve flood risk management in unprotected areas and in already protected areas. Although risk management is improved, there is still risk of overtopping or failure in levee sections during extreme events. Extreme events would be events greater than the design event, such as the annual 0.5% chance or the annual 0.2% chance exceedance flood events. This alternative adds a significant number of structures and pumps that will require maintenance in addition to requiring operators during flood events with possible interior flooding. This plan would require significant clearing and maintenance of areas from RM 294 to RM 302 to insure no increase of flood elevations upstream near the Ross Barnett Reservoir. This conveyance improvement would be needed within a reach of the Pearl River that has not been significantly altered in the past. In addition, pumps would be required at most tributaries to insure management of risk behind the levees at these locations. Due to lack of available sump areas along Lynch and Town Creeks, these pumps would be very large to insure tributary flood flows could be passed during times when the Pearl River is above flood stage.

Table 3-5, Alternative B

ALTERNATIVE B		
Excavation	4.5 million	cubic yards
Clearing and Grubbing	460	acres
Slurry Trench	1.6 million	square feet
Gated Drainage Structures	13	each
Pump Stations	7	each
Floodwalls	6,100	feet
Floodway Clearing for Conveyance	400	acres
Relocation/Condemnation	30	properties

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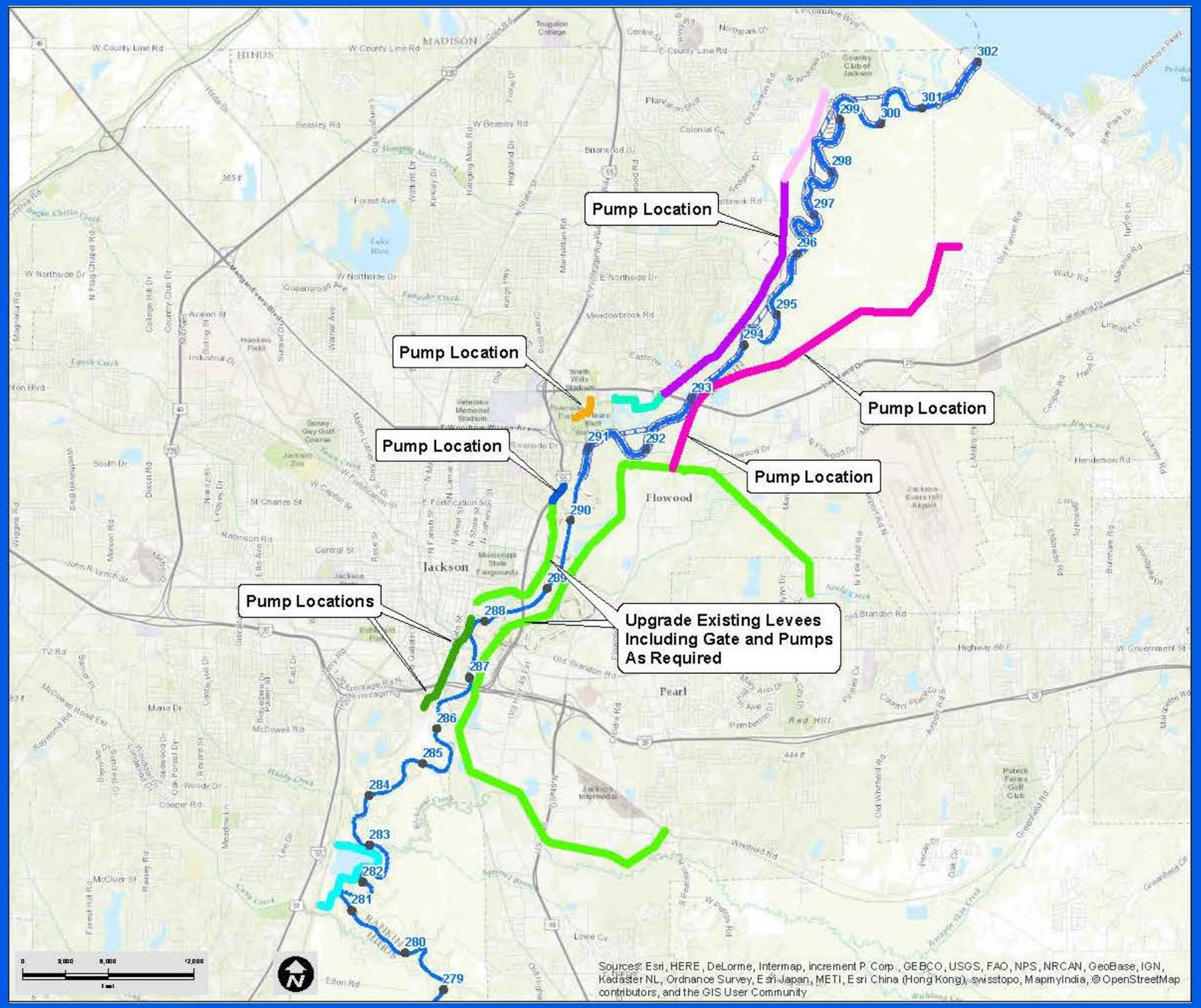

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Figure 3-5
Alternative B

Legend

- River Mile
- Pearl River Channel
- Belhaven Levee
- Existing Levee
- Flowood Levee
- I-20 Levee
- Lakeland West Levee
- LeFleur Levee
- Northeast Jackson 1 Levee
- Northeast Jackson 2 Levee
- Treatment Plant Levee
- Conveyance Improvement

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3.6.4 ALTERNATIVE C (CHANNEL IMPROVEMENT/WEIR/LEVEE PLAN)

This alternative consists of significant channel modification from RM 284 to RM 293.5. Levees exist within much of this reach and would be relocated in some areas to reduce flood levels. This alternative would include excavating the overbanks of the channel and lowering the flowlines through the reach. Lowering the flowlines while maintaining the existing levee elevations will provide significantly more freeboard for Alternative C, with the annual 1%, 0.5%, and 0.2% chance exceedance events being below the proposed top of flood protection. The increased freeboard greatly increases flood risk management capabilities of Alternative C during extreme events.

Excavation would be placed adjacent to existing levees, or adjacent to relocated levees. The large amount of excavation needed would provide substantial land mass or expanded levee widths**,** providing additional protection and additional risk management. The weir currently located at RM 290.7 would be removed and relocated to near RM 284.3 by a weir with a gate for low flows**.** Relocating the weir allows for the water supply to be continued while simultaneously creating an area of surface water approximately 1,900 acres. The new weir would be modified to a higher elevation and expanded width to find a cost effective balance between the amount of conveyance needed to provide flood risk management and the expense of excavation. Lowering the flowlines and relocating the weir provides a larger body of water for flood risk management while reducing channel maintenance along with the future maintenance required of a larger, expanded channel improvement.

For this plan, additional pumps would not be needed to provide protection behind levees except where pumps already exist. While the risk of interior flooding exists, the existing two pump stations have thus far managed this risk.

Table 3-6, Alternative C

ALTERNATIVE C		
Excavation/Levee	25 million	cubic yards
Clearing and Grubbing	2,500	acres
Gated Structures	1	each
LERRD (Lands, Easements and Rights of ways, Relocations, and Disposal areas)	2,750	acres
Residential Condemnation/Relocations	0	each

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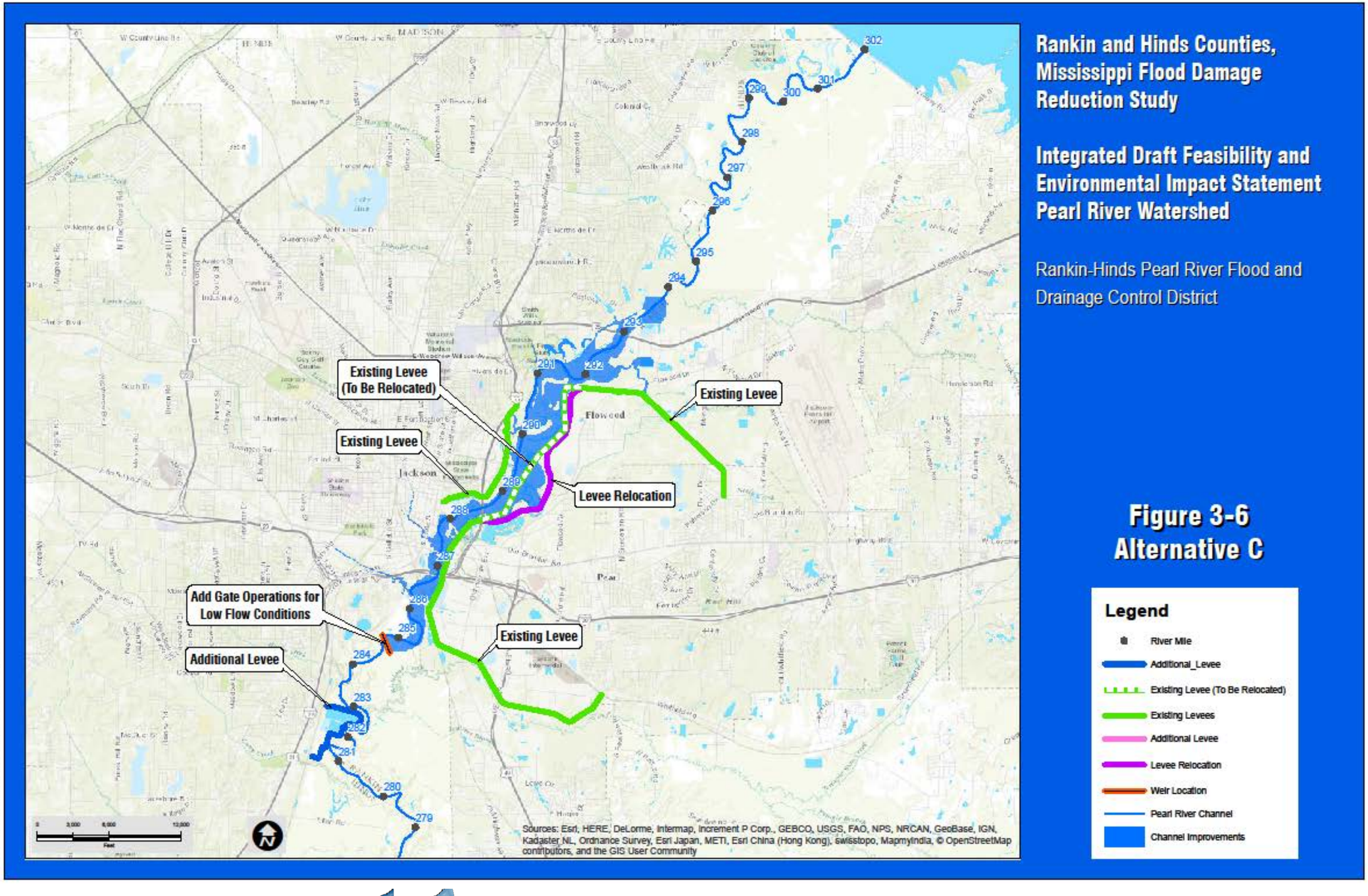

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Figure 3-6
Alternative C

Legend

- River Mile
- Additional_Levee
- Existing Levee (To Be Relocated)
- Existing Levees
- Additional Levee
- Levee Relocation
- Weir Location
- Pearl River Channel
- Channel Improvements

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3.7 COST ESTIMATES

Estimated cost for levees, floodwalls, excavation, gates, weir, real estate, operation maintenance, repair, rehabilitation, and replacement (OMRR&R); environmental mitigation, and non-structural features were calculated for each alterative and compared to help identify the TSP. Cost for non-structural features in each alternative and cost for mitigation were estimated with a range of uncertainty.

Non-Structural Cost: Non-structural cost were based on 100% structure inventory of the area of improvements. The cost of raising structures and/or acquiring structures within an annual 1% chance exceedance flood event return period were evaluated by comparing a range of improvements from elevating to relocation. Due to the numerous structures being slab-on-grade constructions, schools, multiple-story downtown structures, and hospitals, it is believed that a full acquisition and relocation was the best solution for the non-structural alternative. As already discussed, the total cost of this alternative would far exceed $2.0 billion. Not only are the NED benefits negligible, other accounts are also negatively impacted. Environmental Quality (EQ) still will not improve and instead may decline with the possibility of impingement of solid waste areas and impacts to the WWTP. Other social effects (OSE) and Regional Economic Development (RED) will both be impacted by the negative effects of this alternative on community cohesion and tax revenues amid other social and economic consequences.

Based on available information, first costs were developed for non-structural, mitigation, structural features, and real estate requirements for each alterative, or updated (levee plan 2006) to the fullest extent practical with values and newly developed data. Detailed cost estimates are included in Appendix C. As already discussed, Alternative A would not meet goals, objectives, and is cost prohibited. The estimated total first cost to implement Alternative B is $729,410,000. To implement Alternative C, the estimated total first cost is $345,850,000.

OMRR&R Cost: Table 3-7 provides preliminary OMRR&R cost estimates for each alternative. Annual cost will be refined during the feasibility level design and analysis. Upon notice of completion of construction of the project or a functional portion of the project, the local sponsor shall commence OMRR&R responsibilities for the project (Section 8).

Table 3-7, Annual OMRR&R Cost Comparisons

	Alternative B	Alternative C
Total OMRR&R Cost	$2,200,000	$650,000

3.8 SUMMARY OF CATEGORIES AND COMPARISON OF ALTERNATIVES

To facilitate evaluation and comparison of the alternatives, four federal categories were used to assess the effects of the alternatives: National Economic Development (NED), Environmental Quality (EQ), Other Social Effects (OSE), and Regional Economic Development (RED).

3.8.1 NO ACTION ALTERNATIVE

There would be no NED benefits associated with this alternative. The No Action alternative would continue to have high risk of flooding, including impacts to transportation routes, hospitals, and airports, and the local economy. Risk associated with existing flood risk structures would still be impacted, with the additional possibility of water quality impacts due to impairment on old solid waste sites and risk of overtopping at the WWTP. No Action descriptions for each resource was discussed in Section 2 of this report. This section will only include a No Action Summary as compared to each alternative under effected environment.

3.8.2 ALTERNATIVE A

As already discussed, Alternative A would exceed $2.0 billion and fail to meet the planning objectives and have detrimental consequences to the community. Therefore, discussions of cost will be limited due to the extraordinary cost.

3.8.3 ALTERNATIVE B

Alternative B provides NED benefits, but does not maximize benefits. This alternative provides risk management for most areas within the Study Area, reducing impacts to residential and commercial areas. This alternative includes over 28 miles of levees and floodwalls. There will still be risk of overtopping, or failure. Alternative B poses potential uncertainties in areas behind the levees or floodwalls during extreme events with little storage areas behind levees. Pumps are critical to the success of this alternative; however, pump costs are extraordinary. Similar alternatives have been selected and proposed in the past with little support.

3.8.4 ALTERNATIVE C

Alterative C maximizes the net NED benefits. A similar, albeit much larger, plan with greater environmental impacts was the locally preferred plan in recent studies. Alternative C has a smaller footprint than the plan from 2007 but still maximizes the NED benefits. Alterative C has more wetland impacts than alternative B (levee plan) but provides potentially significant water quality benefits with protection and removal of solid and hazardous waste areas within the Project Area. A range of recreational benefits for this alternative was developed adding to the NED benefits. This alternative limits the risk areas behind levees, reducing the miles of levees

and potential risk of overtopping. In addition, only the existing ponding areas will be at risk as they are at present. A range of recreational benefits provides additional value, and the location benefits will provide more advantages to the Regional Economic Development.

3.8.5 COST COMPARISON

Table 3-8 and Table 3-9 below provide a cost comparison between each of the three alternatives.

Table 3-8, Economic Cost Comparison

Equivalent Annual Benefits and Cost Pearl River Basin, Mississippi, Federal Risk Reduction Project (October 2017 Price Level, 50-Year Period of Analysis, 2.750 Percent Discount Rate)			
	Alternative A	Alternative B	Alternative C
Investment Cost			
Total Project Construction Cost	$2,000,000,000	$729,413,364	$345,849,032
Interest During Construction*		$20,242,740	$9,629,973
Total Investment Cost	$2,000,000,000	$749,656,104	$355,479,005
Average Annual Cost			
Interest/Amortization/Initial Investment	N/A	$27,767,951	$13,209,902
OMRR&R	N/A	$2,200,000	$650,000
Total Average Annual Cost	N/A	$27,767,951	$13,859,902
Average Annual Benefits	N/A	$20,947,231	$39,164,442
Net Annual Benefits	N/A	-$6,820,721	$25,304,540
Benefit-Cost Ratio	N/A	0.75	2.83
Benefit-Cost Ratio (computed at 7%)	N/A	0.48	1.41
*Estimated construction period of 3 years			

3.9 IDENTIFYING THE TENTATIVELY SELECTED PLAN (TSP)

Alternative C is the TSP, the LPP, and the NED plan as determined by the evaluation criteria. This plan fulfills the planning objectives as stated, reasonably maximizes net benefits, and is in accordance with national environmental statutes, applicable Executive Orders, and other federal planning regulations for the protection of the nation's environment. Alternative C consistently met goals, avoided constraints, and provides for the most economic benefits. A more detailed discussion of the TSP is included in Section 5 of this report.

Table 3-9, Cost Summary Comparison

Cost Summary Pearl River Basin, Mississippi, Federal Risk Reduction Project (October 2017 Price Levels)			
	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C
Construction Item	Cost	Cost	Cost
Lands and Damages	$2,000,000,000	$71,900,008	$23,056,200
Elements			
Relocation		$15,685,964	$13,076,870
Channels and Levee Improvements		$235,435,532	$198,911,978
Weir		-	$43,854,534
Floodway and Diversions		$33,815,134	-
Recreation		-	$12,581,204
Pumping Plants		$311,609,907	-
Mitigation		$7,361,814	$17,400,000
Pre Construction Engineering		$41,974,624	$30,241,493
Construction Management		$11,630,380	$6,726,753
Total First Cost	**$2,000,000,000**	**$729,413,364**	**$345,849,032**

4.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES (NEPA REQUIRED)

This section describes the effected environment and the environmental consequences of implementing the proposed action alternatives. Resource issues analyzed in this section mirror those discussed in Section 2, which sets out the No Action Alternative. The first part of the section describes the methodology utilized in considering direct, indirect, and cumulative impacts on the resource issues presented. The second part of this section describes the past, present and future projects and/or actions and historical sites within the Study Area to provide necessary information to be considered in the analysis of environmental consequences. The final two parts of this section describe the direct, indirect, and cumulative environmental consequences of implementing the proposed non-structural and structural flood risk management plans considered in this FS/EIS.

4.1 DIRECT, INDIRECT, AND CUMULATIVE IMPACTS

The President's Council on Environmental Quality (CEQ) defines cumulative impacts as those impacts on the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions (40 C.F.R. §1508.7). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Four categories of effects are considered: direct effects caused by the action and occurring at the same time and place as the action[40 C.F.R. §1508.8(a)]; indirect effects caused by the action and occurring later in time or removed in distance, but still reasonably foreseeable [40 C.F.R. §1508.8(b)]; and cumulative effects, as defined above and further explained herein. For the purposes of this report, impact is synonymous with effect.

Cumulative effects can result from a wide range of activities, including the addition of materials to the affected environment, repeated removal of materials or organisms from the affected environment, and repeated environmental changes over large areas and long periods of time. Complex cumulative effects can occur when different types of impacts combine to produce a single effect or suite of effects. Cumulative impacts may also occur when individual disturbances are clustered, creating conditions where effects of one episode have not dissipated before the next occurs (timing) or are so close that their effects overlap (distance).

In assessing cumulative impacts, consideration is given to the following:

- the degree to which the proposed action affects public health or safety;
- unique characteristics (physical, biological, and socioeconomic factors) of the geographic area;
- the degree to which the effects on the quality of the human environment are likely to be highly controversial;
- the degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks;
- the context, intensity, and duration of impacts;
- whether the action is related to other actions with individually insignificant, but cumulatively significant, impacts on the environment; and
- measures to mitigate for impacts.

Before analyzing cumulative effects, an analysis of direct and indirect impacts must be prepared. Each potential impact is described in terms of its context (site-specific, local, or regional), duration (short-term or long-term) and intensity (negligible, minor, moderate, or major). After analyzing direct and indirect impacts, cumulative impacts can be assessed. For the purpose of analysis, the following definitions, unless stated otherwise, are used for all impact topics:

Short-term impacts are impacts that might occur during the site preparation and construction phases or shortly (1 to 6 months) after completion of construction.

Long-term impacts are impacts occurring from completion of the project through the next ten years.

Negligible intensity impacts are impacts that would have no measurable or perceptible changes to the resource.

Beneficial intensity impacts result in resource improvements and have a perceptible change to the resource.

Minor impacts are measurable or perceptible but are localized within a relatively small area. The overall viability of the project would not be affected and, if left alone, would recover.

Moderate impacts cause a change in the resource; however, the impact would remain localized.

Major impacts to the resource would be substantial, highly noticeable, and permanent.

These analyses provide the basis for comparing the effects of the alternatives including the two Structural Alternatives and the No Action (non-structural) Alternative. Intensity of effects and thresholds of significance are defined for both beneficial and adverse effects. To analyze impacts, methods were selected to predict the potential change(s) that would occur with the

implementation of the alternatives. Evaluation factors were established for each impact topic to assess the changes in resource conditions of the action.

In some instances, information may be absent due to exorbitant overall costs or the means of obtaining the information is not known. Where quantitative data were not available, best professional judgment was used to determine impacts. In general, the thresholds used within this report come from existing literature, consultation with subject experts, and appropriate agencies.

The Pearl River Basin, MS, Federal Flood Risk Management Project FS/EIS cumulative impacts assessment method is similar to that used on other federal projects of this type. It follows a traditional cumulative impact assessment method, addressing impacts for a finite set of criteria and comparing known projects within the Study Area for which there is publicly available information to the proposed project. Resource topics were identified to evaluate projects relevant to the future condition of the Study Area.

4.1.1 CUMULATIVE IMPACT ASSESSMENT METHODOLOGY

The steps in cumulative analysis set forth by the CEQ's Considering Cumulative Effects Under the National Environmental Policy Act, January 1997, include:

1. Identify the significant cumulative effects issues associated with the proposed action and define the assessment goals;
2. Establish the geographic scope for the analysis;
3. Establish the time frame for the analysis;
4. Identify other actions affecting the resources, ecosystems, and human communities of concern;
5. Characterize the resources, ecosystems, and human communities identified during scoping in terms of their response to change and capacity to withstand stresses;
6. Characterize the stresses affecting these resources, ecosystems, and human communities and their relation to regulatory thresholds;
7. Define a baseline condition for the resources, ecosystems, and human communities;
8. Identify the important cause and effect relationships between human activities and resources, ecosystems, and human communities;
9. Determine the magnitude and significance of cumulative effects;
10. Modify or add alternatives to avoid, minimize, or mitigate significant cumulative effects; and
11. Monitor the cumulative effects of the selected alternative and adapt management accordingly.

The goals of the assessment are to determine if the cumulative effects with respect to each resource issue result in a net benefit or net deficit with respect to the particular issue. In those cases in which deficits cannot be avoided, the goal is to minimize such deficits and to implement mitigation to compensate for such deficits. The geographic area for this assessment encompasses the Study Area, as described in Section 1 and depicted on Figure 1-1. The time frame for the analysis is fifty (50) years. The 50-year timeframe was chosen because this is the project duration over which impacts have been forecasted and analyzed. The critical question with respect to each resource is the realistic potential of the resource to sustain itself in the future and whether the proposed action will affect this potential.

Future plans can be excluded from cumulative impacts analysis if the action is outside the geographic boundaries or time frame established for the cumulative effects analysis; the action will not affect resources that are the subject of the cumulative effects analysis; and/or including the action would be arbitrary.

Initial research and scoping identified numerous preliminary past, present, and reasonably foreseeable projects and/or actions and historical sites within the Study Area for potential evaluation in the cumulative impacts assessment. Subsequent screening led to the removal of several of these projects, actions and/or sites. Removal resulted from the project not being reasonably foreseeable, insufficient information available to forecast impacts, and/or occurrence outside of the Study Area. Actions eliminated from further evaluation are presented below with justification for exclusion (i.e. not reasonably foreseeable, insufficient information or outside the Study Area).

Best professional judgment was relied upon for cumulative impact assessment to a greater extent than the impact analyses for the proposed project because information on other projects was based entirely on the limited information available in the public domain. A discussion of completed past, current, and future projects/actions within the Study Area and past sites in the Study Area follows.

4.2 WATER ENVIRONMENTS

4.2.1 HISTORICAL AND EXISTING CONDITIONS

Alternative A

***Direct and Indirect Impacts*:** The non-structural alternative entails the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. It proposes the buyout of approximately 3,100 structures, including homes, businesses, government and public buildings, schools, and hospitals. Relocation and other non-structural measures

(Alternative A) would not have significant impacts on the existing Pearl River conditions other than changes in hydrology due to future development.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative A plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Analyzing the relocation and other non-structural measures (Alternative A) with the past, current, and/or future projects and historical sites identified in the following section yields no adverse cumulative effects on existing conditions in the Pearl River. Hence, Alternative A will not result in adverse cumulative impacts with respect to historical low water and existing conditions.

Alternative B

***Direct and Indirect Impacts*:** This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. Structural measures such as levees and floodwalls (Alternative B) would not have significant direct impacts on the existing conditions of the Pearl River. Structural measures providing flood risk management will provide direct beneficial impacts to some structures. Alternative B may result in indirect impacts due to changes in hydrology because of future development. Also, Alternative B is expected to result in indirect short-term impacts to existing hydrology with respect to areas behind levees where an additional amount of water will pond. This ponded water will have the potential to back up into adjacent areas and be stored until the water elevation subsides as a result of levee gate opening, pumping, and/or evaporation.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative B plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Analyzing Alternative B (levees and floodwalls) with the past, current, and/or future projects and historical sites will not result in adverse cumulative effects to the existing Pearl River conditions. Any potential for ponding in sump areas behind the levees, is expected to have a local, short-term impact on existing conditions since levee gate opening, pumps and/or evaporation are expected to address any ponding issues.

Alternative C

Direct and Indirect Impacts: Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. Structural measures such as levees, channel excavation, and construction of an in-channel weir (Alternative C) would not have significant direct or indirect impacts on the existing conditions of the Pearl River. Alternative C includes a relocation of an expanded higher elevation weir with a low-flow gated structure at RM 284.3.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative C plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Analyzing Alternative C (levees, channel excavation, and construction of an in-channel weir) with the past, current, and/or future projects and historical sites will not result in adverse cumulative effects to existing conditions of the Pearl River.

4.3 COMPLETED, CURRENT, AND FUTURE PROJECTS/ACTIONS WITHIN THE STUDY AREA

4.3.1 COMPLETED PROJECTS WITHIN THE STUDY AREA

1. Jackson and East Jackson Levee projects consisted of 13.5 miles of levees, pumps, and channelization work. The two segments of levees were constructed between 1964 and 1968. The Jackson levee lies on the west bank of the Pearl River and is approximately 1.8 miles long. It protects approximately 800 acres (with the 0.2 mile extension constructed in 1984 on the north end) including the fairgrounds area, businesses and Interstate 55. The East Jackson Levee lies on the east bank of the Pearl River and is approximately 11.3 miles long. It protects approximately 5,870 acres in Pearl, Mississippi, and portions of Flowood and Richland, Mississippi.

2. MS Hwy 25 Bridge work performed in 1983 removed material from the west bank of the Pearl River to increase conveyance.

3. The Floodway Clearing Project was completed in 1984 by the PRBDD as local sponsor for the USACE. It included clearing of a portion of the Pearl River floodplain extending from approximately 0.5 miles below the Jackson sanitary landfill to the Woodrow Wilson Bridge, a total of 3.3 river miles. The project consisted of 237 acres of complete clearing, 20 acres of selective clearing, 89 acres of partial clearing, and placement of 39,000 tons of rip rap around bridges. The Floodway Clearing Project area continues to be maintained by spraying herbicide to control vegetation every 4 to 5 years.

4. The Ross Barnett Reservoir was constructed from 1962 to 1965 primarily for water supply and recreation. It occupies an area of 48.4 sq. mi. with a volume of 310,129 acre feet. The permit for the reservoir impoundment requires maintenance of minimum flow into the Pearl River: "no water shall be appropriated or impounded under the authority at any time when the discharge from the reservoir is less than 112 million gallons per day." This minimum discharge is equivalent to 170 cfs, which is twice the minimum low flow recorded prior to the construction of the reservoir. Because of permit requirements, the reservoir has actually resulted in increased minimum flow.

Implementation of the Ross Barnett Watershed Management Plan should result in improved water quality which will in turn result in higher quality water being discharged into the project reach. On the average, 96% of the water entering the project reach originates upstream of the Ross Barnett Reservoir. The reservoir also functions as a sedimentation basin for the downstream project reach.

5. Weirs on Pearl River

    a. Weir at waterworks in Jackson for drinking water supply

    b. While outside of the immediate project area, multiple weirs, shown in Figure 4-1, are situated in the lower Pearl including (1) south of Bogalusa to keep water in the canal, (2) Walkiah Bluff and (3) in Bogue Chitto Bayou which includes a weir in a canal with 3 locks.

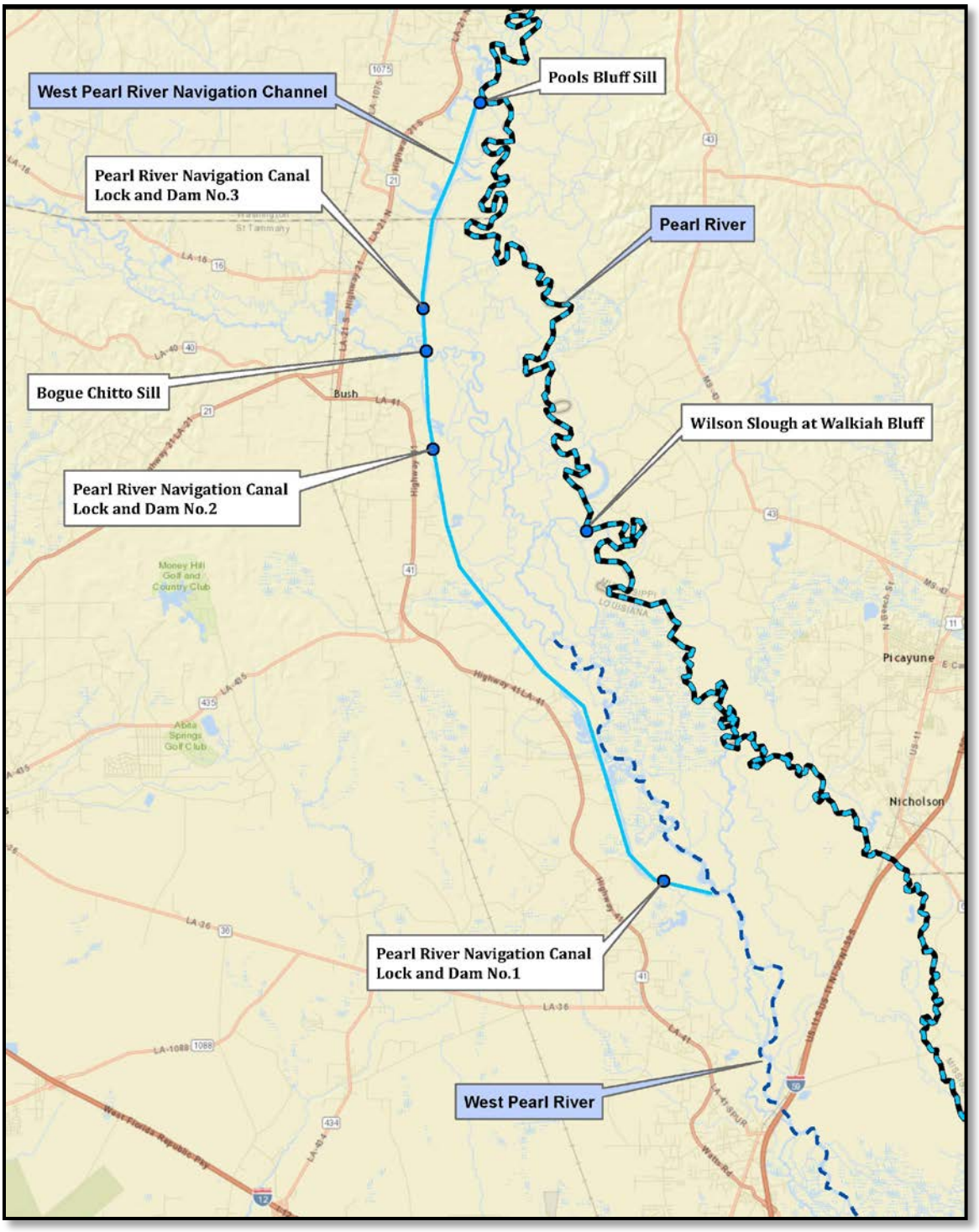

Figure 4-1, Weirs on the Lower Pearl River

4.3.2 CURRENT PROJECTS/ACTIONS WITHIN THE STUDY AREA

- **Savanna Street WWTP** discharges downstream of Jackson, at approximately RM 282 (permit number MS0024295). The discharge from this facility consists primarily of treated municipal wastewater generated from the city of Jackson and portions of Hinds, Madison and Rankin counties. The permit for this facility specifies limits for ammonia, total residual chlorine, fecal coliform, carbonaceous biochemical oxygen demand, dissolved oxygen (DO), total phosphorus, total nitrogen, pH, TSS, and toxicity in the effluent. The City of Jackson entered into a Consent Decree with EPA and MDEQ on November 20, 2012, to address frequent sanitary sewer overflows, accidental discharge of untreated wastewater at the Savanna Street WWTP and violations of the NPDES permits at the WWTP serving the city. The objective of the Consent Decree is that the City of Jackson will come into compliance with the Clean Water Act, the Mississippi Air and Water Pollution Control Law, and its NPDES permits. The Consent Decree required submission of a comprehensive performance evaluation (CPE) of the Savanna WWTP by April 2014. Thereafter, the Consent Decree requires submission of a composite correction program (CCP) within 12 months after EPA approval of the CPE (approximately July 2015). Certain repairs are required to be completed within 24 months after EPA approval of the CCP (approximately October 2017), and other repairs are required to be completed within 60 months of EPA approval of the CCP (approximately October 2020). In addition, the Consent Decree requires development and implementation of programs to insure proper capacity, management, and operation and maintenance of the sewer system.

  Since the discharge from the Savanna Street WWTP enters the Pearl River downstream of the location of the project proposed in Alternative C, it will not influence the water quality of the proposed impoundment. Note however that the current permit limits for the Savanna Street WWTP are based on a critical low flow of 290 cfs. If Alternative C is implemented, it will be necessary to maintain a minimum flow of 290 cfs through the relocated weir to provide adequate dilution to support the NPDES permit for the Savanna Street WWTP.

  Although the Savanna Street WWTP will not influence the water quality of any alternative, a portion of the collection system which serves the Savanna WWTP has the potential to impact the alternative plans. Specifically, the West Bank Interceptor (WBI) transports sewage from Jackson and South Madison County to the Savanna WWTP, following along the Pearl River from the point at which the Pearl River, the northern Hinds County line, and the southern Madison County line meet and travelling along the Pearl River to the Savanna WWTP. Currently, the WBI is under a Consent Decree which required an evaluation to detect problems and the development of a work plan to repair such problems by June 2013. The Consent Decree also requires a complete evaluation and

report be submitted by July 2015. In addition, the Consent Decree requires that cleaning, debris removal, and total rehabilitation of a minimum of 20% of WBI pipe be completed within 72 months after EPA approval of the WBI Rehabilitation Plan (approximately October 2020). Final repairs, including pipe lining, are to be completed within 174 months after EPA approval of the WBI Rehabilitation Plan (approximately January 2030).

- **Trahon/Big Creek WWTP** (permit number MS0044059) is listed on the permit as "Jackson POTW, Trahon and Big Creek" is an oxidation ditch design plant with a 4.5 mgd capacity. The average daily flows are reportedly 2.1 mgd.

  The Trahon/Big Creek WWTP is located within the Study Area, downstream of the project footprint and downstream of the Savanna Street WWTP. Like the Savanna Street WWTP, discharge from this plant enters the Pearl River downstream of the project proposed in Alternative C and will not influence the water quality of the pool created by the relocated weir. Furthermore, as a part of the City of Jackson's wastewater collection and transmission system, the Trahon/Big Creek WWTP is subject to compliance with the 2012 Consent Decree.

- **O.B. Curtis Water Treatment Plant** (permit number MS0046906) discharges within the Study Area into the Pearl River just upstream of the project footprint proposed in Alternative C. The discharge from this facility consists primarily of filter backwash. Historical flows from this facility have reached 7.5 mgd, while recent flows have been around 1.5 mgd. The permit for this facility includes limits for pH and total suspended solids (TSS), and requires measurement and reporting of ammonia nitrogen, total residual chlorine, flow, biochemical oxygen demand (BOD), and total dissolved solids (TDS). No violations of NPDES limits have been reported for this facility over the period for which DMR data are available from EPA, December 2005 through May 2014 (EPA ICIS accessed August 2014). The minimum reported pH of 5.59 is less than the permit limits of 6 to 9 and total residual chlorine concentrations are high. It may be necessary to modify the permit for this discharge if Alternative C is implemented.

- **The Entergy Rex Brown Plant** discharges into Eubanks Creek include cooling tower blowdown from Unit 1 and cooling lake system discharge, low volume wastewater, and boiler blowdown from Unit 3. The plant discharges stormwater runoff and cooling lake system discharge, low volume wastewater, and boiler blowdown from Units 1 and 4 into Town Creek. Eubanks Creek and Town Creek are in Jackson and are tributaries of the Pearl River. These tributaries join the Pearl River within the area of the impoundment proposed in Alternative C. The discharges from this facility consist of cooling water, storm water runoff, and low volume wastewater. The permit for this facility specifies limits for

oil and grease, pH, TSS, temperature, total residual chlorine, chromium, and zinc. This permit expired in July 2013. No permit violations have been reported for this facility.

- **Nonpoint source discharges** occur from the approximate 3,202 sq. mi. of area of the watershed which contributes to the Pearl River at RM 280. Approximately 95% of this watershed drains into the Ross Barnett Reservoir. Over 60% of the watershed is comprised of forest and wetlands. Downstream of the Ross Barnett Reservoir, a significant area of the watershed is developed/urban land associated with the Jackson metropolitan area. Runoff from urban areas can carry pollutants such as nutrients, sediment, and oil and grease to receiving waterbodies.
- **City of Jackson MS4 NPDES Permit** manages the water quality of storm water runoff from the city of Jackson. Stormwater runoff from the Jackson drains into waterbodies within the Study Area and would discharge to the impoundment proposed in Alternative C. Jackson's MS4 Permit requires Best Management Practices to insure the quality of storm water discharged from the Municipal Separate Storm Sewer System into State waters.

4.3.3 FUTURE PROJECTS/ACTIONS WITHIN THE STUDY AREA

- **Airport Parkway** proposes a new high speed toll link between downtown Jackson and the airport, including a major bridge over the Pearl River.
- **West Rankin Utility Authority WWTP** was issued a wastewater discharge permit on April 14, 2015, to construct a new wastewater treatment facility with a proposed discharge downstream of the impoundment proposed in Alternative C.
- **The West Rankin Parkway** is a proposed project to construct a new 3.5 mile right-of-way as a north-south corridor between Pearl and Flowood. Project construction is within the levee-protected area, and discharge is routed to enter the Pearl River below the project area.

4.3.4 HISTORICAL SITES WITHIN THE PROJECT STUDY AREA

- Unpermitted landfills along the Pearl River include:

    a. **Unpermitted Lefleur's Landing Site (Jefferson Street Landfill)** consists of a tract of land of approximately forty-five (45) acres owned by the City of Jackson. It is located between the Pearl River and Jefferson and Pascagoula Streets and is depicted by "5a" on Figure 4-2. Historical data indicates that the City of Jackson operated facilities on this site dating back to the early 1900s. Former activities included vehicle storage and maintenance operations, vehicle fueling utilizing underground storage tanks, incinerator, painting operations, animal control and shelter, administrative and police functions, and landfilling operations. Some

remediation has occurred at the site; however, some residual contamination may remain. In addition, the landfill activities at the site did not include any formal engineering controls to prevent storm water and groundwater from interacting with debris and leachate or to prevent the offsite migration of leachate and compounds of concern. Erosion during high water periods in the Pearl River have resulted in exposure of the waste materials and rubbish materials which may be washed into the river during the high water conditions. In conclusion, this site is a source of waste residuals and chemicals entering the Pearl River.

b. **Gallatin Street Landfill Site** was an unpermitted municipal sanitary landfill. It is located approximately 1,000 feet east of the corner of Gallatin Street and East McDowell Road on a point bar on the west side of the Pearl River in Jackson, Hinds County, Mississippi from RM 285 to 286 and is depicted by "5b" on Figure 4-2. The total area of the landfill site is approximately 117 acres, approximately 62 acres of which were utilized for landfill purposes. The landfill was active from approximately 1963 to 1980 and was operated as a municipal landfill by the City of Jackson. The site was operated with no original engineering controls, such as a leachate collection system, cap or liner, to prevent leachate from migrating offsite and interacting with groundwater. Note that a clay cap was retroactively installed to minimize human exposure pathways. The State of Mississippi did not require the city to maintain any type of permit for the facility, nor were there any restrictions on the type or quantity of wastes accepted. Known wastes deposited at the landfill include: household garbage, general industry waste, construction debris and waste, hospital waste, municipal water and sewage sludges, raw sewage from septic tankers, dead animals and contaminated produce, poultry, dairy products and meats. Groundwater samples collected from borings placed within the landfill found leachate with concentrations of cadmium, lead and nickel which were above regulatory standards. A visual inspection on July 8, 2014, observed debris protruding from the bank of the Pearl River. Due to the landfill's location on a cut-bank with a history of erosion issues and the presence of major utilities, the site is a potential threat for release of leachate and debris to the Pearl River. One water sample for leachate characterization was collected and cadmium, lead and nickel were detected in concentrations above the maximum contaminant levels (MCLs) under the Safe Drinking Water Act.

- **The former Gulf States Creosoting Company Site** consists of approximately 114 acres and is located at 1625 Flowood Drive (Mississippi Highway 468) in Flowood, Rankin County, Mississippi. The property extends from the swampland and oxbow lakes along the Pearl River at RM 290 to RM 292. The property was owned by Gulf States Creosoting Company

as early as 1929 and operated as a wood treating facility until the mid-1950s. Soil impacts from organic and inorganic hazardous substances were found to be present at the site. Examples of the hazardous substances found on site and attributable to the former onsite operations include metals (barium, cobalt, manganese and zinc) and creosote residuals such as a variety of semi-volatile polynuclear aromatic hydrocarbons (PAHs). Sediment samples collected from the oxbow slough located west of the former Gulf States Creosoting Company property exhibited elevated levels of constituents used in the wood preserving industry. Creosote was observed on the surface of the waters in the adjacent swamp named "Creosote Slough" and creosote residuals occurring in the sediment were found to cover a broad area.

- **The former Sonford Products Lumber Mill** is located at 3506 Payne Drive in Flowood, Rankin County, Mississippi, and is approximately half a mile east of the proposed project area. The site operated as a lumber mill and wood treatment facility from 1972 to 1985. Compounds of concern identified at this site include pentachlorophenol (PCP), mercury, lindane, and phenylmercuric acetate. The site was placed on EPA's National Priorities List (NPL) in 2007. In September 2009, *Record of Decision: Summary of Remedial Alternative Selection report* was prepared by Region IV of the EPA and the remedy selected included an in-situ treatment of contaminated media (both soils and groundwater) using chemical oxidation and enhanced subsurface biodegradation. Due to the distance from the proposed project boundary, remedial efforts completed to date, and future remediation efforts planned, the former Sonford Products site is not believed to pose a significant threat of impact to the proposed project alternatives.

- **The former Rival Manufacturing site** is located approximately 1500 feet east of the proposed project area on the west side of Highway 49 in Flowood, Rankin County, Mississippi. The Rival facility manufactured crockpots and was found to have contributed lead and polynuclear aromatic hydrocarbons to the surrounding soils and surface waters. The Phase I Environmental Site Assessment report prepared by BCM Engineers in 1993 reported that the impact was restricted to soil and surface water and no evidence of impact to groundwater was identified. Soils and sediments from an onsite pond were excavated and entombed in a soil mound containment structure constructed on the site and the pond was closed. Due to EPA's successful remedial efforts and the facility's distance from the proposed project area, impact from the former Rival Manufacturing Companies facility is considered unlikely.

- **Three automotive salvage yard sites** were identified in proximity to the project area: one site is inside the project area and the other two are not. Historically, automotive salvage yards in general have been known to contribute hydrocarbons, metals, solvents, and

other COCs to the environment. However, no specific studies or information regarding environmental conditions at these automotive salvage years are readily available. For this reason, the one automotive salvage yard inside the project area will be investigated, and if necessary, remediation of the site will be consistent with all applicable federal and state laws and regulations.

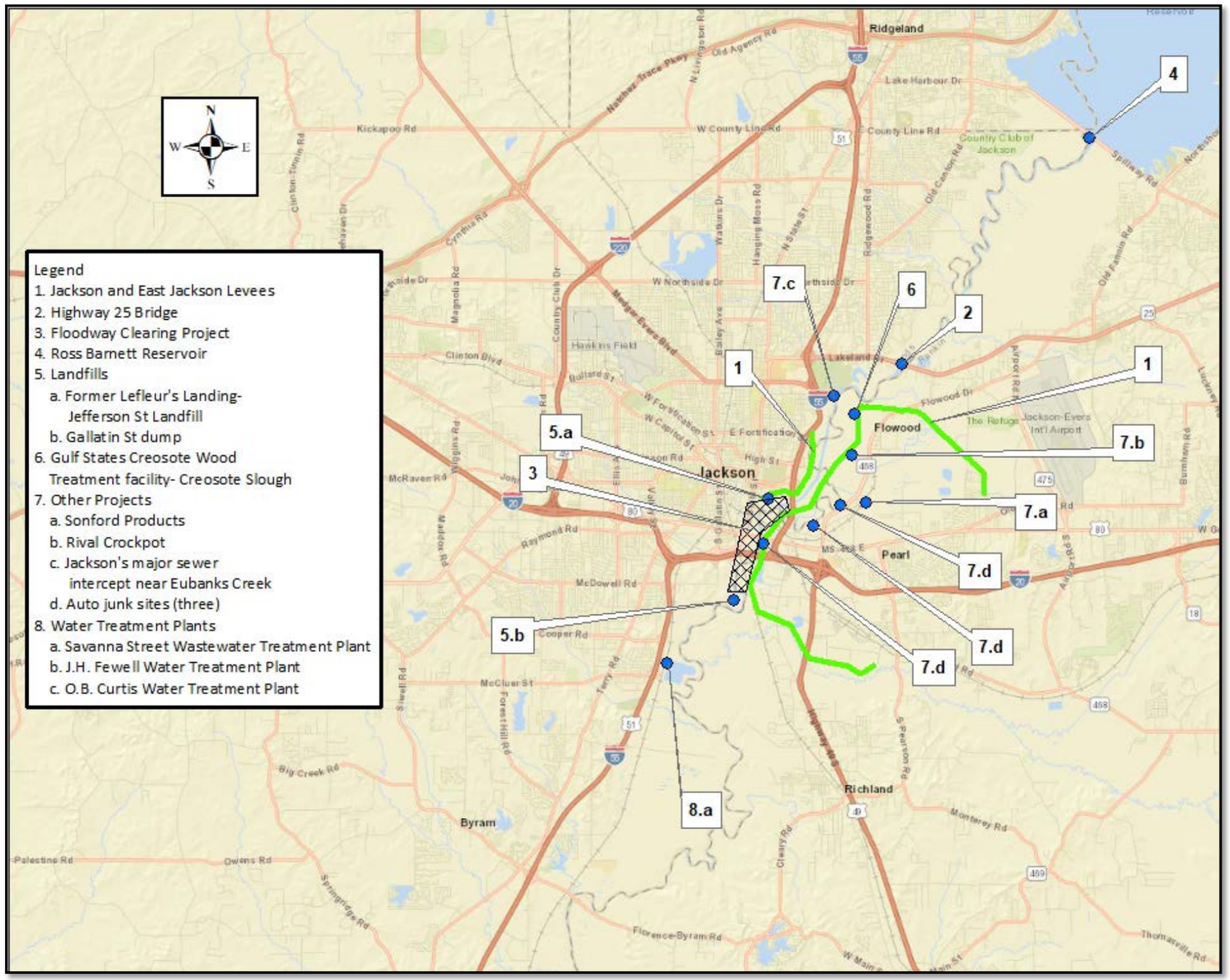

Figure 4-2, Site Locations of Completed, Current, and Future Projects and Actions

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4.4 HUMAN ENVIRONMENT

This section sets forth the scientific and analytic basis for the comparison of the alternatives considered in this FS/EIS. The discussion includes the environmental impacts of the alternatives including the proposed action on each human environment resource issue.

4.4.1 POPULATION AND HOUSING

Alternative A (Non-Structural)

***Direct and Indirect Impacts*:** The non-structural alternative involves the elevation or buyout and/or relocation of existing, potentially affected structures within the Study Area. It is the most disruptive of the three alternatives to this resource because the non-structural alternative proposes the buyout of approximately 3,100 structures, including homes and businesses. The cost of structure removal is estimated to be over $2 billion. Affected structures behind the levees are not included in this buyout. The loss to the existing and future human environment is dramatic. An evacuation of this magnitude would considerably affect every sector of the real estate market, in addition to shifting the population and existing tax base.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative A plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Cumulative impacts would be major and long-term, with the evacuation of the existing floodplain areas complicating the relocation of the population and its associated housing needs. The housing and commercial tax base would decline dramatically within the Project Area.

Alternative B

***Direct and Indirect Impacts*:** This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. The Alternative B levee plan would provide some beneficial impacts to the human environment. These positive impacts would be realized by virtue of protecting existing businesses and neighborhoods from future disruption and destruction of a major flooding event. However, some areas will have direct adverse impacts due to the potential for impounding drainage in the sump areas.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative B plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Long term impacts to the human environment would be beneficial in most areas, with protecting existing homes and businesses. It is not expected that additional benefits from new housing and population would be expected.

Alternative C

***Direct and Indirect Impacts*:** Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. It provides the benefits of Alternative B with added enhancements to the overall business, employment, and industrial activity. These benefits will be realized after the development of the associated body of water resulting from channel improvement and weir construction.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative C plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. The channel improvements will provide significant flood risk management and will allow for riverfront access and development, along with recreational opportunities. The new activities made possible by this amenity will stimulate community development, population, and housing for the project life and beyond.

SUMMARY OF POPULATION AND HOUSING IMPACTS

Alternative A (Non Structural):

- Most disruptive alternative
- Shift in population and existing tax base

Alternative B:

- Protects existing businesses and neighborhoods
- Potential for impounding drainage in sumps for some areas

Alternative C:

- Provides same benefits as Alternative B with additional benefits to overall business activity
- Channel improvements provide significant flood risk management
- Allows for riverfront access and development, along with recreational opportunities
- Stimulates community development and increases population and housing

4.4.2 EMPLOYMENT, BUSINESS, AND INDUSTRIAL ACTIVITY

Alternative A (Non-Structural)

***Direct and Indirect Impacts*:** This alternative would include the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. It proposes the buyout of approximately 3,100 structures, including homes, businesses, government and public buildings, schools, and hospitals. This plan does not include a buyout of structures behind the levees. The removal of residents and businesses will eliminate business activity and shift

employment patterns. Unless business activity and population is retained within the ROI, there will be an overall loss of vitality and an accompanying loss of tax base, property value, and tax revenues.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative A plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Cumulative impacts will be a dramatic reduction in employment, business, and industrial activity. This will include a steady, continuous decline, only at an accelerated pace.

Alternative B

***Direct and Indirect Impacts*:** This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. This alternative will have minimal beneficial direct and indirect impacts on the community's ability to further develop its business and industrial activities. Some areas will have moderate adverse direct and indirect impacts on these resources due to possible impoundment drainage in sump areas.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of Alternative B plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Although existing infrastructure will be protected, an incremental increase in employment, businesses activity, and industrial activity is expected to be minimal.

Alternative C

***Direct and Indirect Impacts*:** Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. This plan provides flood risk management, while the associated body of water, a product of the channel improvement and weir construction, provides an additional benefit for business, employment, and industrial activities. The channel improvements will allow for riverfront access and development, along with recreational opportunities. The new activities made possible by the water amenity will stimulate community development to a greater degree than Alternative B, which provides no added amenity.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative C plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Beneficial, long-term, cumulative impacts will continue with respect to employment, business activities, and industry activities over the life of the project for not only the local project area, but for the region.

SUMMARY OF EMPLOMENT, BUSINESS, AND INDUSTRIAL ACTIVITY IMPACTS

Alternative A (Non Structural):

- Eliminates business activity and shifts employment patterns
- Unless business activity and population is retained within the ROI, there will be an overall loss of vitality and an accompanying loss of tax base

Alternative B:

- Has minimal beneficial impacts on the community's ability to further develop its business and industrial activities
- In some areas, has moderate adverse impacts on resources due to impoundment drainage in sump areas
- Minimal incremental increases in employment, business activities, and industrial activities are expected

Alternative C:

- New activities made possible by water amenity will stimulate community development to a greater degree than Alternative B
- Impacts will be beneficial over the life of the project for not only the local project area, but also the entire region

4.4.3 PUBLIC FACILITIES AND SERVICES

Alternative A

***Direct and Indirect Impacts*:** This alternative would entail the elevation or buyout and/or relocation of 3,100 existing, potentially affected structures within the Study Area. The proposed buyout includes homes, businesses, government and public buildings, schools, and hospitals. This alternative would have major, long-term, adverse direct and indirect impacts on public facilities and services. Although residences would be removed, infrastructure would still remain in place and susceptible to damage. It is not expected that all infrastructures could be removed and therefore, would remain subject to disruptions during flood events. Since none of the structures behind existing levees would be relocated under this alternative, those structures would not receive any additional flood risk management and facilities such as the Savanna Street WWTP would remain vulnerable to flooding.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative A plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Some public facilities would have to be

relocated, providing less services for the project area for the project life. The overall impact of this alternative would be major adverse cumulative impacts to public facilities and services.

Alternative B

***Direct and Indirect Impacts*:** This alternative includes the construction of additional levee segments and the associated additional floodway clearing along the Pearl River channel. Alternative B would have long-term moderate positive direct and indirect impacts for public facilities and services by providing flood risk management. However, levees restrict the area over which flood waters can disperse and result in higher water elevations during flood events, which will require additional sumps and pumps. These rising elevations within the levees will cause adverse impacts on utilities on the riverside of the levees, such as the wastewater interceptor which could potentially experience more frequent overflows into the system.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative B plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. This alternative would provide some long-term, beneficial impacts for public utilities and services. However, continued wastewater overflows during flood events would continue to adversely impact water quality and degrade the Pearl River system.

Alternative C

***Direct and Indirect Impacts*:** Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. This alternative would have beneficial impacts for public facilities with services provided with additional flood risk management. Public facilities, such as the WWTP, will also receive benefits. In addition, lowering the Pearl River flood stages throughout the area will provide further improvements to infrastructure impacted by flood events, including the interceptor that traverses along the river.

This alternative also provides public services to the community. With improved access to the riverfront, the opportunity for increased recreational use of the waterway emerges. Also, the development of public recreational facilities and walking trails will increase nonconsumptive utilization of the area's available resources.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative C plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Long term improvement to public services would be expected due to enhancement of measures that reduce flood risk.

SUMMARY OF IMPACTS TO PUBLIC FACILITIES AND SERVICES

Alternative A (Non Structural):

- Infrastructure would still be susceptible to damage and disruption during flood events
- Facilities, such as the Savanna Street WWTP, located behind existing levees would receive no additional flood risk management
- Some public facilities would have to be relocated, providing less services

Alternative B:

- Provides flood risk management for public facilities and services
- Higher water elevations during flood events will require additional sumps and pumps
- Water quality degradation of the Pearl River System caused by wastewater overflows during flood events will continue

Alternative C:

- Provides flood risk management for public facilities and services
- Lowers flood stages for the Pearl River and provides improvements to infrastructure impacted by flood events

4.4.4 COMMUNITY AND REGIONAL GROWTH

Alternative A (Non-Structural)

***Direct and Indirect Impacts*:** This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. It proposes the buyout of approximately 3,100 structures including homes, businesses, government and public buildings, schools, and hospitals. The removal of residents and businesses will eliminate business, thus eliminating community and regional growth resulting in major long-term adverse direct and indirect impacts to these resources.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative A plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. With the removal of residents and businesses, the community within the project area will experience substantial negative growth over the project life.

Alternative B

***Direct and Indirect Impacts*:** This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. Minor, long-term, beneficial impacts in community development would occur with this

alternative. Community and regional growth would be minimal, as protection would only be provided to areas already developed. This alternative will cause some areas to experience moderate adverse direct and indirect impacts due to potential for impounding drainage in sump areas.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative B plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Only existing residents and businesses will be protected with minimal opportunity for new areas of growth. Therefore, only minimal additional growth would be expected for the project area.

Alternative C

***Direct and Indirect Impacts*:** Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. These new activities made possible by the waterbody functioning as a flood risk management measure and as an amenity will serve to stimulate community development to a greater extent than Alternative B, which provides no added amenity. This will result in major, long-term, direct and indirect, beneficial impacts to the community and regional growth.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative C plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Growth opportunities for new, improved lands through flood risk management and the waterbody amenity would provide numerous growth opportunities for the community.

SUMMARY OF IMPACTS TO COMMUNITY AND REGIONAL GROWTH

Alternative A (Non Structural):

- Removes residents and eliminates business, thus eliminating community and regional growth

Alternative B:

- Causes some areas to experience adverse impacts due to potential for impounding drainage in sump areas
- Only existing residents and business will be protected, leaving minimal opportunity for new areas of growth

Alternative C:

- New possible amenities will stimulate community development to a greater extent than Alternative B
- Opportunities for growth through new lands and the waterbody amenity provide numerous community growth opportunities

4.4.5 TAX REVENUES AND PROPERTY VALUES

Alternative A (Non-Structural)

***Direct and Indirect Impacts*:** This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. It proposes the buyout of approximately 3,100 structures including homes, businesses, government and public buildings, schools, and hospitals. This plan does not include the buyout of structures behind the existing levees. Unless businesses and the population needed to support them are retained within the ROI, there will be major, long-term, adverse direct and indirect impacts resulting in overall loss of vitality and an accompanying loss of tax base, property value, and tax revenues.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative A plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Long-term tax revenues will continue to decline as properties are removed from the tax roll. In addition, the sales of businesses located in areas from which residents would be displaced would likely be negatively impacted, resulting in future negative impacts to the sales tax base.

Alternative B

***Direct and Indirect Impacts*:** This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. This alternative will provide flood risk management for existing businesses and neighborhoods. However, some areas will have moderate, adverse long-term, direct and indirect, impacts due to possible impounding drainage in sump areas during flood events. This alternative will have minor, beneficial impacts on the future ability of the community to further develop its business and neighborhood activities, with minor, beneficial impacts on tax revenues and property values.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative B plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. With the current decline in values in the project area, tax revenues with this alternative would be expected to remain flat at best. In the long-term, property values would be expected to continue to decline in value, but at a slower pace than without this alternative, thus reducing the tax base for the project area.

Alternative C

***Direct and Indirect Impacts*:** Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. The enhanced flood protection and newly expanded riverfront within the confines of the existing levee structure will allow for riverfront access and development, along with recreational opportunities. The newly expanded

riverfront within the confines of the existing levee structure will allow for riverfront access and development, along with recreational opportunities. These new activities made possible by the water amenity will serve to stimulate community development to a greater degree than Alternative B, resulting in long-term, beneficial, direct and indirect impacts on these resources. Increases in development along the riverfront and increases in real estate values due to the flood risk management will increase the tax base, and therefore tax revenue, within the Study Area.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative C plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Property values for the project life are expected to increase in the areas of the riverfront amenity. This alternative should result in increases in long-term tax revenue and property values due to enhanced flood risk management plus new development and growth in the Study Area.

SUMMARY OF IMPACTS TO TAX REVENUES AND PROPERTY VALUES

Alternative A (Non Structural):

- Could result in an overall loss of tax base, property value, and tax revenues
- Long-term tax revenues will decline as properties are removed from the tax roll
- Business sales located in areas with displaced residents will be negatively impacted, which will negatively impact the sales tax base

Alternative B:

- Has minor, beneficial impacts on the future ability of the community to further develop its business and neighborhood activities, with minor, beneficial impacts on tax revenues and property values
- Tax revenues are expected to remain flat at best
- Property values are expected to decline at a slower pace, thus reducing the tax base in the project areas

Alternative C:

- Increases in riverfront development and increases in real estate values will increase the tax base and tax revenue in the Study Area
- Property values along the riverfront amenity are expected to increase
- Enhanced flood risk management and new development in the area should result in increases in long-term tax revenues and property values

4.4.6 COMMUNITY COHESION

Alternative A (Non-Structural)

***Direct and Indirect Impacts*:** This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. It proposes the buyout of approximately 3,100 structures including homes, businesses, government and public buildings, schools, and hospitals. Structures behind the existing levees would not be included in the buyout. This alternative would result in major, long-term adverse direct and indirect impacts on community cohesion. The ultimate effect of Alternative A would be to eliminate the existing effected community.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative A plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. The removal of this number of residences and businesses would have major, long-term, adverse impacts on the individual areas and overall community.

Alternative B

***Direct and Indirect Impacts*:** This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. This alternative affords flood risk management to existing structures, but also produces moderate long-term adverse direct and indirect impacts to this resource due to the potential for impounding drainage during flood events. This alternative would result in minor, long-term, beneficial impacts to tax revenues and property values, which can strengthen community stability and community cohesion.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative B plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Due to the beneficial impacts from enhanced flood risk management, community cohesion is expected to be stable over the life of the project.

Alternative C

***Direct and Indirect Impacts*:** Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. The new activities made possible by the water amenity will result in long-term, beneficial, direct and indirect impacts expected to stimulate community development and improve community cohesion for the area.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative C plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. With the enhanced flood risk management and water amenity, this alternative would be expected to enrich community cohesion with the opportunities for growth, employment, and new businesses.

SUMMARY OF IMPACTS ON COMMUNITY COHESION

Alternative A (Non Structural):

The ultimate effect of Alternative A would be to eliminate the existing effected community

Alternative B:

- Beneficial impacts to tax revenues and property values can strengthen community stability and cohesion
- Benefits from enhanced flood risk management will create stabilized community cohesion over the life of the project

Alternative C:

- Beneficial impacts to tax revenues and property values can strengthen community stability and cohesion
- Benefits from enhanced flood risk management will create stabilized community cohesion over the life of the project
- New recreational activities are expected to stimulate community development and improve community cohesion
- Opportunities for growth, employment, and new businesses will enrich community cohesion

4.4.7 TRANSPORTATION

Alternative A (Non-Structural)

***Direct and Indirect Impacts*:** This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. It proposes the buyout of approximately 3,100 structures including homes, businesses, government and public buildings, schools, and hospitals. This plan does not include a buyout of structures behind the levees. This alternative would remove many structures from areas at high risk for flooding, and some of the streets still impacted by flood events would no longer be needed. However, interstates, state routes, and other local roads with high average daily traffic would still be inundated during storm events resulting in major congestion. The expected annual damages to roads and bridges were estimated to be over $800,000 for existing conditions. Major

transportation routes, including rail, air, and automotive corridors, would not receive any flood risk management with this alternative.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative A, plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Increases in traffic will make impacts to traffic and rerouting during floods only greater during the project life.

Alternative B

***Direct and Indirect Impacts*:** This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. This alternative provides benefits to most major transportation routes. However, flood risk still exists as the development of more levees within the Project Area may result in possible inundation in low lying areas behind the levees during flood events. In addition, railway transportation routes that cross the Pearl River would still be subject to flooding due to the elevation of water levels within the levee reaches. The expected annual damages to roads and bridges were estimated to be over $800,000 for existing conditions, and Alternative B is projected to provide over $400,000 in flood risk management benefits to transportation routes.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative B, plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Some transportation routes would be improved; however, in other areas, cumulative improvement will be minimal at best.

Alternative C

***Direct and Indirect Impacts*:** Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. As this construction will not impact roads, temporary impacts to transportation are not anticipated. This alternative improves impacts to most transportation routes, including all major transportation routes, by reducing risk to levee segments by reducing flood elevations. This is the only alternative that improves existing impacts to the rail corridors that cross the Study Area. The beneficial impact is a result of reducing flood elevations in the vicinity. The expected annual damages to roads and bridges were estimated to be over $800,000 for existing conditions, and Alternative C is projected to provide over $700,000 in flood risk management benefits to transportation routes.

***Cumulative Impacts*:** Overall transportation routes would receive the most flood risk management with this alternative, including rail transportation. With protected transportation infrastructure, traffic routes during flood events will remain operational over the life of the project.

SUMMARY OF IMPACTS ON TRANSPORTATION

Alternative A (Non Structural):

- Removal of structures from areas of high risk would cause some of the streets still impacted, to no longer be needed
- Roads with high average daily traffic would still be inundated during flood events
- Increases in traffic will make rerouting during flood events more challenging

Alternative B:

- Flood risk still exists as development of new levees may result in additional inundation
- Railway routes crossing the Pearl River would still be subject to flooding

Alternative C:

- Reduces risk to levee segments by reducing flood elevations
- Improves impacts to most transportation routes, including rail corridors
- Traffic routes would remain operational during flood events

4.4.8 ENVIRONMENTAL JUSTICE

"Environmental justice" is the fair treatment and meaningful involvement of all people – regardless of race, color, national origin, culture, education, or income – in the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no racial, ethnic, or socioeconomic group should bear a disproportionate share of adverse effects as a result of the execution of federal, state, local, and tribal environmental programs and policies (FEMA 2007). Environmental justice concerns are also applicable to federal plans, functions, programs and resources. 42 U.S.C. §4331(b). Meaningful involvement is realized by recognizing and including several factors:

- Potentially affected community residents have an appropriate opportunity to participate in decisions about a proposed activity that affects their environment or health;
- The public's contribution can influence the regulatory agency's decision;
- The concerns of all participants are considered in decision-making process;
- Decision makers seek out and facilitate the involvement of those potentially affected.

Executive Order 12898, "*Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*" February 1994, requires each federal agency to consider environmental justice issues in its programs, policies and actions. Each agency is required to address disproportionate adverse effects of its activities on race, color, national origin, culture, education, and/or income, including minority and low-income populations--which are the only categories identified in this project area. Hence, in compliance with this Executive Order, the

Flood Control District evaluated the potential effects of the alternatives on any minority and/or low-income populations in the project area.

Alternative A

This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. The project area impacted by this alternative includes residential areas, commercial areas, industrial areas, schools, and hospitals, and the population is comprised of all races (minority and non-minority) and all income levels (low, middle, and high). This alternative involves relocating structures by buying the land upon which the structures are located, with the exception of structures located behind existing levees. The total number of structures to be relocated in this alternative would be in excess of 3,100. The structures subject to buy-out are determined by mapping the area over which the river naturally flows at specific flood stages. It includes the buy-out of *all structures* in the areas over which floodwaters flow, irrespective of race or income level, except for those structures behind existing levees.

Many structures in multiple areas that impact quality of life and community cohesion are affected with this alternative. In addition, major transportation routes, airports, and rail lines would remain at risk during flooding events, which would result in adverse impacts with respect to those services. Further, flood risk would not be reduced for existing structures currently protected by the existing levees, and no flood risk management improvement would be realized at the $300 million WWTP that serves the area.

Since buyouts are proposed for all structures located in areas over which floodwaters naturally flow at specific flood stages, except for structures located behind existing levees, similar impacts occur to all affected areas, regardless of race or income level. Furthermore, of the approximately 3,100 structures proposed for buy-out, only 295 are located in areas with environmental justice concerns. Hence, this alternative would not have a disproportionate effect on minority or low-income populations. Environmental justice effects would be less than significant, but as noted above, impacts would be experienced in areas bought out.

Alternative B

This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. The project area impacted by this alternative includes residential areas, commercial areas, industrial areas, schools, and hospitals, which serve populations of all races (minority and non-minority) and all income levels (low, middle, and high). Additional levees would improve flood risk management in unprotected areas and improve risk management in areas already protected. Although flood risk management is improved, there is still a risk of overtopping or failure in levee sections during extreme events. This alternative would require the relocation /condemnation of thirty properties.

Since new levees are proposed for construction in areas most impacted by flooding regardless of race or income levels, this alternative would not have a disproportionate effect on minority or low-income populations. Therefore, environmental justice effects would be less than significant, but as noted above, impacts would occur due to construction of new levees.

Alternative C

Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. The project area impacted by this alternative includes residential areas, commercial areas, schools, and hospitals, and the population is comprised of all races (minority and non-minority) and income levels (low, middle, and high). This alternative would consist of excavating the overbanks of the channel in the areas which most often experience flooding. In addition, levees in some areas would be relocated to further reduce flood levels.

Flood risk management projects typically include some relocation to provide the most benefit. This alternative does not propose condemnation of any residential areas including minority and/or low income areas. However, it would propose voluntary buy-outs in areas most prone to flooding. Regardless of the potential option of voluntary buy-outs, all communities within the project area will receive some level of flood risk management benefit.

Several areas expected to continue to experience flooding during events similar to the 1979 Flood Event and during an annual 1% chance exceedance flood event are specifically addressed in Appendix E. These areas will experience significant reductions in flooding during flood events of lesser magnitude than an annual 1% chance exceedance flood event. In conclusion, Alternative C does not have a disproportionate effect on minority or low-income populations. Therefore, environmental justice effects would be less than significant.

Direct impacts such as air, noise, and other health risks were analyzed. Due to setback of residential areas from the proposed project construction areas, health risks associated with air quality, noise, or other health risks would not impact the areas as described within the project area.

Implementation of the project would not adversely impact public transportation or transportation routes during construction due to location of construction activities as shown in Figure 5 of Appendix E. Construction will be located along the river and access to the river will not impact major transportation routes, public utilities, or public services.

SUMMARY OF IMPACTS ON ENVIRONMENTAL JUSTICE

Alternative A (Non Structural):

- Structures that impact quality of life and community cohesion would be affected
- Major transportation routes would remain at risk
- No risk management would be realized at the Savanna Street WWTP that serves the area

Alternative B:

- Continuing risk of overtopping or failure in levee sections during extreme events
- Requires the relocation/condemnation of thirty properties
- Would have no disproportionate effect on minority or low-income populations

Alternative C:

- Proposes no condemnation of any areas, including minority and/or low income areas
- Proposes voluntary buyout in areas most prone to flooding
- All communities will receive some level of flood risk management
- Health risks associated with air quality, noise, etc. would have no impact due to setback of residential areas from the proposed project construction areas
- No adverse impacts to public transportation
- Would have no disproportionate effect on minority or low-income populations

4.5 NATURAL ENVIRONMENT

The next part of this section sets forth the scientific and analytic basis for the comparison of the alternatives considered in this FS/EIS. The discussion includes the environmental impacts of the alternatives, including the proposed action, on each natural environment resource issue.

4.5.1 SOILS, WATER BODIES, AND PRIME AND UNIQUE LANDS

Alternative A

***Direct Impacts and Indirect Impacts*:** This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. Given this, any potential for impacts to soils would be temporary in nature and would occur only during the period of construction during the elevation activities, demolition, and/or relocation activities. The direct and indirect impacts would be considered as short-term and moderate adverse impacts. These potential impacts could be further minimized through the utilization of appropriate stormwater best-management practices during any construction, demolition, and/or relocation activities. In addition, impacts to any water bodies within the Study Area as a result

of the implementation of this alternative would not be anticipated. Given the fact the project is located within an urban area, there are no Prime and Unique Lands located within the Project Area, so there would be no anticipated impacts to these resources.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of Alternative A plus the direct and indirect impacts attributable to the other previous existing and authorized projects in the Pearl River Watershed. Since the anticipated impacts from this alternative would be considered short-term and moderate in nature, no significant cumulative impacts would be anticipated.

Alternative B

Direct Impacts: This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. Specific direct impacts to soils within the Project Area would be anticipated during the construction period for both the levee segments and the floodway clearing areas. The breakdown of the anticipated impacts per the soils associations present within the Project Area is shown in Table 4-1. Moderate and long-term adverse impacts to soils within the Project Area would be anticipated. The utilization of proper stormwater Best Management Practices (BMPs) can help offset potential additional direct impacts to the soils in the Project Area during construction, and post-construction impacts can be minimized through the implementation of the appropriate stabilization measures. The project will impact portions of the Cascilla-Arkabutla soils association in Rankin County and the Cascilla-Chenneby soils association in Hinds County, both of which are known to contain significant amounts of hydric soils.

Moderate and long-term adverse direct impacts to water bodies within the Project Area would also be anticipated. These adverse impacts would be associated with the filling activities for the levee segment construction and related clearing activities for both the levee segments and the floodway clearing activities. The extent of the direct impacts can be minimized through the implementation of avoidance measures and storm water BMPs where possible.

Since no Prime and Unique Lands exist within the Project Area, no direct adverse impacts would be anticipated as a result of the implementation of this alternative.

Indirect Impacts: Moderate, long-term indirect adverse impacts to soils within the Project Area could be anticipated because of operations and associated maintenance through the life of the project. The utilization of proper stormwater BMPs can offset potential indirect impacts to the soils in the Project Area during construction, and post-construction impacts can be avoided through the implementation of the appropriate stabilization measures.

Table 4-1, Soil associations directly impacted by various alternatives

Soil Associations	Alternative B (acres)	Alternative C (acres)
Cahaba fine sandy loam	0	52.38
Tippo-Urban land complex	1.92	50.54
Cascilla-Arkabutla association	222.67	1040.27
Leverett silt loam	1.39	1.09
Tippo silt loam	9.47	191.23
Guyton silt loam	1.02	16.16
Gillsburg silt loam	3.54	25.91
Oaklimeter silt loam complex	8.90	0
Pits-Udorthents complex	4.77	0
Kirkville fine sandy loam	0	101.93
Adler silt loam	4.00	9.25
Cascilla-Chenneby association	342.30	798.19
Calloway-Urban land complex	0	11.61
Grenada silt loam, 0-2% slopes	55.48	25.89
Grenada silt loam, 2-5% slopes	10.90	28.16
Loring-Urban land complex, 2-8% slopes	2.39	0
Riedtown silt loam	34.57	18.5
Siwell-Urban land complex, 2-8% slopes	1.17	0
Siwell-Urban land complex, 8-15% slopes	7.52	47.21
Urban	12.94	50.86
Water	61.09	394.51

Indirect adverse impacts to water bodies within the Project Area can be anticipated. The anticipated indirect impacts would be considered moderate and long-term in nature. Clearing activities, specifically those associated with the floodway clearing, will result in a reduction in vegetative cover that will decrease shading on those water bodies present within the clearing limits and the adjacent water bodies. Following construction, these areas would be maintained in an herbaceous cover type over time, and the resultant loss of the shading effects could lead to increased water temperatures during hotter periods of the year.

Since no Prime and Unique Lands exist within the Project Area, no indirect impacts would be anticipated as a result of the implementation of this alternative.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts to soils and water bodies present within the Project Area and within the construction limits of Alternative B plus the direct and indirect impacts attributable to the other previous existing and authorized projects in the Pearl River Watershed. In addition, there is potential for future

developmental activities associated with the enhanced flood risk management. Given the nature of the proposed construction activities, minor, long-term adverse cumulative impacts to soils and water bodies within the Project Area would be anticipated.

Alternative C

Direct Impacts: Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. Direct impacts to the soils within the Project Area would be associated with the removal of the existing soils within the channel improvements area and the placement of the soils within the designated disposal areas, along the outside of the channel improvements. A total of approximately 2,848.62 acres would be impacted, of which approximately 2,390.16 acres are within the Cascilla-Arkabutla association and the Tippo silt loam in Rankin County and the Cascilla-Chenneby association in Hinds County, all of which are known to contain hydric soils. The utilization of proper stormwater BMPs can offset additional potential direct impacts to the soils in the Project Area during construction, and post-construction impacts can be minimized via the implementation of the appropriate stabilization measures. Given the extent of the construction activities, implementation of Alternative C would result in moderate, long-term, adverse impacts to soils within the project area.

Approximately 464.50 acres of existing water bodies within the channel improvement footprint, including the Pearl River channel itself and its tributaries, will be impacted by this alternative. A total of 80.42 acres would be impacted by the excavation activities associated with the channel improvement footprint, primarily oxbow lakes and sloughs. An additional approximately 375.42 acres outside the channel improvement footprint would be impacted as a result of further inundation, including portions of Eubanks Creek, Hanging Moss Creek, Lynch Creek, Purple Creek, Three-Mile Creek, Town Creek, Eastover Creek, Belhaven Creek, and Conway Slough. These specific water bodies and numerous other existing water bodies will be incorporated into the footprint of the channel improvements. Additional direct impacts to water bodies would be anticipated by the filling activities within the dredge disposal areas. As a result, moderate, long-term adverse impacts to the existing waterbodies would be anticipated as result of the implementation of Alternative C.

Since no Prime and Unique Lands exist within the Project Area, no direct impacts would be anticipated as a result of the implementation of this alternative.

Indirect Impacts: Indirect impacts to soils within the Project Area could be anticipated because of ongoing operations and associated maintenance through the life of the project. The utilization of proper stormwater BMPs can offset potential indirect impacts to the soils in the Project Area during construction, and post-construction impacts can be avoided through the implementation of the appropriate stabilization measures.

Indirect impacts to adjacent waterbodies within the project area could also be anticipated through the implementation of Alternative C. Existing interconnections to adjoining waterbodies could be affected and existing inflow and outflow functions within the areas could also be affected. Given this, the potential adverse impacts on waterbodies from the implementation of this alternative would be considered as moderate in intensity and long-term in duration.

No Prime and Unique Land will be impacted. Existing non-hydric soils within the channel improvement area may develop hydric characteristics as a result of inundation.

Cumulative Impacts: For the most part, cumulative impacts would be the incremental direct and indirect impacts of Alternative C plus the direct and indirect impacts attributable to the other previous existing and authorized projects in the Pearl River Watershed. The cumulative impacts for soils within the project area would be considered as moderate and long-term. However, cumulative impacts within the Pearl River Watershed are considered to be minor in intensity and long-term in duration. The same overall cumulative impacts for waterbodies within the watershed would also be considered minor, but long-term. As proposed, Alternative C would provide enhanced flood risk management while also providing the potential for future developmental activities upon the completion of construction activities. Future development activities associated with the project construction could provide additional cumulative impacts, particularly to soils. However, the determination of any future development activities associated with the project implementation would not be feasible as a part of this assessment process.

SUMMARY OF IMPACTS ON SOILS, WATER BODIES, AND PRIME AND UNIQUE LANDS

Alternative A (Non Structural):

- Impacts to any water bodies within the Study Area as a result of implementation of this alternative would not be anticipated
- No impact anticipated on Prime and Unique Lands

Alternative B:

- Moderate and long-term adverse impacts to soils within the Project Area would be anticipated
- Impacts portions of Cascilla-Arkabutla soils association in Rankin County and Cascilla-Chenneby soils association in Hinds County
- Impacts to water bodies would be anticipated
- No impact anticipated on Prime and Unique Lands
- Reduced vegetative cover, decreasing shading on present water bodies, increasing water temperatures

Alternative C:

- A total of approximately 2, 848.62 acres would be impacted
- Approximately 464.50 acres of existing water bodies will be impacted by channel improvement activities
- No impact anticipated on Prime and Unique Lands
- Existing interconnections to adjoining waterbodies could be affected
- Existing inflow and outflow functions within the areas could also be affected

4.5.2 WATER QUALITY AND WATER QUANTITY

4.5.2.1 *WATER QUALITY*

Alternative A

***Direct and Indirect Impacts*:** This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. It proposes the buyout of approximately 3,100 structures including homes, businesses, government and public buildings, schools, and hospitals. Relocation and other non-structural measures would not have significant impacts on water quality conditions in the Pearl River because most of the water entering the project reach originates upstream of Ross Barnett Reservoir.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative A plus the direct and indirect impacts attributable to the other previous existing

and authorized projects and sites in the Study Area. Relocations within the existing floodplain could result in additional green space that would act as a best-management practice to improve the water quality of localized runoff, but it is not expected to result in a measureable improvement of water quality in the river. Water quality in the project reach should be similar to the no action alternative.

Alternative B

***Direct and Indirect Impacts*:** This alternative includes the construction of additional levee segments, and the associated and additional floodway clearing along the Pearl River channel. Structural measures such as levees and floodwalls would not have significant direct impacts on water quality conditions in the Pearl River. The construction of additional levees and floodwalls would eliminate some overland flow runoff that now enters the river as a distributed source through natural areas. Runoff would be collected in sump areas that could degrade water quality if not managed properly. If these structural features resulted in more development near the river, some degradation in water quality from localized run-off could impact the existing water quality in the Pearl River. Any required clearing in the floodplain could have indirect impacts by eliminating existing natural areas that act as BMP's to improve water quality. Activities will be covered under a storm water permit with required stormwater BMPs to help offset potential adverse impacts to water quality during construction. Post-construction impacts can be further minimized through stabilization measures. Implementation of this alternative could result in some degradation of water quality compared to the no action alternative but such adverse impacts would be expected to be minor and short-term.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative B plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. If these structural features resulted in more development near the river, some degradation in water quality from localized run-off could impact the existing water quality in the Pearl River. Note that adverse impacts would be temporary and primarily during construction. Also, any construction would be subject to applicable federal and state stormwater control regulations and/or permits.

Alternative C

***Direct and Indirect Impacts*:** Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. Structural measures such as channel excavation and construction of a larger in-channel weir would impact water quality in the Pearl River. With this alternative, a 10-mile impoundment would be created, water depths would increase, and velocities would decrease under low flow conditions resulting in changes in water quality. The greater volume of water in the impoundment will reduce temperature variations

caused by changes in meteorological conditions and result in dissolved oxygen concentrations that are slightly lower but still meeting water quality standards at a depth of 5-ft. Increases in productivity (photosynthetic oxygen production from algae and macrophytes) will also occur but growth of algae and macrophytes will continue to be light-limited. The water quality in this proposed impoundment is expected to be similar to the existing Ross Barnett Reservoir as they will have similar average depths and most of the water entering the proposed impoundment will originate from the reservoir.

Water quality data collected in the Pearl River upstream of the existing low water weir during July 2014 indicate that some intermittent stratification would occur in the proposed impoundment but dissolved oxygen concentrations would generally meet the state water quality standards at a depth of 5-ft. Since the residence time of the proposed impoundment is significantly less than the residence time of Ross Barnett Reservoir (i.e., 3.6 days vs 42 days), less stratification and productivity would be expected in the proposed impoundment compared to the Ross Barnett Reservoir.

The July 2014 data also shows that during localized storms over the project reach, low dissolved oxygen concentrations in urban runoff causes the dissolved concentrations in the Pearl River to temporarily decrease below existing water quality standards for dissolved oxygen. This is a transient problem that is quickly remedied by diluting with upstream water. Best-managements practices will be implemented to minimize this effect with Alternative C. With more dilution water available due to the volume of the proposed impoundment, the impact of localized storms on the Pearl River dissolved oxygen content may be reduced. The water quality modeling results in Appendix D indicate that water quality standards will be maintained in the proposed impoundment.

Effects on water quality and sediment would be localized and would not measurably impact water and sediment quality of the Study Area or the Pearl River below the weir at RM 290.7. Turbidity would increase whenever sediment is being removed and placed during channelization work. Measurable increases in turbidity would be temporary; lasting only days after channelization activity is completed and would not extend far beyond the area where sediment is being disturbed. Turbidity increases would be managed by Mississippi's requirement that turbidity not exceed 50 Nephelometric Turbidity Units above background turbidity at the time of discharge outside a 750-foot mixing zone. This is the standard set forth by the Mississippi Department of Environmental Quality in their "Regulations for Water Quality Criteria for Intrastate, Interstate, and Coastal Waters," which was adopted by the Mississippi Commission on Environmental Quality in 2012 and approved by the U.S. EPA in 2014.

In addition, potential impacts to water quality would be further minimized through the utilization of storm water BMP's and stabilization measures in required storm water permits. Fill limits will

be sloped away from the Pearl River to capture and treat the initial stormwater runoff with a variety of features, including grass swales, water quality treatment ponds, constructed wetlands and other water quality treatment features.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative C plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. As noted above, Alternative C would result in temporary short-term, adverse impacts to water quality both during and for a short time following construction of the project. Construction of Airport Parkway, West Rankin Utility Authority WWTP, and West Rankin Parkway together with construction of Alternative C would result in short-term, adverse impacts to water quality due to erosion and storm water runoff. Since all construction projects are required to comply with applicable federal and state storm water regulations and required permits, the impacts would be minimal and short-term. Note that Alternative C would result in long-term, beneficial cumulative impacts on water quality with other past, present, and future projects and historical sites for several reasons. For example, the construction of Alternative C would eliminate the Floodway Clearing Project and any potential adverse impacts on water quality from chemical sprays used to remove vegetation during maintenance work along the over 250 acre area. In addition, Alternative C includes removal of existing historical unpermitted solid waste units in the floodplain, removal and capping of an existing hazardous waste site, and remediating as necessary an automotive salvage yard, which should reduce the risk of future contamination from these existing sources. Since 98% of the project's watershed is located upstream of the Ross Barnett Reservoir, implementation of the existing Ross Barnett Reservoir Management Plan should address any water quality issues associated with the existing TMDLs since the impairments are largely due to nonpoint sources. The City of Jackson's existing MS4 permit and Storm Water Management Program address nonpoint source pollution from local runoff.

SUMMARY OF IMPACTS ON WATER QUALITY

Alternative A (Non Structural):

- No significant impacts on water quality in the Pearl River
- Additional green space would act as a best-management practice to improve the water quality of localized runoff
- Water quality should be similar to the no action alternative

Alternative B:

- Additional structures would eliminate some overland flow runoff that now enters the river
- Runoff would be collected in sump areas that could degrade water quality if not managed properly

Alternative C:

- Decreased velocities under low flow conditions could result in changes in water quality
- Growth of algae will continue to be light-limited
- Minor short term impacts to dissolved oxygen
- Temporary increase in turbidity regulated by Mississippi standards
- Temporary, short-term adverse impacts to water quality during and for a short time following construction
- Eliminates Floodway Clearing Project and any potential adverse impacts on water quality from chemical sprays used to remove vegetation over a 250 acre area
- Removes existing unpermitted solid waste units in the floodplain as well as an existing hazardous waste site

4.5.2.2 *WATER QUANTITY (HISTORICAL LOW WATER)*

Efforts were made to quantify the amount of water that could be lost due to evaporation at the Ross Barnett Reservoir. The computations included quantifying the proposed evaporation losses as a total volume, and then comparing that volume to the overall Pearl River Watershed volume that empties into Lake Borgne.

According to Introduction to Hydrology, Second Edition (Viessman, et al, 1977), available data indicates that the annual ratio of lake evaporation to pan evaporation is 0.7, and multiplying the pan evaporation by that ratio factor gives the equivalent lake evaporation. The ratio factor is commonly referred to as a pan coefficient, and the 0.7 pan coefficient was corroborated by Water Resources Engineering (Wurbs and James, 2002). The pan coefficient was then verified to be

regionally appropriate by confirming with evaporation analysis done by USACE at Sardis Lake, near Sardis, Mississippi, in 2011. Evaporation rates from the pan are generally greater than the evaporation rates experienced in lakes, due to the pan heating up and other heat transfer properties; therefore, the pan coefficient is commonly used to estimate the actual lake evaporation at a given location. To quantify the amount of evaporation that could occur, mean estimated pan evaporation depths for each month were obtained from National Oceanic and Atmospheric Administration (NOAA) at the Jackson, Mississippi, International Airport. A pan coefficient of 0.7 was used to correlate the mean pan evaporation to estimated lake evaporation. The surface area of the Ross Barnett Reservoir used in the calculations was 33,000 acres.

A review of the monthly mean flowrate of water was then performed on historical data from 1939 through 2014. Monthly gage statistics were obtained from the following United States Geological Survey Sites: Site number 02486000 at Highway 80 in Jackson, MS; Site Number 02489500 at Highway 26 in Bogalusa, LA; and Site Number 02492000 at Highway 21 in Bush, LA (Bogue Chitto River). The monthly mean flowrates (cfs) for each site were converted to total volumes for each month in million gallons. The volumes from the Bogalusa Gage, the Bogue Chitto Gage, and the estimated Lower Pearl computation were added together for a total volume at the mouth of the Pearl River System. The mean evaporation loss of the Ross Barnett Reservoir is estimated to be 1.12% of the total water volume that flows into Lake Borgne from the Pearl River Basin.

This computed percentage of water lost to evaporation at Jackson assumes that the total volume of water at Jackson will reach Lake Borgne. From the rainfall that falls in the basin, only 33% is typically runoff. The remaining amount is typically lost to plant absorption, ground seepage, ponding, and evaporation. Although difficult to calculate, given the potential water losses downstream of Jackson along the Pearl River, such as additional evaporation, water seepage, and sanctioned and unsanctioned withdraws, the estimate of 1.1% is very conservative and could be less than 50% of this amount by the time it reaches Lake Borgne some 300 miles downstream.

To illustrate any impacts the evaporation rates may have on the volume of water of the Pearl River, a review of the mean annual volume of water was performed from 1939 through 2014. The annual gage statistics were obtained from the same three USGS sites listed above, and mean annual flowrates were acquired for each “water year”. A “water year” refers to data from October of the preceding year through September of the named year. The mean annual flowrates were then converted to total volume in million gallons.

Viewing the results from the charts, an upward trend line is apparent when documenting the total volume of water at both locations. The Ross Barnett Reservoir was completed in the mid-1960s, and does not appear to have had an impact on overall water volume. Several factors could explain this upward trend, including urbanization within the drainage basin. However, it is

important to note the Ross Barnett Reservoir has not reduced the mean annual volume of water received by the Lower Pearl Basin. Neither the volume of water lost to evaporation at the Ross Barnett Reservoir, computed as 1.1%, nor the water release plan utilized by the reservoir has reduced the flows on the Lower Pearl.

To further illustrate other factors that may impact the overall flow of water along the Lower Pearl, the rainfall data for Bogalusa, LA, at the lower Pearl Basin, and Goshen Springs, MS, in the upper Pearl basin, was obtained from the NOAA. Total precipitation, in inches, from Station Number 160945 in Bogalusa, Louisiana was acquired for each available year from 1937 through 2008. The rainfall totals were plotted alongside the total volume of water recorded by the gage. The figure indicates a direct correlation between total water volume and the amount of rainfall within the watershed. More rainfall for a given year yields a higher volume of water for that year. These results indicate the evaporation from water impoundments, such as the Ross Barnett Reservoir, seem to have a very minor role in determining the amount of water received at the Lower Pearl region. Further discussion of the water quantity assessment can be found in Appendix C.

Alternative A

***Direct and Indirect Impacts*:** This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. It proposes the buyout of approximately 3,100 structures, including homes, businesses, government and public buildings, schools, and hospitals. Relocation and other non-structural measures (Alternative A) would not have significant impacts on the low water conditions of the Pearl River other than changes in hydrology due to future development.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative C plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Analyzing the relocation and other non-structural measures (Alternative A) with the past, current, and/or future projects and historical sites identified in Section 4.3 above yields no adverse cumulative effects on historical low water in the Pearl River. Two water intake structures have the potential for local, short-term, negligible effects to low water; however, any impact from the intakes would be offset by minimal release required by the Ross Barnett Reservoir's permit to sustain the established minimum low flow of the Pearl River. Also, all other projects and sites either discharge water into the Pearl River, resulting in local, short-term, beneficial effects on low water, or have no effect with respect to low water conditions. Hence, Alternative A will not result in adverse cumulative impacts with respect to historical low water.

Alternative B

***Direct and Indirect Impacts*:** This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. Structural measures such as levees and floodwalls (Alternative B) would not have significant direct impacts on the low water conditions of the Pearl River. Alternative B may result in indirect impacts due to changes in hydrology from future development. Also, Alternative B is expected to result in indirect, short-term impacts to existing hydrology with respect to areas behind levees where an additional amount of water will pond. This ponded water will have the potential to back up into adjacent areas behind the levees and be stored until it subsides as a result of levee gate opening, pumping and/or evaporation.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative B plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Analyzing Alternative B (levees and floodwalls) with the past, current, and/or future projects and historical sites will not result in adverse cumulative effects to low water conditions of the Pearl River. As noted for Alternative A, two water intake structures have the potential for local, short-term, negligible effects to low water; however, any impact from the intakes would be offset by minimal release required by the Ross Barnett Reservoir's permit to sustain the established minimum low flow of the Pearl River. Also, all other projects either discharge water into the Pearl River resulting in local, short-term, beneficial effects on low water or have no effect with respect to low water conditions. Hence, Alternative B will not result in adverse cumulative impacts with respect to historical low water conditions. Any potential for ponding in sump areas behind the levees is expected to have a local, short-term impact since levee gate opening, pumps, and/or evaporation are expected to address any ponding issues.

Alternative C

***Direct and Indirect Impacts*:** Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. Structural measures such as levees, channel excavation, and construction of an in-channel weir (Alternative C) would not have significant direct or indirect impacts on the low water conditions of the Pearl River. Alternative C includes a relocation of an expanded higher elevation weir with a low-flow gated structure at RM 284.3. Relocating the weir is not anticipated to have any impact that would decrease the quantity of water or water elevation downstream as the proposed replacement weir is a low-gate weir which would be submerged during large flood events. Since Alternative C provides flood risk management by lowering the water surface elevation through the reach, as opposed to increasing storage, the plan is not anticipated to impact peak flows through the reach.

Results of an investigation of the amount of water that could be lost to evaporation in water impoundments, such as the Ross Barnett Reservoir, indicate that evaporation would a negligible impact on quantity of water passing through the Lower Pearl region. The analysis of evaporation associated with the expanded water surface area from the impoundment and downstream analysis is included in Appendix C. Alternative C is expected to result in indirect, moderate, long-term, beneficial impacts to low water due to changes in hydrology from future development and the resulting increased runoff from developed impervious surfaces. Low flow for Alternative C has been analyzed in detail due to downstream concerns for low flow and water quality, and more detailed analysis is included in Appendix C.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative C plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Analyzing Alternative C (levees, channel excavation, and construction of an in-channel weir) with the past, current, and/or future projects and historical sites will not result in adverse cumulative effects to low water conditions of the Pearl River. As noted for Alternative A, two water intake structures have the potential for local, short-term, negligible effects to low water. Any impact from the intakes would be offset by minimal release required by the Ross Barnett Reservoir's permit to sustain the established minimum low flow of the Pearl River. Also, all other projects either discharge water into the Pearl River resulting in local, short-term, beneficial effects on low water or have no effect with respect to low water conditions. In fact, Alternative C may result in increased potential for runoff from construction and from developed impervious surfaces. In any event, minimal release would be legally required to be maintained by the Ross Barnett Reservoir to established minimum flow of the Pearl River. Any release from the Ross Barnett Reservoir will pass through the weir location proposed by Alternative C with a low flow-gated structure. Hence, Alternative C has negligible, if any, cumulative impacts to low water downstream of the Project Area. Finally, the opportunity may arise where improved low flow conditions can be provided by working closely with the Ross Barnett Reservoir operations.

SUMMARY OF IMPACTS ON WATER QUANTITY

Alternative A (Non Structural):

- No significant impacts on low water conditions other than changes in hydrology due to future development
- Water intake structures have potential local, negligible effects to low water that would be offset by minimal release required by minimum low flow regulations

Alternative B:

- May result in indirect impacts due to changes in hydrology
- Changes in hydrology expected for areas beyond levees
- Water intake structures have same impacts as Alternative A
- Other projects may discharge water into the Pearl River resulting in local, short-term, beneficial effects on low water

Alternative C:

- Evaporation would be negligible on quantity of water
- Moderate, long-term, beneficial impacts on low water expected from change in hydrology and increased runoff
- Water intake structures have same impacts as Alternatives A and B

4.5.2.3 *PEARL RIVER TRIBUTARIES AND INTERIOR DRAINAGE*

Alternative A

***Direct and Indirect Impacts*:** This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. It proposes the buyout of approximately 3,100 structures, including homes, businesses, government and public buildings, schools, and hospitals. Relocation and other non-structural measures would not have significant direct impacts on the interior drainage of the Pearl River tributaries. However, structures that are now impacted by tributary runoff with extreme Pearl River stages would not be indirectly impacted if they are relocated.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative A plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Due to lack of direct and indirect impacts, relocation and other non-structural measures would have minimal if any adverse cumulative impacts.

Alternative B

***Direct and Indirect Impacts*:** This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. Most prior studies of tributaries with levees within the Project Area included pumps at tributary locations in order to minimize risk and possible impacts to interior areas during high flood stages of the Pearl River. Although pumps were not included in the preliminary draft plan of 2007, no interior analysis was performed to determine impacts of levees without pumps at these locations. Updated information and analysis of interior areas presented significant impacts and risk associated with levees without pumps. This conclusion would be expected because of pumps now being located on similar tributaries within the existing levee reaches. Direct impacts would include the blockage of tributary flow and therefore, the need for pumping tributary flows during extreme events. Indirect impacts of flow blockage would result in impacting or flooding sump areas needed for pump stations to perform efficiently.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative B plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Increased impacts of damming, leveeing of eight (8) additional tributaries plus the tributaries already impacted behind existing levees would be anticipated with implementation of this plan. These cumulative impacts would include incremental environmental impacts and impacts to natural tributary flows. Appropriately sized pumps would be required to minimize the adverse impacts of this alternative.

Alternative C

***Direct and Indirect Impacts*:** Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. Major tributaries exist within the evaluation area between RM 280 and RM 298 of the Pearl River.

The tributaries near the upstream side of the proposed weir location were reviewed to determine backwater impacts, if any, based on a normal pool elevation of 258.0-ft.

The additional tail water, generated by the lake pool, increases the flood profile for a short reach length upstream during the lower flood events. The increased flood profile elevations do not exceed the existing channel top banks and other modifications could be made to address any minor increases. Based upon this evaluation, a pump station would not be required for the tributaries, resulting in minimal impact to the tributaries.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative C plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Cumulative impacts would be minimal due to raising of the Pearl River tail water. Tributary flows would not be blocked and thus, would not affect interior drainage during flood events.

SUMMARY OF IMPACTS ON CHANNEL STABILITY

Alternative A (Non Structural):

- Relocation and other non-structural measures would have no significant impacts on interior drainage of the Pearl River
- Structures now impacted by tributary runoff with extreme Pearl River stages would not be impacted if relocated

Alternative B:

- Direct impacts would include blockage of tributary flow resulting in the need for pumping flows during extreme events
- Flood sump areas needed for pump station efficiency

Alternative C:

- Additional tail water increases flood profile for a short reach length during lower flood events
- Pump station not required resulting in minimal impact to tributaries

4.5.2.4 *CHANNEL STABILITY (EROSION AND SEDIMENTATION)*

Alternative A

***Direct and Indirect Impacts*:** This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. It proposes the buyout of approximately 3,100 structures, including homes, businesses, government and public buildings, schools, and hospitals. Relocation and other non-structural measures would not have significant impacts on channel stability conditions of the Pearl River. Channel stability would not be significantly altered. Erosion would continue in areas where the landfills impinge on the floodplain and could cause continued landfill breaches in those areas.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative A plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Long term effects of lack of channel maintenance near landfills could result in incremental erosion in these areas. Other cumulative impacts are not expected for this alternative.

Alternative B

***Direct and Indirect Impacts*:** This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. Structural measures such as levees and floodwalls could have some impact on channel stability. The clearing and conveyance improvements from RM 293.5 to RM 302.0 could increase overbank erosion and accelerate bank erosion in this reach due to removal of vegetation. In addition, with the construction of these features, velocities of flood flows will increase, increasing the possibility of erosion.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of Alternative B plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. The increase in velocities through the leveed reach along with unprotected overbanks in the upper reaches could contribute to long term sedimentation in downstream reaches, although this would be expected to be minimal.

Alternative C

***Direct and Indirect Impacts*:** Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. Due to the channel excavation and change in potential hydraulic parameters, a more detailed analysis was performed for this alternative. Structural measures such as levees, channel excavation, and construction of an in-channel weir were analyzed to preliminarily determine impacts of channel stability upstream and downstream of the Project Area. Based on the results of this preliminary assessment, it is believed there may be some potential sediment issues that will have to be addressed in the project area. However, these issues do not appear to be unmanageable, and a sediment management plan can be developed that will be feasible from an engineering, economic, and environmental perspective.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of Alternative C plus the direct and indirect impacts attributable to the other previous existing and authorized projects and sites in the Study Area. Cumulative impacts to erosion and sedimentation can be confined in a small reach within the project limits. Implementation of appropriate BMPs, including but not limited to, timing and sequence of work, will help minimize any adverse impacts. Downstream sedimentation and erosion are not seen as a long term concern when compared with other existing projects in the area.

SUMMARY OF IMPACTS ON PEARL RIVER TRIBUTARIES AND INTERIOR DRAINAGE

Alternative A (Non Structural):

- Relocation and other non-structural measures would have no significant impacts on channel stability conditions
- Continued erosion in areas where the landfills impinge on the floodplain which could cause continued landfill breaches in those areas
- Lack of channel maintenance near landfills could result in incremental erosion

Alternative B:

- Levees and floodwalls could have some impact on channel stability
- Clearing and conveyance improvements could increase overbank erosion and accelerate bank erosion
- Increased velocities could increase the possibility of erosion as well as sedimentation in downstream reaches

Alternative C:

- Some sediment issues may arise but appear to be manageable
- Cumulative impacts can be confined to a small reach within the project limits

4.5.3 VEGETATIVE RESOURCES

Alternative A

Direct and Indirect Impacts: This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. It proposes the buyout of approximately 3,100 structures, including homes, businesses, government and public buildings, schools, and hospitals. The implementation of Alternative A would not lead to any anticipated direct impacts to vegetation resources within the Project Area. Indirect impacts could be associated with relocation efforts assuming that existing vegetative cover would be removed in the relocation areas. Since the specific relocation areas have not been identified, it would not be feasible to determine the magnitude of the indirect impacts to the vegetation resources within those areas. Direct positive impacts on vegetation resources would be anticipated since the current locations would be returned to green space. Modifications to existing infrastructure (i.e. roads and utilities) or construction of new utilities as a result of relocated structures would also be anticipated.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of implementing Alternative A plus the direct and indirect impacts to other previous existing and authorized projects in the Pearl River Watershed. As noted, the potential direct and indirect impacts would be minimal and associated with any potential relocation activities. Additionally,

mitigation measures related to restoration of greenspace at the existing locations would lessen the overall level of adverse impacts that could be anticipated. Given this, any potential adverse cumulative impacts would be minor and short-term in duration.

Alternative B

***Direct Impacts**:* This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. A total of approximately 784.0 acres would be impacted with the construction of the levees and the associated clearing activities included in Alternative B. Of the 784.0 acres, approximately 735.74 acres include vegetative resources and associated terrestrial habitats. The specific breakdown of the vegetation resources and the associated acreage of each type directly impacted by the proposed alternative are included in Table 4-2. The construction of the project would result in the removal of the existing vegetation resources present within the levee segment right-of-way, the associated clearing limits along the levee alignment, and the clearing activities within the proposed floodway limits along the Pearl River channel. Of the total approximately 735.74 acres of vegetative resources impacted, Alternative B would impact a total of approximately 291.49 acres of forested wetlands, approximately 30.12 acres of scrub shrub wetlands, approximately 5.88 acres of emergent wetlands, and an additional approximately 18.54 acres of cypress slough habitat. The details of the jurisdictional wetlands and "other waters of the U.S." impacts for this alternative are included in the Wetlands Delineation and Determination Report included in Appendix D. An additional approximately 389.71 acres of upland habitats and associated vegetation resources would also be impacted by this alternative. The clearing activities would result in a conversion of habitat types within the specific impact areas that will be maintained in a primary herbaceous to scrub shrub habitat related to the ongoing maintenance activities. Given the clearing activities involved, the implementation of Alternative B would lead to adverse impacts to vegetation resources within the Project Area that would be minor in intensity and long-term in duration.

Indirect Impacts: The anticipated indirect impacts to the vegetation resources within the Project Area would be associated with any potential future development activities that may occur as a result of the enhanced flood protection. No specific indirect impacts associated with the actual project construction would be anticipated. Further indirect impacts can be anticipated from the floodway vegetation control measures that would be incorporated into the project management plan. The cleared floodway areas will be maintained through time through the use of herbicides to maintain a scrub shrub habitat within these areas. Given the potential effects, the indirect, adverse impacts to the vegetation resources within the Project area would be considered as minor in intensity and long-term in duration.

Cumulative Impacts: Cumulative impacts would be the incremental direct (~735.74 acres) and indirect impacts of implementing and operating Alternative B on vegetation resources plus the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. Development activities within the Project Area over time have already resulted in significant adverse impacts to vegetation resources within the area that are cumulative in nature. The potential for further cumulative impacts associated with the increased development activities as a result of the enhanced flood protection cannot be determined at this time but can be anticipated. In addition, the conversion of habitat associated with this alternative would result in adverse cumulative impacts to vegetation resources within the Project Area that would be moderate in intensity and long-term in duration. The adverse impacts that would occur relative to the Pearl River Watershed would, however, be considered as minor and long-term in duration.

Alternative C

Direct Impacts: Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. A total of approximately 2,848.0 acres will be directly impacted by the implementation of Alternative C of which a total of approximately 2,542.38 acres contain vegetation resources and associated terrestrial habitat types. It can be anticipated that the vast majority of the vegetation resources located within the proposed project construction and fill limits would be removed during the construction phase. The specific vegetation resources and the acres of each type that would be impacted as a result of the implementation of Alternative C are included in Table 4-2 below. Of the total 2,542.38 acres of vegetation resources present, the impacted area includes approximately 1,017.22 acres of forested wetland, 266.12 acres of scrub shrub wetland, 65.13 acres of emergent wetland, and 150.13 acres of cypress and tupelo gum slough habitat. The details of the jurisdictional wetlands and "other waters of the U.S." impacts for this alternative are included in the Wetlands Delineation and Determination Report included in Appendix D. In addition, a total of approximately 1,043.66 acres of upland habitats with vegetation resources would also be impacted.

The existing vegetation resources found within the approximately 1,901.0 acres of the proposed channel enhancement area will be directly impacted. There will also be at least temporary, if not long-term, direct impacts to the vegetation resources that now exist within the approximately 947.0 acres of the proposed dredge disposal fill areas. The fill areas will be re-vegetated following the completion of the construction activities to at least an herbaceous state. Further re-vegetation of the fill areas over time will be dependent upon the longer term plans for these areas. Areas within the proposed channel excavation area have been identified for avoidance during the excavation activities. These areas would be maintained in their current vegetated

state and the existing natural habitats. In addition, the Alternative C plans include the construction of additional natural areas and parks within significant portions of the project fill areas. Given the extent of the project construction activities, the direct, adverse impacts to the vegetation resources within the Project Area are considered major in intensity and long-term in duration. Mitigation measures, including habitat restoration activities, will help offset the intensity of these impacts during and after the construction activities are completed.

Indirect Impacts: The anticipated indirect impacts to the vegetation resources within the Project Area would be associated with any potential future development activities that may occur as a result of the enhanced flood protection. No specific indirect impacts associated with the actual project construction would be anticipated. Therefore, the potential indirect, adverse impacts associated with the Alternative C implementation would be considered as minor in intensity and long-term in duration.

Cumulative Impacts: Cumulative impacts would be the incremental direct (~2,542.38 acres) and indirect impacts of implementing and operating Alternative C on vegetation's resources plus the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. The potential for further cumulative impacts associated with the increased development activities as a result of the enhanced flood protection cannot be determined at this time but can be anticipated. The conversion of existing vegetation resources associated with the Alternative C implementation associated with other existing and proposed projects would lead to adverse cumulative impacts within the Project Area, specifically that are considered to be major in intensity and long-term in duration. Conversion of habitats and removal of vegetation across the watershed in general has not been significant and future conversion activity throughout the watershed is not anticipated. Therefore, cumulative impacts associated with the proposed alternative relative to the Pearl River Watershed would be considered as moderate in intensity and long-term in duration. Mitigation measures associated with the implementation of Alternative C can further offset cumulative adverse impacts associated with the project across the watershed and, more specifically, in proximity to the Project Area.

1 *Table 4-2, Direct Impacts to Vegetative Resources*

Alternatives and Habitat Types	Direct Impacts (Acres)
Alternative B--forested wetlands/cypress sloughs	310.03
Alternative B--emergent and scrub shrub wetlands	36.00
Alternative B--upland forestland	343.14
Alternative B--upland emergent and shrub land	46.57
TOTAL ALTERNATIVE B	**735.74**
Alternative C--forested wetlands cypress sloughs	1,167.47
Alternative C—emergent and scrub shrub wetlands	331.25
Alternative C-- upland forestland	605.92
Alternative C--upland emergent and shrub land	437.74
TOTAL ALTERNATIVE C	**2,542.38**

SUMMARY OF IMPACTS ON VEGETATIVE RESOURCES

Alternative A (Non Structural):

- Direct, positive impacts on vegetation resources would be anticipated since the current locations would be returned to green space
- Mitigation efforts of green space would lessen the level of adverse impacts
- Modifications to existing infrastructure would be anticipated

Alternative B:

- Approximately 735.75 acres of impacted vegetative resources
- Construction of the project would result in the removal of existing vegetation resources present within some portions of the project area
- Given the clearing activities involved, implementation would lead to adverse impacts to vegetation resources that would be minor but long-term
- Floodway vegetation control measures could cause indirect impacts through the use of herbicides

Alternative C:

- Existing vegetation will be directly impacted
- Temporary, if not long-term, direct impacts to resources present within the proposed dredge disposal fill areas is anticipated
- Includes the construction of additional natural areas and parks
- Mitigation measures will help offset the intensity of impacts during and after construction

4.5.4 WILDLIFE RESOURCES

Alternative A

Direct Impacts: This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. It proposes the buyout of approximately 3,100 structures, including homes, businesses, government and public buildings, schools, and hospitals. Since Alternative A involves the non-structural relocation or demolition of existing affected structures, no direct impacts to wildlife resources would be anticipated. Conversely, the restoration of the existing urban habitat to the historic forestland habitat would provide a more positive impact to the wildlife resources by recreating or restoring the historical habitat types within the Project Area specific to the affected locations. Given this, direct, adverse impacts associated with the implementation of Alternative A would be minor and short-term in duration.

Indirect Impacts: No specific indirect impacts would be anticipated from the implementation of Alternative A. Potential indirect impacts could be anticipated in the event that the relocated structure locations are within existing habitat areas that would require clearing and/or conversion prior to the placement of the relocated structures and associated infrastructure improvements. As a result, the potential indirect, adverse impacts would be minor in intensity and potentially long-term in duration.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of implementing Alternative A plus the direct and indirect impacts to other previous existing and authorized projects in the Pearl River Watershed. The magnitude of the potential cumulative impacts associated with this alternative, specifically at the locations of the relocated structures and associated infrastructure improvements, would be difficult to determine at this time. Some level of cumulative adverse impacts associated with the relocation of the affected structures at the relocation sites can be anticipated. However, while the potential cumulative adverse impacts would be minor in intensity and potentially long-term in nature, the significance of any potential cumulative impacts would be negligible.

Alternative B

Direct Impacts: This alternative includes the construction of additional levee segments, and the associated and additional floodway clearing along the Pearl River channel. A total of approximately 784.0 acres would be impacted by the construction of Alternative B. A significant portion of the impacted area is existing wildlife habitat. The Project Area contains habitat types that support both native game and non-game wildlife species. Portions of the habitat will be converted through the filling activities associated with the levee segment construction. Other portions will be converted from the existing forestland habitat to an herbaceous habitat-type

within the clearing areas and along the levee alignments. Additional areas, specifically along the bank of the Pearl River, will be cleared for floodways and will ultimately be maintained, primarily, in a scrub shrub habitat type utilizing herbicides. The conversion of the prevalent forestland habitat to the proposed herbaceous and/or scrub shrub habitats will also lead to habitat loss for many of the wildlife species that presently utilize the Project Area. In addition, the presence of the levees will result in extended flood events on the unprotected side that will lead to the displacement of wildlife from these areas for longer periods of time. The extended duration of flooding events within these areas could lead to adverse impacts on these wildlife habitats. Conversely, the creation of the subsequent herbaceous and scrub shrub habitats will increase utilization for other wildlife species found within the Project Area. Additionally, significant portions of the Project Area have already been developed further impacting wildlife resources within the Project Area. As a result, the direct, adverse impacts to wildlife resources within the Project Area would be moderate in intensity and long-term in duration.

Indirect Impacts: The habitat conversion specific to the levee segment construction and associated clearing activities will also lead to some level of indirect impacts for the adjacent habitats and the wildlife species that utilize those habitats. Though difficult to quantify, the indirect impacts for the adjoining habitats and the species that utilize those habitats can be anticipated from an overall perspective. Given the nature of the activities, the indirect, adverse impacts are considered to be minor in intensity and long-term in duration.

Cumulative Impacts: Cumulative impacts would be the incremental direct and adjacent impacts of implementing and operating Alternative B on wildlife resources plus the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. The magnitude of the habitat conversion associated with the implementation of Alternative B along with the previous and anticipated development activities would result in cumulative adverse impacts within the Project Area that are moderate in intensity and long-term in nature. The potential for further cumulative impacts associated with the increased development activities as a result of the enhanced flood protection cannot be determined at this time. Given the amount of available wildlife habitats within the Pearl River Watershed in total, the anticipated cumulative adverse impacts are thought to be minor in intensity and long-term in duration.

Alternative C

Direct Impacts: Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. The impact from Alternative C will affect approximately 2,848.0 acres of which approximately 2,542.0 acres provide some degree of terrestrial wildlife habitat along the Pearl River. Of the total impacted acreage, approximately 1,901.0 acres would be excavated for the channel improvements and an additional

approximately 947.0 acres would be utilized as fill areas for the dredge disposal material. The remainder of the impacted acreage includes the Pearl River channel and other major water bodies comprising the existing aquatic habitats and the accretion areas along the river channel.

Wildlife utilization within the Project Area varies by habitat types and by the effects of the adjacent urban areas with the associated human influences. It can be assumed that the existing terrestrial wildlife habitat and the wildlife resources within the Project Area will be directly impacted by the removal of the terrestrial habitat that currently exists within the channel improvement area. However, the project was designed to avoid most wildlife habitats associated with Mayes Lake and LeFleur's Bluff State Park. Though the existing terrestrial habitats would be removed, the conversion to aquatic habitats in these areas would be utilized by other wildlife species. Temporary, direct impacts would be experienced as a result of the dredge disposal fill areas created during construction. Such impacts could be longer term depending upon the type of restoration activities implemented at the various fill areas following completion of construction activities. Further assumptions can be made that wildlife populations will adjust to habitat changes in general and will utilize adjacent habitats to a greater degree than currently exists.

Alternative C design considerations will also incorporate avoidance and minimization measures relative to the channel excavation and the placement of dredge disposal fill areas. Other design aspects for this alternative will be incorporated to minimize direct impacts upon the existing wildlife habitat, with avoidance of forested habitats where possible. Project design will also include islands, one or more of which will be left within the channel improvements excavation area to decrease direct impacts to wildlife resources within the Project Area. Existing habitats in these areas will be protected and enhanced. Preservation and protection measures to insure wildlife utilization through the project life will also be incorporated into Alternative C. Given the nature of the proposed construction, the direct, adverse impacts to wildlife resources associated with the implementation of Alternative C are considered moderate in intensity and long-term in duration.

Indirect Impacts: Wildlife access into and out of the proposed channel modification area would not be significantly impacted as much of the wildlife species within the Project Area are highly mobile, and migration into the adjoining habitats would be anticipated. As a result of channel modifications, increases in available habitat for aquatic wildlife, migratory waterfowl, shore birds, and other water dependent species would be anticipated. Existing wildlife utilization of the habitats adjoining the specific Project Area would not be impacted by project implementation; therefore, indirect, adverse impacts to wildlife resources would be considered minor but potentially long-term in duration. Any indirect impacts due to the habitat conversion

associated with future development activities that result from the implementation of Alternative C should be minimal but cannot be determined at this time.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct (~2,542.0 acres) and indirect impacts of implementing and operating Alternative C on wildlife resources, along with the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. The potential for further cumulative impacts associated with any increased development activities as a result of the enhanced flood protection afforded by Alternative C cannot be determined at this time. In making this statement, it is acknowledged that Alternative C may result in riverfront development while including measures to enhance wildlife habitats. Additionally, the conversion of the existing wildlife habitats within the Project Area associated with the implementation of Alternative C will result in cumulative, adverse impacts that would be moderate in intensity and long-term in duration specifically within the Project Area. Mitigation measures, particularly within the Project Area, along with the migration of the wildlife species to the unaffected habitats in proximity of the construction activities will help offset the long-term impacts to the wildlife resources. Cumulative adverse impacts relative to the Pearl River Watershed in general will be minor and long-term in duration given the amount of available habitats that are present within the watershed.

SUMMARY OF IMPACTS ON WILDLIFE RESOURCES

Alternative A (Non Structural):

- No direct impacts to wildlife resources would be anticipated
- Restoration of existing urban area to historic forestland habitat would provide a more positive impact
- Some level of cumulative adverse impacts associated with the relocation of the affected structures at the relocation sites can be anticipated

Alternative B:

- Conversion of habitat to scrub shrub habitat type could lead to habitat loss for many wildlife species in the Project Area
- Levees, resulting in extended flood events, will lead to displacement of wildlife for longer periods

Alternative C:

- Existing terrestrial wildlife habitat and the wildlife resources within the Project Area will be directly impacted by the removal of the terrestrial habitat within the channel improvement area
- Conversion to aquatic habitats would be utilized by other species
- Design aspects incorporated to minimize direct impacts upon the existing wildlife habitat, with avoidance of forested habitats where possible
- Increased protection and enhancement of existing habitats
- Preservation measures incorporated
- Due to channel modifications, increases in available habitat for water dependent species would be anticipated

4.5.5 AQUATIC AND FISHERIES RESOURCES

Alternative A

Direct Impacts: This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. It proposes the buyout of approximately 3,100 structures, including homes, businesses, government and public buildings, schools, and hospitals. Since Alternative A involves the non-structural relocation of existing affected structures, no direct impacts to aquatic and fisheries resources are anticipated. Therefore, any potential direct, adverse impacts would be minor and short-term in duration.

Indirect Impacts: Given the nature of the proposed action for this alternative, no indirect impacts are anticipated from this non-structural alternative. Likewise, any potential indirect, adverse impacts would be considered as minor and short-term in nature.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of implementing and operating Alternative A plus the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. Given the determination that no direct or indirect impacts to aquatic and fisheries resources would be associated with the implementation of Alternative A, no cumulative impacts are anticipated.

Alternative B

Direct Impacts: This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. A total of approximately 47.0 acres of open water habitats, including cypress sloughs that contain aquatic and/or fisheries resources, would be directly impacted by Alternative B. Most of this habitat would be directly impacted by the construction of the levee segments that are a part of this alternative. In addition, construction of the levee segments would have direct, adverse impacts to segments of perennial streams, intermittent streams, and ephemeral streams found within the Project Area. These streams support aquatic and, to some degree, fisheries resources. These areas impacted by levee construction would be converted to upland grassland (levee) habitats. The more mobile fish species and some aquatic species would migrate from the construction areas, while other aquatic species would be displaced during construction. Further direct impacts can be anticipated that are associated with the fragmentation of the aquatic habitats, specifically those remnant water bodies located on the protected side of the levees. As a result, direct, adverse impacts associated with this alternative are considered as moderate in intensity and long-term in duration.

Indirect Impacts: With this alternative, indirect, adverse impacts would be anticipated and associated with floodway clearing along the Pearl River channel, which will impact the cypress sloughs that are present within the project area. The removal of tree-sized vegetation would effectively eliminate much of the shading along the river channel and sloughs, which would lead to increased water temperatures, especially during the summer months, and could result in indirect impacts to the aquatic and fisheries resources within the open water habitats. Given this, the indirect, adverse impacts on the fisheries resources associated with the loss in habitat and the floodway vegetation removal activities would be moderate in intensity and long-term in duration.

Cumulative Impacts: Cumulative impacts would be the incremental direct (~47.0 acres) and indirect impacts of implementing and operating Alternative B on aquatic and fisheries resources

along with the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. As noted, the loss in habitat from the levee filling activities along with the floodway clearing will result in both direct and indirect adverse impacts to the aquatic and fisheries resources within the Project Area. As a result, the cumulative adverse impacts would be moderate and long-term in intensity within the Project Area. However, given the extent of the anticipated adverse impacts, the cumulative impacts within the Pearl River Watershed would be minor in intensity and long-term in duration.

Alternative C

Direct Impacts: Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. The proposed Alternative C Project Area contains approximately 231.0 acres within the existing Pearl River channel, in addition to approximately 358.0 acres of open water habitat and cypress/tupelo gum sloughs. Also, there are additional perennial, intermittent, and ephemeral streams located within the proposed project construction area. These riverine and other open water habitats support aquatic and fisheries resources, some of which would incur direct impacts as a result of project construction.

It is anticipated that overall available aquatic and fisheries habitat would increase as a result of the channel improvements, with the total area available for aquatic and fish habitat estimated at 1,901.0 acres, post-construction. Hydrologic modeling performed for this study indicates that there would be negligible changes to flows within the river system, meaning the existing riverine habitat would be similar in nature following construction. Some aquatic and fisheries habitats within the proposed fill areas would be impacted. However, the project design associated with fill areas will avoid and limit impacts, and a significant "net loss" in aquatic habitat is not anticipated. Given these design considerations, the limited direct impacts would be evident but are not specifically measurable at this time.

Alternative C also includes the relocation of a weir from RM 290.7 to approximately RM 284, at the south end of the channel improvements area. The weir would be utilized to maintain the baseline water level within the channel improvements area and to maintain the existing hydrologic flows within the Pearl River channel. As noted, the hydrologic modeling indicates that minimal changes in flows will occur as a result of the weir construction.

The new weir construction, however, will lead to some level of direct impacts associated with the limitation on migration of both aquatic and fisheries resources from downstream of the weir location northward into the channel improvement area and upstream of the Project Area during normal flows. Access from downstream, however, will still be provided during periods of high flows on the river. Given the fact that the existing weir is in place at the J. H. Fewell Water Treatment Plant site (RM 290.7) within the Project Area, the overall effect on most aquatic

species arising from the relocation of the weir structure to RM 284 would be minimal. It can also be anticipated that most aquatic and fisheries populations would be temporarily displaced from specific portions of the river channel during construction activities but that the existing populations would not be permanently impacted.

As noted, the existing weir that is located within the Project Area at RM 290.7 already impedes the upstream and downstream migration for most, if not all, of the fisheries species found within the river channel, particularly during low flows. However, the aquatic studies that have been completed within the project area do not indicate that the presence of the existing weir structure has significantly impacted the aquatic and fisheries populations within the Project Area.

Significant increases in aquatic and fisheries habitat associated with the channel improvements will provide an associated direct benefit to aquatic and fisheries resources. At present, the depths of the river channel through the vast majority of the project area have been significantly impacted by the past dredging activities associated with the previous flood control project. Siltation has been substantial from the existing weir structure downstream through the project area. As a result, aquatic and fisheries habitats through the project area have been compromised and water depths have decreased through time impacting the utilization for numerous species.

The channel improvements associated with Alternative C will include the excavation of the existing Pearl River channel in the Project Area and the widening of the channel out to varying distances. At the same time, the excavation activities will be conducted at varying depths through the channel improvements area to provide more diversity in water depths and more overall biodiversity within the system. Concurrently, the relocated weir structure will be constructed in a manner to provide a normal pool level through the area that will facilitate the ongoing maintenance of the diverse water depths through the pooling area associated with the project. These actions should result in an overall improvement of aquatic and fisheries habitats and provide for a more consistent and diverse habitat for most of the historic species found in the river system.

Accordingly, the construction of Alternative C would not lead to any significant direct impacts to these resources within the Project Area. Given this, the direct, adverse impacts associated with the implementation of Alternative C would be moderate in intensity and long-term in duration. However, a degree of uncertainty as to the extent of the aquatic and fisheries resources and the species makeup within the channel improvements is also acknowledged. In addition, potential impacts to the historic populations relating to the upstream and downstream migrations with the weir structure in place are unknown. Given this, an important aspect of the specific project design functions and, more importantly, the post-construction period would be the implementation of a project-specific adaptive management plan that would incorporate

population monitoring and the development of alternative approaches to adapt to observed adverse effects.

Indirect Impacts: Any indirect impacts associated with the implementation of Alternative C are associated with limits on upstream migration of aquatic and fisheries resources from downstream of the proposed weir. However, as noted, the implementation of adaptive management will provide a learned approach to alternative management features and activities that can provide potential positive outcomes for the affected populations relative to the pre-construction conditions. Passage will still occur during high flow events and migration patterns for most species will not be significantly impaired. In fact, given the existing weir at the J. H. Fewell Water Treatment Plant, migration can arguably be anticipated to improve in comparison to pre-project conditions. Indirect impacts for aquatic and fisheries resources within the channel improvements area and upstream of the project limits would not be anticipated given the design variables. Accordingly, it is anticipated that the overall level of indirect impacts would be minor and long-term in duration.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of implementing and operating Alternative C on aquatic and fisheries resources along with the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. The potential impacts associated with the implementation of Alternative C would be incrementally direct, but limited, and include indirect impacts and impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. Given the limited nature of both the direct and indirect impacts, significant cumulative adverse impacts on aquatic and fisheries resources would be anticipated to be moderate in intensity and long-term in duration within the Project Area. Cumulative adverse impacts relative to the Pearl River Watershed would be minor and long-term in intensity. The implementation of an adaptive management plan and associated management alternatives should offset the significance of any anticipated cumulative impacts as a result of the project implementation.

SUMMARY OF IMPACTS ON AQUATIC AND FISHERIES RESOURCES

Alternative A (Non Structural):
No significant impacts to aquatic and fisheries resources anticipated

Alternative B:

- 47.0 acres of open water habitats would be directly impacted by construction of levees
- Floodway clearing could effectively eliminate much of the shading along the river and cypress sloughs, increasing water temperatures which could indirectly impact aquatic and fisheries resources

Alternative C:

- Project construction could impact riverine and other open water habitats that support aquatic and fisheries resources
- Overall available habitat would increase due to channel improvements
- Negligible flow changes within the river system
- Limitation on migration of aquatic and fisheries resources due to the new weir construction is anticipated, however access from downstream will be provided during high flows
- Historic migration population numbers would need to be monitored

4.5.6 ESSENTIAL FISH HABITAT (EFH)

Alternative A

Direct Impacts: This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. It proposes the buyout of approximately 3,100 structures, including homes, businesses, government and public buildings, schools, and hospitals. Alternative A involves the non-structural relocation of existing affected structures. Since no EFH is present within the project area, no potential direct, adverse impacts would be anticipated.

Indirect Impacts: Given the nature of the proposed action for this alternative and the fact that EFH is not present within the Project Area, no indirect impacts would be anticipated from the non-structural alternative.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of implementing and operating Alternative A plus the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. Given the determination that no direct or indirect impacts to EFH resources would be anticipated with the

implementation of Alternative A, the likelihood of any potential cumulative, adverse impacts associated with the implementation of this alternative would not be anticipated.

Alternative B

Direct Impacts: This alternative includes the construction of additional levee segments, and the associated and additional floodway clearing along the Pearl River channel. As previously noted, the stretch of the Pearl River through the Project Area includes the historic spawning habitat for the threatened Gulf sturgeon (*Acipenser oxyrhynchus desotoi*). In addition, USFWS and NMFS identified the Pearl River as a part of the Critical Habitat Unit 1, beginning at the Ross Barnett Reservoir spillway southward through the Project Area to the mouth of the Pearl River. However, the Project Area does not include any EFH so no potential direct, adverse impacts to EFH as the result of the implementation of Alternative B would be anticipated.

Indirect Impacts: Given the nature of the floodway clearing activities associated with this alternative, indirect impacts to potential Gulf sturgeon spawning habitat could be anticipated. However, the presence of any Gulf sturgeon within the Project Area cannot be confirmed due to the limited study efforts that have taken place. More importantly, the Project Area does not contain EFH and therefore, no indirect impacts would be anticipated with the implementation of Alternative B.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of implementing and operating Alternative B on the EFH, as well as the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. However, there would be no direct impacts or indirect impacts on the EFH since no designated EFH is present within the Project Area. Given this, the cumulative impacts on the EFH within the Project Area would be similar to those anticipated for the future without the project conditions (No Action Alternative) and therefore, would not be anticipated.

Alternative C

Direct Impacts: Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. As noted, the length of the Pearl River through the Project Area is included in the Critical Habitat Unit 1 designation for the Gulf sturgeon. However, the NMFS has not designated any EFH within the Project Area. Alternative C includes excavation for the channel improvements and the relocation of the existing weir structure within the Pearl River channel and adjacent areas. Although the Project Area is designated as Critical Habitat for the sturgeon, direct impacts to EFH would not be anticipated since EFH is not present within the Project Area.

Indirect Impacts: Given the nature of the channel excavation activities associated with this alternative, indirect impacts to potential Gulf sturgeon spawning habitat could be anticipated.

However, the presence of any Gulf sturgeon within the Project Area cannot be confirmed due to the limited study efforts that have taken place. More importantly, the Project Area does not contain EFH and therefore, no indirect impacts to EFH would be anticipated with the implementation of Alternative C.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of implementing and operating Alternative C on the EFH, plus the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. The Critical Habitat designation for the Gulf sturgeon within the Project Area is a primary consideration as it regards the assessment of the potential adverse impacts associated with the implementation of Alternative C. However, the lack of any designated EFH within the Project Area would not lead to any adverse effects to EFH from the implementation of Alternative C.

SUMMARY OF IMPACTS ESSENTIAL FISH HABITAT (EFH)

Alternative A (Non Structural):
No significant impacts to EFH are anticipated
Alternative B:
No significant impacts to EFH are anticipated
Alternative C:
No significant impacts to EFH are anticipated

4.5.7 THREATENED AND ENDANGERED SPECIES

Alternative A

Direct Impacts: This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. It proposes the buyout of approximately 3,100 structures, including homes, businesses, government and public buildings, schools, and hospitals. Two threatened aquatic species as listed by the USFWS are either known or thought to occur within the limits of the Project Area. The two listed species include the threatened Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), discussed in Section 4.5.6 and the threatened ringed sawback turtle (*Graptemys oculifera*). Also, on May 4, 2015, the USFWS issued the Interim Final 4(d) Rule under the ESA relative to the protection of the Northern Long-eared Bat (*Myotis septentrionalis*). The interim rule includes the project area within the current buffer zone for the summer hibernation area for the NLEB. In 2017, the USFWS added the Wood stork, (*Mycteria Americana*), a threatened species, to the listing for the entire state of Mississippi. Though no known nesting locations are present within the Project Area, suitable habitat is present.

As noted, the American bald eagle (*Haliaeetus leucocephalus*) is known to frequent portions of the Pearl River Watershed and particular areas around the Ross Barnett Reservoir. A new nest site was identified by the MDWFP in 2017 located adjacent to the southeast portion of the Project Area. The Louisiana black bear (*Ursus americanus luteolus*) could also frequent the Project Area but no sightings have ever been recorded. The bald eagle and the Louisiana black bear have both been removed from the threatened and endangered species listing. Given these factors, potential impacts to the species referenced above were not further evaluated. Additionally, while the Pearl Darter (*Percina aurora*) was historically present within the Pearl River drainage basin, the USFWS has determined it has been extirpated within the river system. Therefore, potential impacts to this species were also not further evaluated.

Since Alternative A involves non-structural relocation of existing affected structures and would have no direct impact on the Pearl River channel, no direct impacts to the two listed aquatic species or their habitats would be anticipated. In addition, the potential clearing activities that could be associated with the relocation of the existing structures could potentially have direct, adverse impacts to the NLEB summer habitat within the area. However, these potential direct, adverse impacts would be considered as minor in intensity and short-term in duration given the preponderance of available habitat within the general project area.

***Indirect Impacts**:* Given the nature of the proposed action for this alternative, no indirect impacts to the two listed aquatic species or their habitats would be anticipated from the non-structural alternative. However, the existing weir at the J. H. Fewell Water Treatment Plant site would stay in place and would still be an impediment to the upriver migration of the sturgeon. In addition, the available summer habitat for the NLEB and the potential nesting habitat for the Wood stork within the project area is sufficient. Therefore, the potential indirect, adverse impacts for all four species would be considered as minor in intensity and short-term in duration.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of implementing and operating Alternative A, as well as the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. As noted, the potential direct and indirect adverse effects on the two listed aquatic species would be minor and short-term from the implementation of Alternative A. Likewise, any potential cumulative adverse impacts to the summer habitat for the NLEB or potential nesting habitat for the Wood stork within the project area would also be considered as minor in intensity and short-term in duration.

Alternative B

***Direct Impacts*:** This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. Two threatened

aquatic species as listed by the USFWS are either known or thought to occur within the limits of the Project Area. The two listed species include the threatened Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), discussed in Section 4.5.6, and the threatened ringed sawback turtle (*Graptemys oculifera*). As noted, on May 4, 2015, the USFWS issued the Interim Final 4(d) Rule under the ESA relative to the protection of the Northern Long-eared Bat (*Myotis septentrionalis*). The interim rule includes the project area within the current buffer zone for the summer hibernation area for the NLEB. In 2017, the USFWS added the Wood stork, (*Mycteria Americana*), a threatened species, to the listing for the entire state of Mississippi. Though no known nesting locations are present within the Project Area, suitable habitat is present.

As noted, the American bald eagle (*Haliaeetus leucocephalus*) is known to frequent portions of the Pearl River Watershed and particular areas around the Ross Barnett Reservoir. A new nest site was identified by the MDWFP in 2017 located adjacent to the southeast portion of the Project Area. The Louisiana black bear (*Ursus americanus luteolus*) could also frequent the Project Area but no sightings have ever been recorded. The bald eagle and the Louisiana black bear have both been removed from the threatened and endangered species listing. Given these factors, potential impacts to the species referenced above were not further evaluated. Additionally, while the Pearl Darter (*Percina aurora*) was historically present within the Pearl River drainage basin, the USFWS has determined it has been extirpated within the river system. Therefore, potential impacts to this species were also not further evaluated.

Alternative B includes the construction of additional levee segments and the clearing of floodway areas along the Pearl River channel. Given this, no direct benefits or impacts to the Gulf sturgeon or any Gulf sturgeon habitat in the Project Area would be anticipated given the fact that this alternative does not involve any manipulation of or direct impacts to the Pearl River channel. Therefore, any potential direct, adverse impacts to the Gulf sturgeon habitat would be minor and short-term in duration.

Alternative B will impact approximately 47.0 acres of existing open water habitat primarily associated with the levee segments construction and the associated filling activities. Given the nature of the ringed sawback turtle and Wood stork habitat, direct impacts to the available habitat within the Project Area would be anticipated by the filling activities and the associated conversion in basking and feeding habitat within the project area. As a result, the direct, adverse impacts to the ringed sawback turtle and the potential Wood stork habitat would be minor in intensity and long-term in duration.

The clearing activities and associated conversion of the forestland habitat associated with the construction of the levee segments and the floodway clearing could potentially have direct, adverse impacts to available summertime habitat for the NLEB. However, substantial quantities of available NLEB summertime habitat are present within the Project Area. Therefore, the

potential direct, adverse impacts to the NLEB summertime habitat within the Project Area with the implementation of Alternative B would be minor in intensity but long-term in duration.

Indirect Impacts: Given the nature of the floodway clearing activities associated with this alternative, indirect impacts to the two listed aquatic species and their habitats would be anticipated. As noted, the floodway clearing activities will include the removal of all of the tree species within the floodway clearing limits. Much of the clearing activities would take place along the banks of the Pearl River channel. Given this, increases in water temperatures within the river would be anticipated, especially during the summer months, which is associated with both the Gulf sturgeon spawning period and the ringed sawback turtle nesting period. In addition, the turtle populations utilize the river channel for feeding and basking year-round and some level of indirect impacts would be attributed to the floodway clearing activities. However, the significance of these potential indirect impacts to the listed species and their habitats within the Project Area would be difficult to estimate or quantify. In addition, the potential presence of any Gulf sturgeon within the Project Area cannot be confirmed. Moreover, the existing weir at the J. H. Fewell Water Treatment Plant site would remain in place as an impediment to any upriver migration of the Gulf sturgeon. Given these conditions, the indirect, adverse impacts on both the aquatic species would be considered as minor in intensity but long-term in duration.

Potential summertime habitat for the NLEB and potential nesting habitat for the Wood stork (*Mycteria Americana*) exists within the Project Area outside the areas of direct impact discussed above. As a result, the direct, adverse impacts associated with the forestland clearing activities would not lead to significant indirect, adverse impacts on the NLEB or Wood stork habitat within the Project Area. As a result, the potential indirect, adverse impacts to the NLEB habitat or Wood Stork habitat associated with the implementation of Alternative B would be minor and short-term in duration.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct (~47.0 acres) and indirect impacts of implementing and operating Alternative B on the listed species and their habitats plus the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. As discussed, the direct, adverse impacts to the Gulf sturgeon within the Project Area would be minor and short-term in duration. Likewise, the direct, adverse impacts to the ringed sawback turtle, the NLEB, and the Wood stork would be minor but long-term in duration within the Project Area. The indirect, adverse impacts within the Project Area for both the listed aquatic species would be minor but long-term in nature. Indirect, adverse impacts associated with the habitat conversion on the potential NLEB summertime habitat and the potential Wood stork nesting habitat would be minor but short-term in duration given the amount of available habitat. From the standpoint of cumulative adverse impacts within the Pearl River Watershed, the effects are considered as minor in

duration and potentially long-term in duration for all three species and habitats that were evaluated. The available downstream habitat available to the Gulf sturgeon is substantial as is the upstream and downstream habitat for the ringed sawback turtle. Additionally, the amount of potential available summertime habitat for the NLEB and overall nesting habitat for the Wood stork within the Pearl River Watershed is substantial and potential impacts would be extremely minimal.

Alternative C

Direct Impacts: Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. Two threatened aquatic species as listed by the USFWS are either known or thought to occur within the limits of the Project Area. The two listed species include the threatened Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), discussed in Section 4.5.6, and the threatened ringed sawback turtle (*Graptemys oculifera*). Additionally, on May 4, 2015 the USFWS issued the Interim Final 4(d) Rule under the ESA relative to the protection of the Northern Long-eared Bat (*Myotis septentrionalis*). The interim rule includes the project area within the current buffer zone for the summer hibernation area for the NLEB. In 2017, the USFWS added the Wood stork, (*Mycteria Americana*), a threatened species, to the listing for the entire state of Mississippi. Though no known nesting locations are present within the Project Area, suitable habitat is present.

As noted, the American bald eagle (*Haliaeetus leucocephalus*) is known to frequent portions of the Pearl River Watershed and particular areas around the Ross Barnett Reservoir. A new nest site was identified by the MDWFP in 2017 located adjacent to the southeast portion of the Project Area. The Louisiana black bear (*Ursus americanus luteolus*) could also frequent the Project Area but no sightings have ever been recorded. The bald eagle and the Louisiana black bear have both been removed from the threatened and endangered species listing. Given these factors, potential impacts to the species referenced above were not further evaluated. Additionally, while the Pearl Darter (*Percina aurora*) was historically present within the Pearl River drainage basin, the USFWS has determined it has been extirpated within the river system. Therefore, potential impacts to this species were also not further evaluated.

Alternative C includes the excavation of the existing Pearl River to provide channel improvements and the associated fill activities for the dredge disposal material. Alternative C also includes the construction of a relocated weir structure at the lower-end of the channel improvements excavation area.

The Gulf sturgeon historically utilized the Pearl River and may use other major rivers that flow into the Gulf of Mexico for spawning. Based upon the most recent studies that have been performed, two weir structures in the lower reaches of the Pearl River are presently thought to

impede the upstream migration of the sturgeon. In addition, an existing weir structure at the J. H. Fewell Water Treatment Plant site further impedes migration through the Project Area. Though the stretch of the Pearl River through the Project Area was previously designated as Critical Habitat for the Gulf sturgeon, very limited study efforts have taken place since that designation and therefore, very limited data exists relative to the utilization of the upstream limits of the river channel given the presence of the existing weir structures.

It can be assumed that the construction of the proposed weir structure as a part of the Alternative C project features could lead to direct, adverse impacts on the historical Gulf sturgeon spawning habitat within the Project Area relative to prior historic migration patterns. However, the most recent ongoing study efforts seem to indicate that the historic migration patterns are limited to the portions of the Pearl River below the two weir structures miles south of the Project Area. Even still, design considerations can be incorporated on the relocated weir structure that could provide a passageway for the Gulf sturgeon that will help minimize any direct impacts to sturgeon spawning habitat in and upstream of the Project Area as a part of the adaptive management. In addition, the existing weir at RM290.7, the location of the J. H. Fewell Water Treatment Plant site, would be removed.

The Gulf sturgeon utilizes a riverine environment as their spawning habitat. Alternative C includes channel improvements that would alter the existing riverine environment. However, due to past dredging projects of the USACE and state government subdivisions, the existing conditions within much of the river channel through the Project Area would not be considered as preferred habitat by either listed aquatic species. In addition, the relocated weir structure will be designed to maintain the existing flows within the river channel and, would provide a riverine environment that the sturgeon could utilize if the historic upstream migration patterns were to resume. Also, the project would include the implementation of an adaptive management plan that would include monitoring functions and the ability to provide alternative measures and/or structures that would insure that the Gulf sturgeon migration into and through the Project Area is available, post-project construction. Given this, it can be assumed that no overall habitat loss would be incurred with the proposed project construction; therefore, direct, adverse impacts to the Gulf sturgeon habitat within the Project Area would be considered as minor in intensity and long-term in duration.

As discussed, the ringed sawback turtle exists within the Study Area, both upstream and downstream of the Project Area. This turtle lives within the Pearl River channel and the tributaries, oxbow lakes, and sloughs that connect to the river within the Project Area. Importantly, the turtle utilizes the accretions or sandbars along the river channel as nesting habitat. The river channel, tributaries, oxbow lakes and sloughs are utilized as feeding and basking habitat.

As noted, Alternative C includes the excavation activities for the channel improvements and the construction of the weir structure at the lower end of the excavated channel improvements area. As a result of this, Alternative C would have some direct, adverse impact on ringed sawback turtle populations and habitat within the Project Area.

For several years, the MDWFP Museum of Natural Science staff has conducted surveys on the ringed sawback turtle populations within the Pearl River in close proximity to the Project Area, specifically on the segment of the Pearl River north of MS Hwy 25 and north of the proposed Project Area. There are additional study and survey areas in the upper reaches of the Pearl River, north of the Ross Barnett Reservoir and several miles downstream of the Project Area. However, most of the stretch of the Pearl River encompassing the Alternative C Project Area has not been included in the MDWFP monitoring and survey areas. Apparently, existing low water conditions within the stretch of the river that was previously dredged and channelized, along with the associated limited amount of suitable nesting habitat within this portion of the river has resulted in lower ringed sawback turtle population numbers and therefore, less than suitable habitat conditions and utilization. Given this, the exact extent of the turtle population within the Project Area has not been fully established by the MDWFP or USFWS during ongoing monitoring events.

The preponderance of the Pearl River through the Alternative C Project Area was dredged and channelized as a part of a past flood control project. As a result, much of the historic ringed sawback turtle habitat through the Project Area was modified and the vast majority of nesting habitat no longer exists within this stretch of the river. Though the MDWFP and USFWS believe ringed sawback turtles are present and utilize this stretch of the river, survey efforts have been limited and the extent of the population within the Project Area is not known at this time. In addition, the channel improvements will in essence enlarge the existing Pearl River channel and continue to provide habitat for both listed species. Additionally, the relocated weir structure will provide a means to maintain the existing hydrologic flows and water levels within the channel improvements area.

As noted, the assumption can be made that direct, adverse impacts to both listed aquatic species habitats will occur with the implementation of Alternative C. However, based upon available data and the assessment of existing conditions present within the Project Area and the Pearl River Watershed, particularly the two existing downstream weirs, the extent of the direct, adverse impacts within the Project Area on the two threatened aquatic species are thought to be minor in intensity and long-term in duration.

The implementation of Alternative C would include the clearing of a substantial amount of existing forestland habitat within the Project Area that could be potential summertime habitat for the NLEB. Though the significance of the available habitat utilization by the NLEB is not known at this time, the potential available habitat does exist within the Project Area. In addition, the

availability of suitable NLEB habitat within close proximity to the Project Areas is also substantial. As a result the potential direct, adverse impacts to the available NLEB habitat within the Project Area would be minor in intensity and long-term in duration.

The implementation of Alternative C would also include the conversion of a limited amount of existing slough habitat into open water habitat. The existing slough habitat could be considered as available nesting habitat for the Wood stork. Though the utilization of any available nesting habitat by the Wood stork is not known at this time, the potential available habitat is present within the Project Area. As a result, the potential direct, adverse impacts to the available Wood stork nesting habitat with the Project Area would be minor in intensity and long-term in duration.

Indirect Impacts: Given the fact that the weir structure is included in the Alternative C plans, the potential for indirect, adverse impacts to the Gulf sturgeon exists with the implementation of this alternative. The relocated weir structure would be constructed at the lower end of the channel improvements area and could serve as a restriction to Gulf sturgeon passage through the Project Area and the remainder of the Pearl River channel upstream to the Ross Barnett Reservoir spillway. However, as noted, a weir structure already exists within the Project Area at RM 290.7 and minimal to normal flow levels through the river channel below the existing weir structure already restricts upstream migration. The construction of Alternative C, including relocation of the existing weir, could improve the potential sturgeon upstream migration beyond the existing weir location.

As noted, the MDWFP has conducted surveys and ongoing monitoring of the ringed sawback turtle population upstream of the Alternative C Project Area, from the MS Hwy 25 bridge to the Ross Barnett Reservoir spillway. As further noted, limited survey efforts have taken place within the stretch of the river through the Project Area. As a result, the population of the ringed sawback turtle within the river through the Alternative C Project Area is relatively unknown. However, both the MDWFP and USFWS believe that the turtles utilize this stretch of the river for at least feeding and basking habitat. Given this, there is a potential for some level of indirect, adverse impacts to the ringed sawback turtle population with the construction of the relocated weir structure due to the potential limitation to turtle passage upstream and downstream of the weir structure. The extent of the indirect impacts relative to the turtle populations within the Project Area and both upstream and downstream of the Project Area would be considered limited. Given this, the potential indirect, adverse impacts to both the listed aquatic species within the Project Area, downstream and upstream of the Project Area would be minor in intensity and long-term in duration.

The potential indirect, adverse impacts on the NLEB habitat within the Project Area would be limited to the time period when the clearing activities take place and associated with any potential relocation of NLEBs that might utilize the habitat within the clearing areas to adjoining

habitats. Given this, the potential indirect, adverse impacts to the NLEB habitat within the Project Area would be minor in intensity and short-term in duration. The same can be anticipated for the potential available nesting habitat for the Wood stork. If there is in fact any nesting activity taking place, the potential indirect, adverse impacts to the Wood stork nesting habitat within the Project area would also be minor in intensity and short-term in duration.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect, adverse impacts of implementing and operating Alternative C on the species discussed above within the Pearl River, as well as the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. However, there would be minor, direct, adverse impacts to the two listed aquatic species, and the significance of the indirect impacts both upstream and downstream of the Project Area on the two listed aquatic species would also be minor.

As previously noted, the limited amount of research conducted on the Gulf sturgeon upstream migration patterns to the extent of the Pearl River within the Project Area indicates that the historic migration patterns may no longer exist beyond the two weir structures on the lower Pearl River. In addition, limited survey efforts regarding the ringed sawback turtle populations and habitats within the stretch of the Pearl River through the project area also indicate limited utilization due to the degradation of the habitat within the Project Area. Based upon the limited study efforts that have taken place, the potential cumulative adverse effects on both species within the Pearl River Watershed in total would be expected to be limited. Given this, the cumulative impacts on the two listed aquatic species and their habitats with the construction of Alternative C would be minor in intensity and long-term in duration.

The potential for cumulative adverse impacts on the NLEB and Wood stork populations and habitats within the Project Area are, at present, based upon the presence of the available habitats with limited to non-existent data about the actual utilization of the available habitats by populations of either species. In relative terms, the extent of the available summertime habitat for the NLEB and overall nesting habitat for the Wood stork throughout the Pearl River Watershed is substantial. As a result, the potential cumulative adverse impacts on the NLEB and Wood stork would be minor in intensity but long-term in duration.

SUMMARY OF IMPACTS ON THREATENED AND ENDANGERED SPECIES

Alternative A (Non Structural):

- No significant impacts on threatened and endangered aquatic species
- Clearing activities could have minor impacts on the summer habitat of the Northern Long-eared Bat
- Continued impediment of upriver migration of the Gulf Sturgeon by the existing J. H. Fewell Water Treatment Plant weir

Alternative B:

- No significant impacts on threatened and endangered aquatic species
- Potential for impact on ringed sawback turtle habitat due to filling activities and the associated conversion of basking and feeding habitat
- Potential for impact on summer habitat of the Northern Long-eared bat
- Potential for impact on nesting habitat for the Wood stork

Alternative C:

- Excavation activities for channel improvements and relocation of the weir could have some direct, adverse impacts on ringed sawback turtle populations
- Clearing of substantial existing forestland habitat could impact habitats for the Northern Long-eared bat
- Clearing and filling of existing slough habitats could potentially impact nesting habitats for the Wood stork
- Relocation of the weir structure could impact Gulf Sturgeon migration

4.5.8 WETLANDS AND "OTHER WATERS OF THE U.S."

Alternative A

Direct Impacts: This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. Alternative A includes the proposed elevation or relocation of existing structures within the flood affected areas. It proposes the buyout of approximately 3,100 structures, including homes, businesses, government and public buildings, schools, and hospitals. Given this, the potential for direct, adverse impacts to wetlands and "other waters of the U.S." would be negligible with the implementation of Alternative A. Therefore, no significant direct impacts would be anticipated. However, there is the potential for impacts on wetlands and "other waters of the U.S." in potential relocation areas. As a result, the direct, adverse impacts associated with the implementation of this alternative would be considered as minor and long-term in duration.

Indirect Impacts: The same can be stated for any potential indirect impacts. Given the nature of the proposed action, no indirect impacts to wetlands and "other waters of the U.S." would be anticipated as a result of the implementation of Alternative A.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of implementing and operating Alternative A, as well as the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. Given the determination that direct or indirect, adverse impacts to wetlands and "other waters of the U.S." would not be likely with the Alternative A implementation, potential cumulative adverse impacts would be anticipated to be minor in intensity, long-term in duration, and specifically associated with potential impacts at relocation areas.

Alternative B

Direct Impacts: This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. During 2014, an updated Wetlands Delineation and Determination Report was completed on the overall Project Area which addressed all three alternatives. A copy of the Wetlands Delineation and Determination Report and a copy of the Preliminary Jurisdictional Determination issued by the USACE Vicksburg District Regulatory Branch, Enforcement Section are included in Appendix D. Based upon the updated wetlands delineation and determination, Alternative B would have direct impacts to a total of approximately 386.72 acres of wetlands and "other waters of the U.S.". Of this total, approximately 89.88 acres would be filled as a part of the proposed levee segments construction, and an additional approximately 135.49 acres would be cleared and converted to a grassland habitat along the levee alignments and maintained in that state through time as the levee segments right-of-way.

In addition to the actual levee segments construction, Alternative B also proposes clearing floodway areas along the Pearl River. These cleared floodways contain approximately 161.35 acres that would be converted from the current habitat types to a primarily scrub shrub habitat and the floodway clearing areas would be maintained in this habitat type through time. These floodway clearing areas would still be considered jurisdictional wetlands and "other waters of the U.S.". However, the existing habitat types would be converted to the scrub shrub habitat, and the floodway clearing areas would be maintained in this habitat type through time. The direct impacts would be offset through mitigation measures as a part of the Alternative B project implementation. Given the extent of the impacts to the jurisdictional wetlands and “other waters of the U.S.”, the direct, adverse impacts would be minor in intensity and long-term in duration.

Indirect Impacts: Given the nature of the proposed action for Alternative B, no significant indirect impacts to wetlands and "other waters of the U.S." would be anticipated by the

implementation of this project. There could be additional wetland impacts in connection with the storage areas for the pump structures. In addition, the added level of flood protection that would be afforded by the project construction could also lead to additional indirect, adverse impacts associated with future development activities within protected area. Project design for Alternative B assumes that borrow material to be utilized in construction of the levee segments would come from upland sources outside of the Pearl River drainage watershed. As a result, any potential indirect, adverse impacts would be minor and short-term in duration.

Cumulative Impacts: Cumulative impacts associated with the implementation of Alternative B would be the incremental direct impacts (~386.72 acres) and the indirect impacts of implementing and operating Alternative B on wetlands and "other waters of the U.S.," as well as the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. The implementation of Alternative B would result in direct, adverse impacts to jurisdictional wetlands and “other waters of the U.S.” that are cumulative in nature, specifically as it relates to the total impacts that have and most likely will continue to occur within the project area. The potential for indirect, adverse impacts associated with the added level of flood protection within the area and the potential future development also exist. Given this, the potential cumulative, adverse impacts within the Project Area associated with the Alternative B construction would be considered as moderate in intensity and long-term in duration. However, the extent of these anticipated direct and indirect, adverse impacts relative to the Pearl River Watershed, and the cumulative adverse impacts associated with the watershed, would be minor and long-term in duration.

Alternative C

***Direct Impacts*:** Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. During 2014, an updated Wetlands Delineation and Determination Report was completed on the overall Project Area which addressed all three alternatives. A copy of the Wetlands Delineation and Determination Report and a copy of the Preliminary Jurisdictional Determination issued by the USACE Vicksburg District Regulatory Branch, Enforcement Section are included in Appendix D. Based upon this study, a total of approximately 1,861.24 acres of wetlands and "other waters of the U.S." would be impacted with the implementation of Alternative C.

Of the total acres of impacts, approximately 1,395.56 acres would be impacted by the excavation activities associated with the proposed channel improvements. Approximately 465.68 acres would be impacted by the dredge disposal fill areas placed along the shoreline. The channel excavation would also result in the creation of an additional approximately 1,901.0 acres of "other waters of the U.S.".

The dredge disposal fill areas were determined following the completion of the wetlands delineation and determination, in order to minimize or avoid wetlands and "other waters of the U.S." to the extent practical. Direct impacts would be further mitigated as a part of the overall project implementation. Based upon the extent of the anticipated impacts to jurisdictional wetlands and "other waters of the U.S.", the direct, adverse impacts associated with the Alternative C construction would be major in intensity and long-term in duration within the Project Area.

Indirect Impacts: Given the nature of the proposed action for Alternative C, no specific significant indirect, adverse impacts to wetlands and "other waters of the U.S." would be anticipated by the implementation of this project. The extent of the Project Area associated with Alternative C was minimized to the extent possible and, at the same time, to meet the project purpose thereby avoiding or minimizing any indirect impacts to wetlands and "other waters of the U.S." In addition, the added level of flood protection that would be afforded by the project construction could also lead to additional indirect, adverse impacts associated with future development activities within protected areas. Given this, the anticipated potential indirect impacts would be minor in intensity and long-term in duration.

Cumulative Impacts: Cumulative impacts associated with the implementation of Alternative C would be the incremental direct impacts (~1,861.24 acres) and the indirect impacts of implementing and operating Alternative C on wetlands and "other waters of the U.S." plus the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. The implementation of Alternative C would result in direct, adverse impacts to jurisdictional wetlands and "other waters of the U.S." that are cumulative, specifically as it relates to the total impacts that have and most likely will continue to occur within the project area. The potential for indirect, adverse impacts associated with the added level of flood protection within the area and the potential future development also exist. Given this, the potential cumulative adverse impacts within the Project Area associated with the Alternative C construction would be considered as major in intensity and long-term in duration. However, the extent of these anticipated direct and indirect, adverse impacts relative to the Pearl River Watershed and the cumulative adverse impacts associated with the watershed would be moderate in intensity and long-term in duration.

SUMMARY OF IMPACTS ON WETLANDS AND "OTHER WATERS OF THE U.S."

Alternative A (Non Structural):

- No significant impacts on wetlands and "other waters of the U.S." in Project Area.
- Potential for impacts on wetlands and "other waters of the U.S." in potential relocation areas.

Alternative B:

- Anticipated direct impacts for approximately 386.72 acres of wetlands and "other waters of the U.S." including filling and clearing.
- Offset of impacts through mitigation measures.
- Potential for additional wetland impacts in connection with storage areas of pump structures.

Alternative C:

- Approximately 1,861.24 acres impacted by proposed channel improvements and dredge disposal fill areas.
- Offset of impacts through mitigation measures.
- Creation of additional 1,901.0 acres of "other waters of the U.S."

4.5.9 CULTURAL AND HISTORIC RESOURCES

Alternative A

Direct Impacts: This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. It proposes the buyout of approximately 3,100 structures, including homes, businesses, government and public buildings, schools, and hospitals. Alternative A, the non-structural approach, would include relocating or elevating existing structures within portions of the affected flood area. None of the structures that would be relocated or elevated are designated historical structures or designated historical sites. Site disturbance associated with this alternative would not impact any known cultural or historical sites or structures. Given this, Alternative A would not have any anticipated direct, adverse impact on any known cultural or historic resources.

Indirect Impacts: Given the nature of the proposed action for this alternative, no indirect impacts to cultural or historic resources would be anticipated. The possibility does exist that structures which would be relocated could result in off-site impacts to cultural or historic resources, but the likelihood of that happening would be minimal. Therefore, the potential indirect, adverse impacts would be minor in intensity and short-term in duration.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of implementing and operating Alternative A, as well as direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. Given the determination that direct or indirect, adverse impacts to cultural or historic resources would not be likely with the Alternative A implementation, potential cumulative adverse impacts anticipated would be minor and short-term in duration.

Alternative B

Direct Impacts: This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. As noted, a Phase I Cultural Resources Survey was completed on the Jackson MSA in 2006. Several archaeological or historical sites were assessed within the project vicinity. Based upon reviews conducted and subsequent coordination with the Mississippi Department of Archives and History (MDAH), the project design for Alternative B took into consideration the location of all known cultural and historical sites within the Project Area. This coordination determined that three sites eligible for the National Register of Historic Places (NHRP) and one site currently listed in the NHRP is located within the footprint of one of Alternative B. Given this, direct adverse impacts to cultural and historic resources would be anticipated with the implementation of Alternative B. These potential direct, adverse impacts would be moderate in intensity and long-term in duration.

Indirect Impacts: The construction activities associated with the implementation of Alternative B are such that the impacts would be limited to the specific footprint of the levee segments and the locations for each of the clearing areas. Given this, no specific indirect impacts would be anticipated as a result of the project construction utilizing this alternative. However, the higher degree of flood protection that would be provided through the implementation of Alternative B could lead to further development within the protected areas. These future development activities could have potential indirect, adverse impacts on cultural or historic resources. These potential impacts can be minimized through avoidance measures. Therefore, any anticipated indirect, adverse impacts would be minor and short-term in duration.

Cumulative Impacts: Cumulative impacts for Alternative B would be the incremental direct and indirect impacts of implementing this alternative, as well as the direct and indirect impacts to cultural and historic resources by other previous, existing and authorized projects within the Pearl River Watershed. As noted, the construction of Alternative B could have direct, adverse impacts on three cultural resource sites eligible for the NHRP and one site currently listed in the NHRP. In addition, potential indirect, adverse impacts associated with future development activities associated with the improved flood protection could be anticipated. However, all efforts to avoid potential impacts were made during the project design stage. As a result, the

cumulative adverse impacts associated with the implementation of Alternative B would be minor in intensity and long-term in duration.

Alternative C

Direct Impacts: Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. As is the case with Alternative B, the design criterion for Alternative C takes into consideration the findings of the Phase I Cultural Resources Survey relative to the location of the known cultural and historic sites within the project vicinity. As a result of the coordination with the MDAH, three sites have been determined to be eligible for the NHRP within Alternative C. During final design, two of these sites (22Ra502 and 22Ra693) will be avoided and not impacted. The remaining site (22Ra689) will be strongly taken into consideration during the final design and avoided if possible. As is the case with any project such as this, there is the potential that unknown cultural or historic sites might exist beyond what was previously known to occur or that were determined to be present as a result of the Phase I Cultural Resources Survey that was completed. In the event additional sites are located during construction, the direct impacts would be minimized through avoidance and further coordination with MDAH. Further, if additional surveys are required, they will be completed prior to construction. Given this, the potential for direct, adverse impacts would be minor in intensity and short-term in duration.

Indirect Impacts: As was the case with Alternative B, the construction activities associated with the implementation of Alternative C are such that the impacts would be restricted to the specific footprint of the channel improvements excavation activities, the dredge disposal material disposal areas, and the weir construction location. The potential exists for indirect impacts to any unknown sites during construction. In the event this happens, construction activities would be suspended until those situations are rectified and further coordination among involved parties takes place. However, the higher degree of flood protection that would be provided through the implementation of Alternative C could lead to further development within the protected areas which have been addressed. These potential impacts can be minimized through avoidance measures. Therefore any anticipated indirect, adverse impacts would be minor and short-term in duration.

Cumulative Impacts: Cumulative impacts for Alternative C would be the incremental direct and indirect impacts of implementing this alternative, as well as the direct and indirect impacts to cultural and historic resources by other previous, existing and authorized projects within the Pearl River Watershed. Based upon the survey completed and the subsequent coordination processes, no significant direct or indirect impacts would be anticipated. In addition, potential indirect, adverse impacts associated with future development activities associated with the improved flood protection could be anticipated. However, all efforts to avoid potential impacts

will be made during the project design stage. As a result, the cumulative adverse impacts associated with the implementation of Alternative C would be minor in intensity and long-term in duration.

SUMMARY OF IMPACTS ON CULTURAL AND HISTORIC RESOURCES

Alternative A (Non Structural):

- No impact on cultural or historic resources
- Minimal potential impact of offsite cultural and historic resources caused by relocation of existing onsite structures

Alternative B:

Direct impacts to three NHRP eligible sites and one NHRP listed site as they are located within the footprint of Alternative B

Alternative C:

- Three NHRP eligible sites known within Alternative C. Two sites will be avoided during final design and one site will be avoided if possible. No direct impacts expected to known resources as a result of channel improvement excavation activities, the dredge material disposal areas,

4.5.10 RECREATIONAL RESOURCES

Alternative A

Direct Impacts: This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. It proposes the buyout of approximately 3,100 structures, including homes, businesses, government and public buildings, schools, and hospitals. Alternative A, the non-structural approach, would include relocating or elevating existing structures within portions of the affected flood area, primarily within more developed commercial, retail, and residential areas. Any site disturbance associated with this alternative would not impact any recreational activities that take place within the Project Area. Given this, Alternative A would not have any direct impact on recreation resources.

Indirect Impacts: Given the nature of the proposed action for this alternative, no indirect impacts to recreation resources would be anticipated from the non-structural alternative. The possibility exists that any structures that would be relocated would result in off-site impacts to recreation resources but the likelihood of that happening would be minimal. Therefore, the potential for indirect, adverse impacts associated with this alternative would be minor in intensity and short-term in duration.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of implementing and operating Alternative A, as well as the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. Given the determination that direct or indirect impacts to recreation resources would not be likely with the Alternative A implementation, any anticipated cumulative adverse impacts would be minor in intensity and short-term in duration.

Alternative B

Direct Impacts: This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. The primary recreational activities found within the Project Area include consumptive activities such as fishing and, to a limited degree, hunting. The primary non-consumptive recreational opportunities include hiking, canoeing, boating, outdoor photography, bike and ATV riding, and observing nature. LeFleur's Bluff State Park is also located in the Project Area.

Based upon the design criteria, Alternative B would have limited direct impacts on recreation resources. It can be assumed that some consumptive activities, such as hunting, would be impacted, primarily within the levee segments right-of-way. Other direct impacts would be anticipated on non-consumptive recreational activities, including hiking, outdoor photography, and observing nature. Other outdoor recreational activities associated with the Pearl River itself would not be directly impacted by this alternative. However, access to the property in which the levee project would be located and the Pearl River itself is extremely limited so the potential for any positive impacts associated with this alternative would be negligible to non-existent. Given the nature of the project construction activities, direct, adverse impacts to the recreational resources within the Project Area would be minor in intensity and short-term in duration.

Indirect Impacts: Indirect impacts to outdoor recreational activities could be anticipated as well. Though fishing, boating, and canoeing activities on the Pearl River would not be directly impacted, some level of indirect, adverse impacts to recreational users of the Pearl River associated with the clearing activities within the proposed floodway areas along the Pearl River channel could be anticipated. Given the nature of the proposed floodway activities these indirect, adverse impacts would be considered as minor in intensity and long-term in duration.

Cumulative Impacts: Cumulative impacts for Alternative B would be the incremental direct and indirect impacts of implementing this alternative, as well as the direct and indirect impacts to the recreation resources by other previous, existing and authorized projects within the Pearl River Watershed. To a large degree, the location of the project, the difficulty of accessing the Project Area, and the limited access to the river itself does not lend itself to a significant level of

recreational use. Therefore, the overall cumulative adverse impacts to the recreational resources associated with Alternative B would be minor in intensity and long-term in duration.

Alternative C

Direct Impacts: Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. To a degree, the limited amount of consumptive outdoor recreational activities, such as hunting, will be directly impacted by the implementation of Alternative C. The conversion of the existing forestland and other terrestrial habitat types will limit the potential for consumptive uses, particularly uses such as hunting. Non-consumptive activities, such as hiking, outdoor photography, and wildlife viewing, would not be as directly impacted because current park areas, specifically the Lefleur's Bluff State Park area, will not be significantly impacted by the project implementation. At the same time, the conversion of the forestland and other habitat types that currently exist to a water habitat type will occur with the implementation of Alternative C. This alternative would increase water-dependent recreational opportunities, such as fishing, boating, and canoeing through additional public access such as boat ramps and marinas. Non-consumptive uses would increase because of the inclusion of multipurpose trails, wildlife viewing areas, amphitheaters, and campgrounds. Currently much of the existing water front area is difficult to access; the additional public access boat ramps and pedestrian access points associated with this alternative would create positive direct benefits to the recreation resources within the Project Area. Alternative C would improve access to the riverfront, increasing the opportunity for public recreational utilization.

There would be temporary limitations on all recreational activities during construction and some degree of long-term direct impacts on some current activities due to habitat conversion and other factors, but the longer term benefits from increased water-based activities should offset any significant direct impacts. As previously noted, an existing weir on the Pearl River within the Project Area provides an impediment to boating activities, but this weir will be relocated further downstream. Under this alternative, kayaking and canoeing would be improved with the inclusion of boat launches to provide access around the new weir structure. Given the conversion in recreational use types associated with this alternative and the limited access that now exists, the anticipated direct, adverse impacts to recreational resources would be minor in intensity and long-term in duration.

Indirect Impacts: The implementation of Alternative C would result in an overall shift from terrestrial to water-dependent activities within the Project Area. Though existing terrestrial based recreational opportunities are restricted because of limited access, the overall availability of these recreational activities would be improved with the project implementation. Alternative

C would include more public access to the river including additional boat ramps, public parks, and trails. Potential indirect impacts to the LeFleur's Bluff State Park and associated recreational activities would be minimized through the project design criteria. Given these factors, the overall indirect, adverse impacts from the implementation of Alternative C would be minor in intensity and long-term in duration.

Cumulative Impacts: Cumulative impacts for Alternative C would be the incremental direct and indirect impacts of implementing this alternative plus the direct and indirect impacts to recreation resources by other previous, existing and authorized projects within the Pearl River Watershed. There will be a shift, to a degree, in the types of recreational opportunities that are available post-construction with the significant shift in habitat with the channel improvements. At the same time, overall recreational activities, primarily those that are water-dependent, would increase. Given this, the cumulative adverse impacts associated with Alternative C would be considered minor and long-term in duration.

SUMMARY OF IMPACTS ON RECREATIONAL RESOURCES

Alternative A (Non Structural):
Minimal possibility exists for relocation of structures to result in offsite impacts of recreational resources

Alternative B:

- Potential exists for some consumptive activities to be impacted within levee segment rights-of-way
- Indirect impacts for recreational users of the Pearl River associated with the clearing activities within the proposed floodway areas could be anticipated

Alternative C:

- Potential exists for impacts of some consumptive activities, particularly hunting, with the conversion of existing forestland and other terrestrial habitat types
- Increases water dependent recreational opportunities
- Increases non-consumptive uses through the inclusion of multipurpose trails, wildlife viewing areas, amphitheaters, and campgrounds
- Positive impacts anticipated with the inclusion of additional public access boat ramps, pedestrian access points, and improved access to the Pearl River riverfront
- Temporary limitations on all recreational activities during construction

4.5.11 AESTHETICS AND VISUAL RESOURCES

Alternative A

Direct Impacts: This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. It proposes the buyout of approximately 3,100 structures, including homes, businesses, government and public buildings, schools, and hospitals. Alternative A, the non-structural alternative, involves raising or relocating existing affected structures within the flood impact areas. These structures, for the most part, are currently located within residential, commercial, and retail areas. Assuming that the affected areas would be restored to a forested habitat once the structures are removed, the further assumption can be made that the direct, adverse impacts from the implementation of Alternative A would be minor in intensity and short-term in duration.

Indirect Impacts: Given the nature of the proposed activities associated with this alternative, indirect impacts would not be anticipated. The potential does exist for indirect impacts to aesthetics and visual resources associated with the relocation sites but those locations have yet to be determined. As a result, the potential indirect impacts to aesthetics and visual resources would be minor in intensity and short-term in duration.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of implementing and operating Alternative A, as well as the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. Given the determination that direct or indirect impacts to aesthetics and visual resources would not be likely with the Alternative A implementation, the anticipated cumulative adverse impacts will be minor in intensity and short-term in duration.

Alternative B

Direct Impacts: This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. Direct impacts to the aesthetics and visual resources from the implementation of Alternative B would be anticipated. At present, much of the area where the levee segments would be constructed consists of forestland habitat. This is also the case with the proposed floodway clearing areas along the Pearl River. The area included within the levee segment alignments would be converted to a constructed levee and the associated cleared right-of-way on either side of the levee segments. These areas would be converted from the current, primarily forestland habitat to an upland grassland habitat-type, directly impacting the aesthetics and visual resources within the Project Area. In addition, the cleared floodways would likewise be converted from what is presently primarily forestland habitat to a scrub shrub habitat, which would also alter the current aesthetics and visual resources within the Project Area. As a result, the direct, adverse impacts

associated with the implementation of Alternative B would be moderate in intensity and long-term in duration within the Project Area.

Indirect Impacts: The same can be said for the indirect impacts associated with Alternative B. The clearing of the levee segments and floodway areas would also impact the aesthetics and visual resources for the adjoining properties. The viewscapes that currently exist from the adjoining properties would be altered and the ongoing maintenance associated with the converted habitats and associated viewscapes would lead to long-term indirect, adverse impacts of moderate intensity, specifically for the adjoining properties to the Project Area. The indirect impacts associated with these actions would also affect the existing aesthetics and visual resources found on the Pearl River, as well as indirectly impacting the recreational boating users that utilize the river.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of implementing and operating Alternative B plus the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. Based upon the proposed project design, there will be both direct and indirect impacts to the aesthetics and visual resources within the Project Area as a result of the clearing activities, the conversion of existing habitat types and the construction of the levee segments that would, in effect, change the existing viewscapes in many locations. Given this, the cumulative impacts associated with the implementation of Alternative B to the aesthetics and visual resources within the area, particularly as it relates to the recreational use on the Pearl River itself, would be considered moderate in intensity and long-term in duration.

Alternative C

Direct Impacts: Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. Alternative C will directly impact the existing aesthetics and visual resources within the Project Area. Much of the Alternative C Project Area is located within a more developed portion of the overall Project Area. Many years of urban sprawl with associated development activities and the previous flood control projects within the Project Area have directly impacted historic aesthetics and visual resources. Alternative C would include excavation activities for channel improvements to convert existing viewscapes from a more forestland habitat view to what would become an open water view.

Design considerations would be incorporated within the Alternative C project implementation to help avoid or minimize the overall significance of the direct, adverse impacts to the existing aesthetics and visual resources within the project area. Covenants would be utilized to help control land use and development along the riverfront and provide an additional level of protection for the viewscapes within the area. The exclusion from excavation and fill of some of

the proposed island areas within the project area will help offset some of the visual impacts from the proposed action. Additionally, while the existing viewscape will change, the proposed action will provide a different but visually pleasing viewscape within the Project Area post-construction that also offsets the magnitude of the direct impacts. Though the direct impacts to the existing viewscapes can be termed significant, the overall significance to the aesthetics and visual resources with the change in viewscapes in the Project Area would be moderate in intensity and long-term in duration.

Indirect Impacts: Alternative C will also have indirect impacts to the existing aesthetics and visual resources within the Project Area. Much of the viewscape that exists in the more northern portions of the Project Area is best defined as a forestland habitat. In the more southern portions of the Project Area, the current viewscape tends to be more urban-developed in nature and includes the existing floodways and levee systems. As is the case with the direct impacts, the indirect impacts to the adjoining properties will be the change of the current viewscape to a water view for most of the proposed Project Area. While the indirect impacts to adjoining properties are evident, the magnitude of the change in viewscapes would not be termed overly significant. As a result, the indirect, adverse impacts associated with the implementation of Alternative C would also be moderate in intensity and long-term in duration.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of implementing and operating Alternative C plus the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. Based upon the proposed project design, there will be both direct and indirect impacts to the aesthetics and visual resources within the Project Area as a result of the excavation activities associated with the channel improvements and the associated dredge disposal fill areas. The overall change in viewscapes within the Project Area is evident but the change in viewscapes to more of a water view is not necessarily considered to be a negative impact. Given this, the cumulative adverse impacts on aesthetic and visual resources associated with the implementation of Alternative C would be considered moderate in intensity and long-term in duration.

SUMMARY OF IMPACTS ON AESTHETICS AND VISUAL RESOURCES

Alternative A (Non Structural):

No significant impacts on aesthetics and visual resources

Alternative B:

- Impacts could be anticipated due to construction of levee segments in currently forested areas and clearing of floodways
- Current viewscapes for adjoining properties would be altered with ongoing associated maintenance

Alternative C:

- Proposed excavation activities for channel improvements would include converting existing viewscapes from forestland habitat to open water
- Covenants utilized to control land use and development along riverfront

4.5.12 NOISE

Alternative A

Direct Impacts: This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. It proposes the buyout of approximately 3,100 structures, including homes, businesses, government and public buildings, schools, and hospitals. The direct impacts associated with Alternative A would be short-term, minor, adverse impacts on noise levels at the specific structure elevation and/or relocation sites. The potential direct impacts would be present on a short-term basis during the construction period only. Given this, the intensity of the direct impacts to noise levels within the Project Area would not be considered significant.

Indirect Impacts: The same conditions can be stated for the indirect impacts from the implementation of Alternative A. The indirect impacts to the adjoining areas would be associated with the short-term increase in noise levels during the construction period only. There is also the potential for an increase in noise level during the construction period at the relocation sites that are chosen. As a result, the indirect, adverse impacts would be minor in intensity and short-term in duration.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of implementing and operating Alternative A, as well as the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. Given the determination that direct or indirect impacts to the noise levels within the Project Area or adjacent areas beyond the construction period would not be likely with the Alternative A

implementation, potential cumulative adverse impacts would likewise be considered as minor and short-term in duration.

Alternative B

Direct Impacts: This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. The same conditions relative to the direct impacts with the implementation of Alternative A would be anticipated. Generally, the increase in noise levels would be a short-term, minor, adverse impact during the construction period. No significant increase in noise levels, and therefore no significant direct impacts to noise levels, would be anticipated long-term. However, the Alternative B plan would include the installation of pumps at locations inside of the levee segments. These pumps would be used on an intermittent basis associated with significant rainfall events, and some level of direct, adverse impacts to noise levels associated with the operation of the pumping systems would be anticipated. Therefore, the anticipated direct, adverse impacts on noise levels associated with Alternative B would be minor in intensity but long-term in duration.

Indirect Impacts: The same conditions can be stated for the indirect impacts from the implementation of Alternative B. The indirect, adverse impacts to the adjoining areas would be associated with the short-term increase in noise levels during the construction period. In addition, indirect, adverse impacts would also be anticipated on the adjoining areas when the pumping systems are operating. Given this, the indirect, adverse impacts associated with Alternative B would be considered as minor and long-term in duration.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of implementing and operating Alternative B, as well as the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. Given the determination that direct or indirect impacts to the noise levels, within the Project Area or within adjacent areas, beyond the construction period are limited to the pumping system operations with the Alternative B implementation, the cumulative adverse impacts would also be minor in intensity and long-term in duration.

Alternative C

Direct Impacts: Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. The direct impacts to noise levels with the implementation of Alternative C would be short-term, minor, adverse conditions during the construction period. Based upon the project design, no long-term direct impacts to noise levels within the Project Area would be anticipated. Additionally, no changes in the current roadways or traffic patterns would be anticipated with the implementation of this alternative since the project footprint is located along corridors that are already major transportation routes. Given

this, the anticipated direct, adverse impacts to noise levels associated with the implementation of Alternative C would be minor in intensity and short-term in duration.

Indirect Impacts: The same can be stated for the indirect impacts to noise levels within the adjacent areas. The potential increase in noise levels to the adjacent areas would be minor, short-term, and limited to the construction period. With much of the area adjacent to the project already developed and with the presence of the Interstate 20 and Interstate 55 transportation corridors within the southern portion of the Project Area, there is a considerable level of noise currently present. Any increases in noise levels, even during construction, would not be significant. As a result, the potential indirect, adverse impacts to noise levels would also be considered as minor in intensity and short-term in duration.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of implementing and operating Alternative C plus the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. Given the determination that direct or indirect impacts to the noise levels within the Project Area or adjacent areas beyond the construction period would not be likely with the Alternative C implementation, the potential cumulative impacts due to the implementation of this alternative would be minor and short-term in duration as it regards noise levels.

SUMMARY OF NOISE IMPACTS

Alternative A (Non Structural):
Noise levels in the structure relocation sites is anticipated to increase during construction

Alternative B:

- No long-term impacts to noise levels anticipated
- Potential for intermittent impacts on noise levels from pumps installed in levee segments
- Potential for impacts on noise level during construction

Alternative C:
Potential for impacts on noise level during construction

4.5.13 AIR QUALITY

Alternative A

***Direct Impacts*:** This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. It proposes the buyout of approximately 3,100 structures, including homes, businesses, government and public buildings, schools, and hospitals. The direct impacts associated with Alternative A would be short-term, minor, adverse impacts on the air quality at the relocation sites. The potential direct impacts would be present on a short-term basis during the demolition and construction period only.

Given this, the intensity of the direct impacts to the air quality within the Project Area would not be considered as significant.

***Indirect Impacts*:** The same conditions would be assumed for the indirect impacts associated with the implementation of Alternative A. The indirect, adverse impacts to any adjoining areas to the Project Area would be minor, short-term, and associated with any demolition and construction activities. There is also the potential for short-term impacts to air quality during the construction period at the relocation sites that are chosen. No long-term indirect impacts related to air quality would be anticipated by the implementation of this alternative.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of implementing and operating Alternative A, plus the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. Given the determination that direct or indirect impacts to air quality within the Project Area and adjoining areas beyond the demolition and construction periods would not be likely with the Alternative A implementation, the potential cumulative impacts would also be considered as minor in intensity and short-term in duration.

Alternative B

Direct Impacts: This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. The same conditions relative to the direct impacts with the implementation of Alternative A would be anticipated. The potential impacts to air quality within the Project Area and the adjoining areas would also be short-term, minor, adverse impacts during the construction period only. No significant adverse impacts to air quality, and therefore no significant direct, adverse impacts to the air quality within the area, would be anticipated long-term as a result of the project construction. Therefore, the anticipated direct, adverse impacts would be minor in intensity and short-term in duration.

Indirect Impacts: The same conditions can be assumed for the indirect impacts associated with the implementation of Alternative B. The indirect impacts to the adjoining areas to the Project Area would be associated with the short-term impacts during the construction period only. No long-term indirect, adverse impacts to air quality within the area would be anticipated.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of implementing and operating Alternative B plus the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. Given the determination that direct or indirect, adverse impacts to air quality within the Project Area and adjoining areas beyond the land clearing and construction periods would not be likely with the Alternative B implementation, the anticipated cumulative adverse impacts would be minor in intensity and short-term in duration.

Alternative C

Direct Impacts: Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. As is the case with the other two alternatives, the direct impacts to the air quality within the Project Area as a result of the implementation of Alternative C would be short-term, minor, adverse impacts during the construction period only. Considering riverfront and project design elements, no long-term direct impacts to the air quality within the Project Area would be anticipated.

Indirect Impacts: The same conditions can be stated for the indirect impacts to the air quality within the areas adjacent to the proposed Project Area. The potential adverse impacts to air quality within the adjacent areas would be minor, short-term, and limited to the construction period only.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of the construction, development, and operation of Alternative C plus the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. Given the determination that direct or indirect impacts to air quality within the Project Area or within the adjacent areas beyond the construction period would not be likely with the Alternative C implementation, the anticipated cumulative adverse impacts would be minor in intensity and short-term in duration.

SUMMARY OF IMPACTS ON AIR QUALITY

Alternative A (Non Structural):
No significant impacts on air quality anticipated
Alternative B:
Indirect impacts could be anticipated for Project Area and adjoining properties during construction period only
Alternative C:
Indirect impacts could be anticipated for Project Area and adjoining properties during construction period only

4.5.14 HAZARDOUS, TOXIC, AND RADIOLOGICAL WASTE (HTRW)

Alternative A

***Direct and Indirect Impacts*:** This alternative would entail the elevation or buyout and/or relocation of existing potentially affected structures within the Study Area. It proposes the buyout of approximately 3,100 structures, including homes, businesses, government and public buildings, schools, and hospitals. Acquisition of properties and facilities within the Project Area

under the Alternative A buyout would have no direct effect upon any HTRW sites or the environmental and potential human health threats posed by the HTRW sites. The environmental and potential human health threats described in Section 2 and Appendix C would remain under this project alternative. Therefore, the potential direct and indirect, adverse impacts would be considered as minor and short-term in duration.

***Cumulative Impacts*:** Cumulative impacts would be the incremental direct and indirect impacts of implementing and operating Alternative A, plus the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. Given the determination that direct or indirect impacts to HTRW sites within the Project Area and adjoining areas would not be likely with the Alternative A implementation, the potential cumulative direct impacts would also be considered as minor in intensity and short-term in duration.

Alternative B

***Direct and Indirect Impacts*:** This alternative includes the construction of additional levee segments and the associated and additional floodway clearing along the Pearl River channel. The construction of levees within the proposed Project Area would have minimal direct effects upon the environmental and potential human health threats posed by the HTRW sites. The potential environmental and human health threats described in Section 2 and Appendix C would remain the same. However, construction of a levee on top of the unpermitted Lefleur's Landing Site would directly affect the physical features of the site. No levee is proposed for construction on top of the unpermitted Gallatin Street Landfill Site. Therefore, no physical impact to the unpermitted Gallatin Street Landfill Site would occur. Alternative B would not remove the potential for HTRW residual leaching to groundwater and the groundwater impact to the Pearl River from each of the HTRW landfill sites. Therefore, remedial actions would be required for this project alternative to address potential leaching from these former landfill sites. The existing levee located at the Gulf States Creosote Company Site would be utilized under Alternative B. Therefore, additional remedial actions would be needed to address creosote residuals within the Creosote Slough and groundwater. The proposed levee segment would potentially impact the Eubanks Creek area where the City of Jackson's major sewer interceptor crosses Eubanks Creek and where historical landfilling activities may have occurred. Sewage overflows may periodically occur during extreme wet weather periods and would need to be addressed in the design of the levee. Local parties suggest the proposed levee segment to be located on the west side of the Pearl River north of MS Hwy 25 will likely impact historic waste disposal sites which may require remediation. Given these conditions, the anticipated direct and indirect, adverse impacts associated with the implementation of Alternative B would be considered as moderate in intensity but likely to be short-term in duration, given the required remediation that would take place.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of implementing and operating Alternative B plus the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. Given the determination that direct or indirect, adverse impacts to known HTRW sites within the Project Area and adjoining areas would be likely with the Alternative B implementation, the anticipated cumulative adverse impacts would be moderate in intensity and short-term in duration.

Alternative C

Direct and Indirect Impacts: Alternative C includes the construction of channel improvements, associated weir structure, and improved levee segments. The construction of the proposed channel improvements would directly impact HTRW sites located within the Project Area. The Gulf States Creosote Company Site is located within the Project Area. The site, or portions thereof, may require avoidance, remediation, or some other mitigating measures. The unpermitted Lefleur's Landing Site is also located along the edge of the proposed channel improvement excavation area. It will require additional capping and bank stabilization measures due to potential leaching of landfill waste and groundwater movement in the area. Further investigations would be necessary to determine potential leaching of landfill waste chemicals to the groundwater and movement of groundwater into the proposed channel improvement. Groundwater controls and a slurry wall may be appropriate remedial actions in this event. The proposed channel improvement excavation area would also bisect the unpermitted Gallatin Street Landfill Site; therefore, excavation and removal of approximately half of the landfill site would be required to construct the proposed channel improvement. This excavated material would then be incorporated into the current remaining landfill area to further elevate the area, cap the area, and provide bank stabilization. Further investigations may be required to determine potential leaching of landfill waste chemicals to the groundwater and movement of groundwater into the proposed channel improvement area prior to the initiation of excavation activities at this location. Again, groundwater controls and a slurry wall may be appropriate remedial actions. Given the extent of the potential impacts on the HTRW sites, the anticipated direct and indirect, adverse impacts would be considered moderate in intensity and short-term in duration due to the remediation activities that would be required.

Cumulative Impacts: Cumulative impacts would be the incremental direct and indirect impacts of the construction, development, and operation of Alternative C plus the direct and indirect impacts attributable to other previous, existing and authorized projects within the Pearl River Watershed. Given the determination that direct and indirect, adverse impacts to HTRW sites within the Project Area would be likely with the Alternative C implementation, the anticipated cumulative adverse impacts would be moderate in intensity and short-term in duration due to the remediation activities that would be required.

SUMMARY OF IMPACTS ON HAZARDOUS, TOXIC, AND RADIOLOGICAL WASTE (HTRW) SITES

Alternative A (Non Structural):

No significant impacts on HTRW anticipated

Alternative B:

- Would not remove potential for HTRW residual leaching to groundwater and the groundwater impact to the Pearl River from HTRW landfill sites so remedial actions would be required
- Remedial measures needed to address creosote residuals within the Creosote Slough and groundwater because of the utilization of the Gulf States Creosote Company Site
- Potential for impact from proposed levee segment to Eubanks Creek where the City of Jackson's major sewer interceptor cross and where historical landfilling activities may have occurred
- Periodic sewer overflows during extreme wet weather periods would need to be addressed

Alternative C:

- Mitigation measures may be required for Gulf States Creosote Company Site
- Additional capping and bank stabilization measure would be required for unpermitted Lefleur's Landing Site
- Excavation and removal of approximately half of the Gallatin Street Landfill Site would be required for construction of proposed channel improvements
- Positive impacts will result due to required remediation

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5.0 TENTATIVELY SELECTED PLAN (NEPA REQUIRED)

Alternative C is the Tentatively Selected Plan (TSP). Feasibility level design will commence after final review and comments are addressed from Public and Agency Review of this document.

5.1 DESCRIPTION OF TENTATIVELY SELECTED PLAN

The TSP consists of channel excavation and widening of a 9.5-mile reach of the Pearl River (Figure 5-1, Figure 5-2, and Figure 5-3). Most of this excavation and construction is within the existing levees and existing channelized sections (Figure 5-4). Elevation reductions due to this excavation would provide reduction of flood elevations not only within the reach of excavation (RM 284.0 to RM 293.5), but additional flood reduction for the approximately 8 miles upstream of the excavation. Flood risk management is gained by widening the floodplain in this area, providing more area to convey flood flows, and by removing areas that constrict the floodplain.

Flood risk management will be realized for over 3,500 structures that currently have a high risk of flooding. Furthermore, an additional 1,200 structures currently behind existing flood protection will experience increased protection and flood risk management due to a decrease in flood elevation adjacent to levee reaches. In addition to structural flood risk management, over 100 miles of interstate and other roads would no longer be impacted by flood events, allowing for emergency service access, while avoiding the evacuation of health care facilities. The reduction of roadway flooding would reduce traffic congestion, road damages, and road closures during high water events. In addition, the Savanna Street WWTP would be protected from damage caused by flooding, and other HTRWs would be further protected or removed.

Non-Structural Measures: The TSP will assess non-structural measures, such as voluntary acquisition of structures in both Hinds and Rankin counties that would otherwise continue to be located in flood prone areas. Implementation of non-structural measures will be developed and updated with more data during the final economic analysis.

In developing the plan, consideration will be given to community cohesion and the requirements set out in EO 12898- Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.

Structural Measures: The structural components consist of excavation of approximately 25 million yards, from RM 284.0 to RM 293.5, ranging in width from 400 to 2000 ft. Some existing levees will be set back with large amounts of fill areas placed behind them. The new land mass created behind the levees will range from 200 to over 1,000 ft in width. To maintain water supply at the J. H. Fewell Water Treatment Plant located at RM 290.7, a weir will be relocated at the downstream limits at RM 284, creating a pool area that provides maximum flood risk management benefits, recreation, and long-term maintenance reduction. Islands will be created from RM 289.5 to RM 292.0, some of which will be used to maintain and create habitat areas for local species. In addition, excavation depths will be varied to create underwater habitat, spawning, and nesting areas. Final environmental features will be developed during feasibility level design. Location benefits for both Hinds and Rankin counties will be realized and will be further analyzed in the feasibility level design. Additional structural components will include a 12' x 12' gate within the relocated weir to maintain minimum low flows as required for the WWTP downstream, as well as for the maintenance of low flow requirements for the Ross Barnett Reservoir. Design parameters will further be refined during the feasibility level design and analysis, which may result in changes. The TSP is anticipated to reduce risk of the 1% chance flood and also reduce risk for other floods exceeding the 1% chance.

SUMMARY OF BENEFITS

- *Lowers flood elevation in area of excavation and approximately 8 miles upstream;*
- *Reduces damages to existing high-risk structures and infrastructure as well as structures already protected by levees;*
- *Reduces need for evacuation of residential and commercial properties and Health Care facilities;*
- *Eliminates flood risk for over 100 miles of Interstate and other roads;*
- *Increases accessibility to Emergency Services;*
- *Reduces traffic congestion due to rerouting and road closures during high-water events;*
- *Provides protection for the Savanna Street WWTP and other HTRWs;*
- *And increases recreational opportunities due to proposed recreational facilities.*

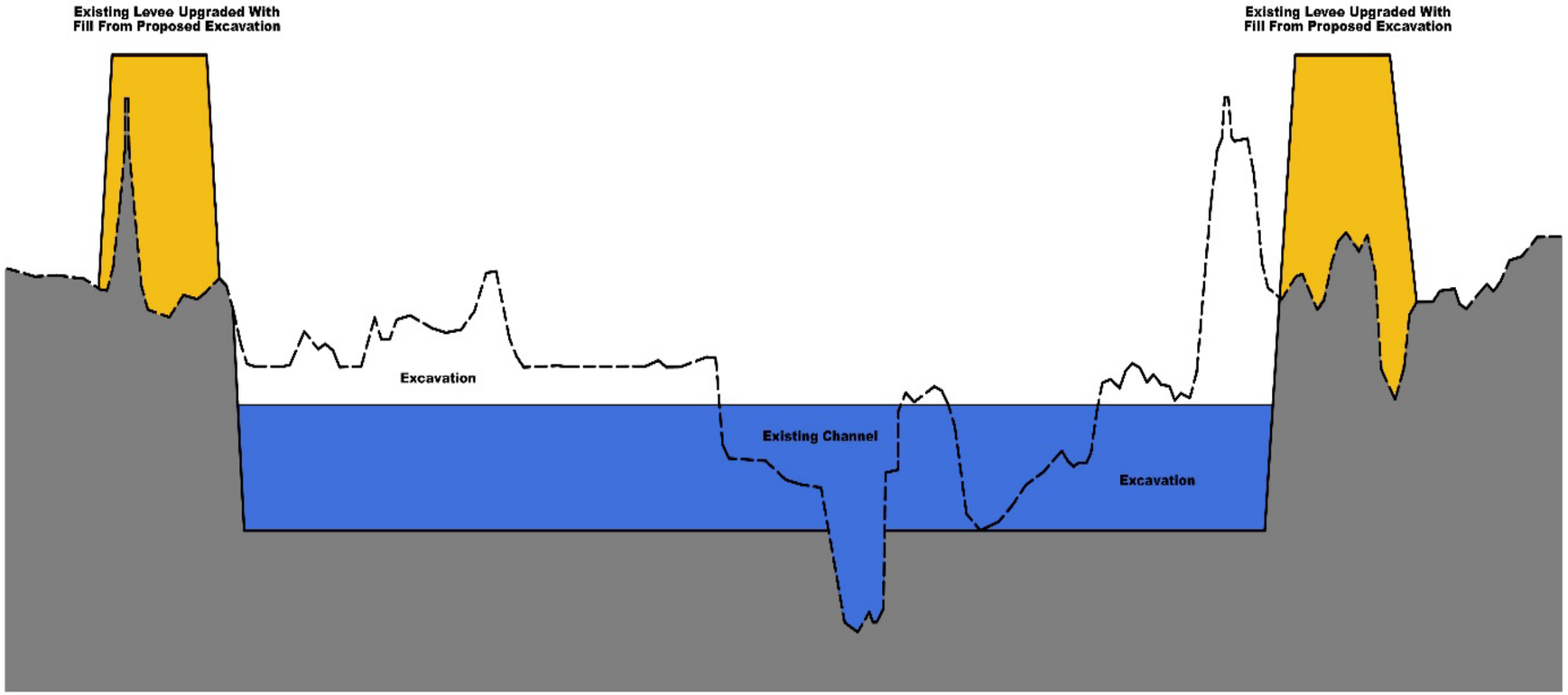

Figure 5-1, Channel Improvement Alternative

Figure 5-2, Plan View of Channel Improvement Alternative

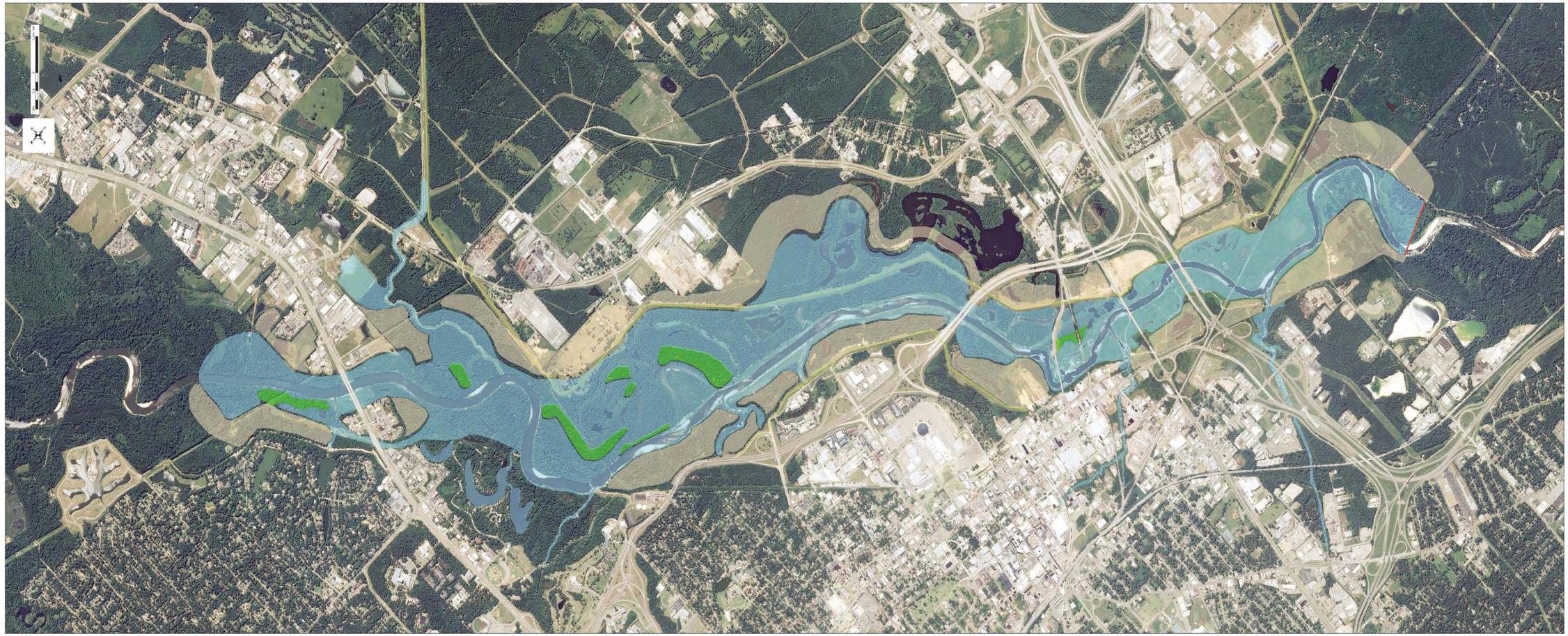

Figure 5-3, Channel Improvement Alternative Layout

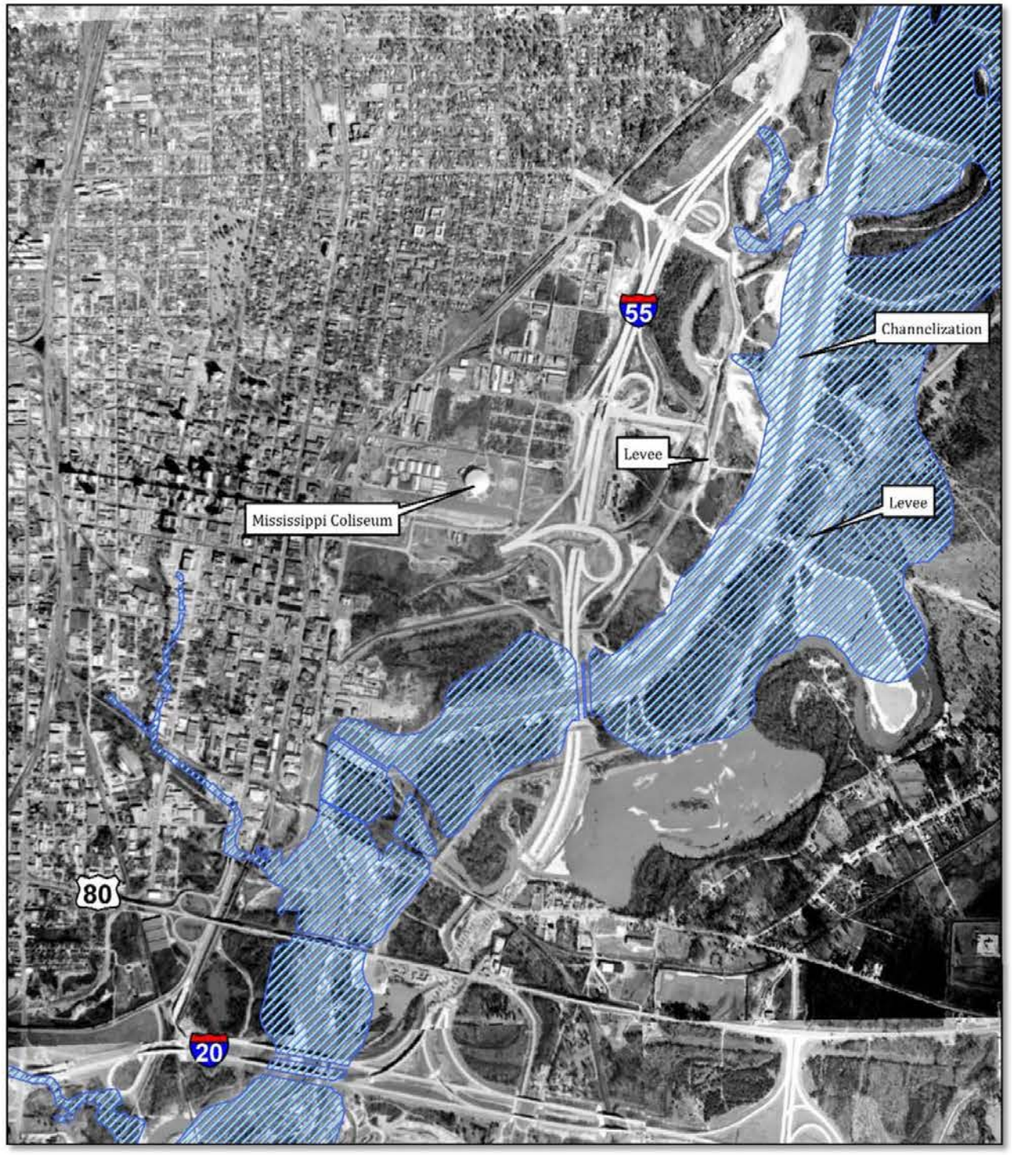

Figure A. 1968 Aerial Photograph

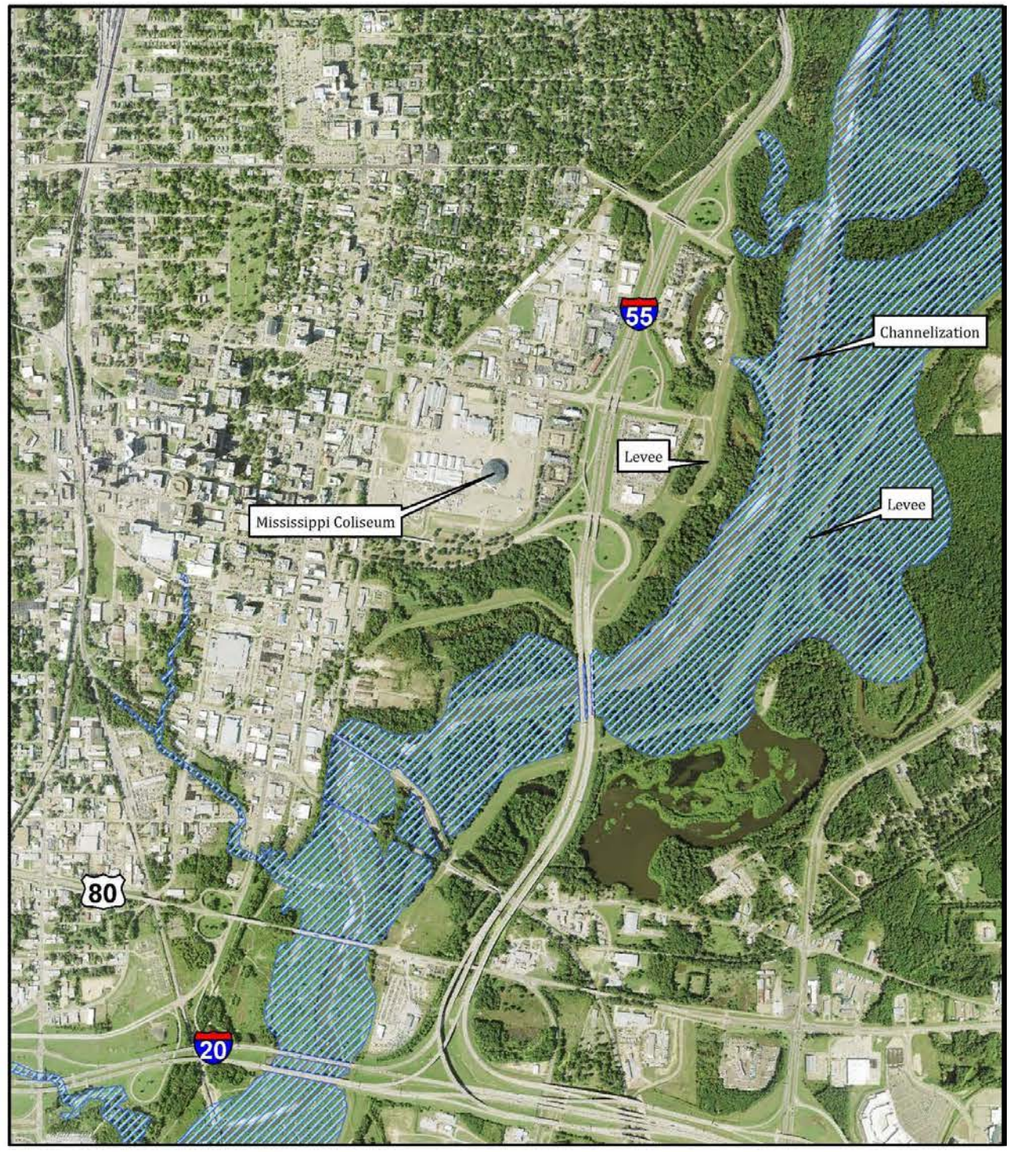

Figure B. 2014 Aerial Photograph

Figure 5-4, The 1968 and 2014 aerial photographs with an overlay depicting the area of channel improvement

The TSP creates the most economic benefits (NED) in addition to being the LPP. The community considers Alternative C as the best plan to provide flood risk management, recreational benefits, and economic opportunities for the area. Although location of recreation benefits will be finalized during the feasibility level design, Figures 5-5 through 5-8 present features used for analyses of these benefits.

The estimated cost of the TSP is $345,850,000. The Benefit-Cost Ratio (BCR) for the TSP is equal to 2.83 with annualized net benefits equal to approximately $25,300,000.

Figure 5-5, Conceptual Recreational Features, RV Park Feature

Figure 5-6, Conceptual Recreational Features, Boat Landing Feature

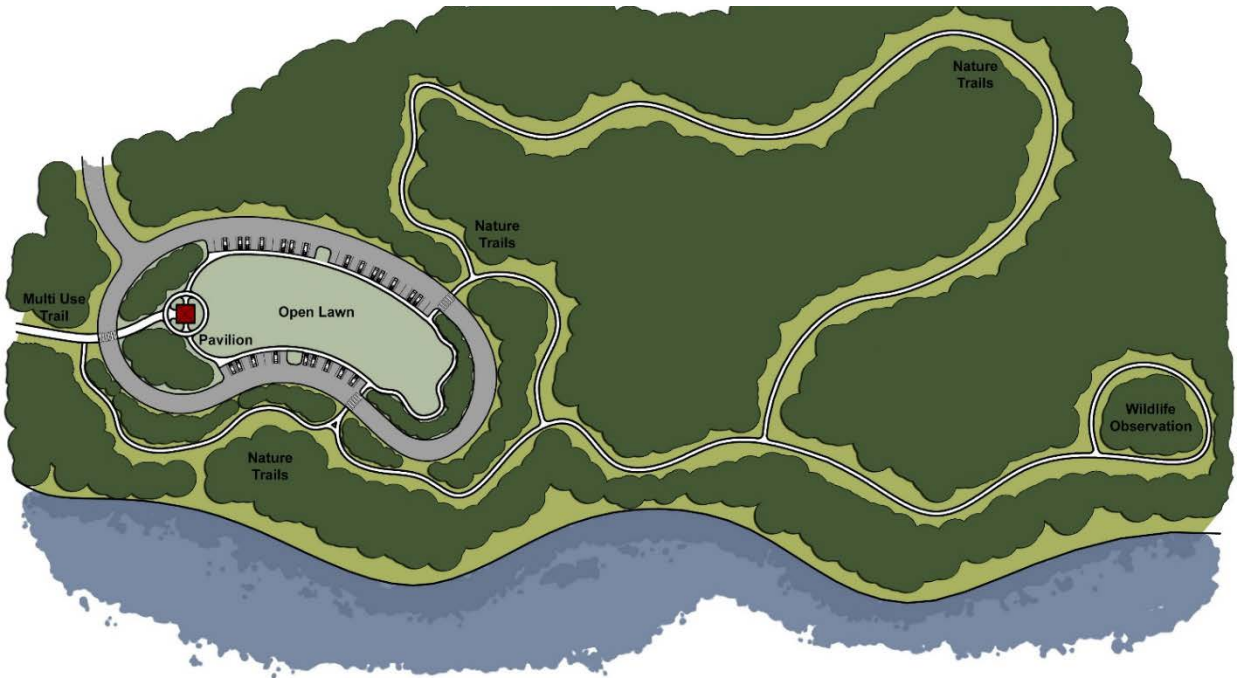

Figure 5-7, Conceptual Recreational Features, Nature Trails Feature

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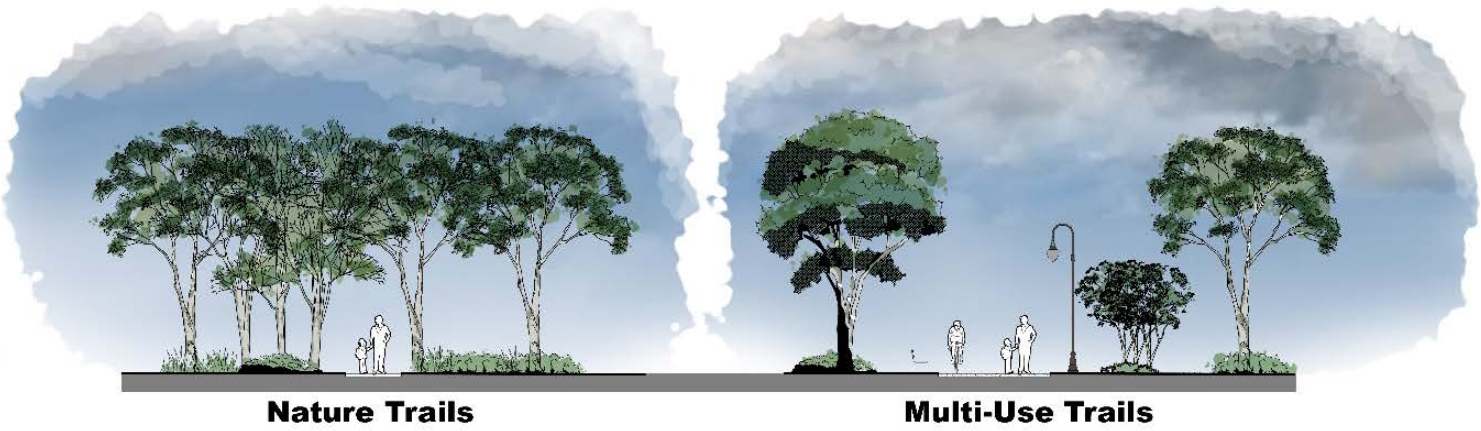

Figure 5-8, Conceptual Recreational Features, Trails

5.1.1 REAL ESTATE REQUIREMENTS

A Real Estate Plan (REP) describing the real estate requirements and cost of the project can be found in Appendix C. The REP was prepared with the estimated right-of-way requirements based on available information. The REP and real estate cost estimated will be finalized during the feasibility level design and analysis.

The Real Estate Plan meets the requirements set forth in ER 405-1-12. Additionally, ER 405-1-04 was utilized in the development of the real estate cost. According to ER 405-1-04, "cost estimates should also be used for projects in which the value of real estate (lands, improvements, and severance damages) is not expected to exceed ten percent of total project costs." Therefore, cost estimates would be appropriate for this project. However, in the interest of prudence, a brief gross appraisal was secured. ER 405-1-04 asserts that a brief gross appraisal is appropriate for projects in which the value of real estate does not exceed 30% of the total project cost. A copy of the appraisal report has been included in Appendix C: Engineering, Real Estate Plan. The appraisal indicated that the cost of acquiring the land within the proposed project footprint could be less than originally calculated using cost estimates. In order to have a conservative assessment of project costs and to account for risks and contingencies, the higher cost estimate values have been used to evaluate the cost for real estate needs.

DESCRIPTION OF LERRD (Lands, Easements & Rights of Ways, Relocations and Disposal Areas)

The REP for Alternative C was prepared with the estimated right-of-way requirements based on available information. The estimated cost of the real estate acquisition for the TSP is $20,580,000. The Alternative C footprint encompasses approximately 1,740 acres of excavation area and 1,009 acres of fill areas for a total footprint of approximately 2,750 acres. Of the 2,750 acres needed for the Alternative C, approximately 1,120 acres are in control of the local sponsor or communities that are members of the Flood Control District. Property in the project footprint that is not already possessed by the Flood Control District will be purchased in fee title. Mitigation land will be acquired in fee as part of the project, as described in more detail in Appendix D of this report.

A detailed evaluation of the number of landowners impacted will be determined during the economic reach analysis of the final feasibility level design. At that time, the appropriate real estate interest to be acquired for non-structural measures will be determined, and the real estate cost will be refined. Public Law 91-646, Title II Relocation Assistance will be utilized during real estate acquisition.

5.1.2 PROJECT BENEFIT ANALYSIS

General

In accordance with congressional authorization, the Flood Control District has prepared a FS/EIS for the purpose of identifying the federal interest in the Pearl River Watershed, Mississippi. An economic evaluation of the improvements being considered is presented in this appendix. It was prepared in accordance with ER 1105-2-100 and ER 1105-2-101, Planning Guidance. The National Economic Development Procedures Manuel for Flood Risk Management and Coastal Storm Risk Management, prepared by the Water Resources Support Center, Institute of Water Recourse, was also used as a reference, along with User's Manual for the Hydrologic Engineering Center-Flood Damage Analysis Model (HEC-FDA).

This evaluation consists of a description of the methodology used to determine economic damages and benefits under existing and with project conditions, also included are descriptions of projects costs and benefit-to-cost analysis. October 2017 price levels were used in the evaluation. The proposed improvements were evaluated by comparing estimated annual project benefits that would accrue to the Study Area with estimated annual project costs. Benefits and costs were converted to average annual equivalent values at the federal discount rate of 2¾ % with a project life of 50 years. The estimated base year (the year in which significant project benefits will accrue as a result of project construction) is the year 2020.

National Economic Development Benefits Considered

The NED Procedures Manual for Urban Flood Damage recognizes four primary categories of benefits for urban flood control plans: inundation reduction, intensification, location, and employment benefits. The majority of the benefits attributable to a project alternative generally result from the reduction of actual or potential damages caused by inundation. Inundation reduction includes the reduction of physical damages to structures, contents, and vehicles. It also includes reduced damages to roads, bridges, and other infrastructure. It also includes the reduction of emergency costs, evacuation and subsistence costs, reoccupation costs, commercial clean up, and Federal Insurance Administration costs saved. Table 5-1 shows

Table 5-1, Equivalent Annual Benefits, TSP

Equivalent Annual Benefits and Cost Pearl River Basin, Mississippi, Federal Risk Reduction Project, Alternative C (October 2017 Prive Level, 50-Year Period of Analysis, 2.750 Percent Discount Rate)		
Investment Cost		
Total Project Construction Cost		$345,849,032
Interest During Construction*		$9,629,973
Total Investment Cost		$355,479,005
Average Annual Cost		
Interest/Amortization/Initial Investment		$13,209,902
OMRR&R		$650,000
Total Average Annual Cost		$13,859,902
Average Annual Benefits		$39,164,442
Net Annual Benefits		$25,304,540
Benefit-Cost Ratio		2.83
Benefit-Cost Ratio (computed at 7%)		1.41
*Estimated construction period of 3 years		

the equivalent annual benefits and costs associated with Alternative C. Other categories such as intensification, reduced fill requirements, and location are discussed in Appendix B.

Projects Costs

With an estimated project implementation cost of $345,850,000 and annual project operation, maintenance, repair, rehabilitation, and replacement (OMRR&R) costs of $650,000, the total average annual cost, including OMRR&R, is $13,860,000. The estimated average annual benefits are $39,160,000. Therefore, the benefit-to-cost ratio is 2.83, and the net annual benefit is $25,300,000. The average annual equivalent costs, benefit-cost ratio, and excess benefits over costs are based on a three year construction period, a base year of 2020, a 2¾ % discount rate, and a period of analysis of 50 years, pursuant to USACE policy. Recreation costs and benefits are presented for the channel improvement alternative only, and do not include operation and maintenance costs. These costs will be refined for the TSP in the final analysis.

5.1.3 OPERATION AND MAINTENANCE, REPAIR, REHABILITATION AND REPLACEMENT

The purpose of the OMRR&R is to sustain the constructed project. The estimated annual OMR&R cost is $650,000. This estimate will be further refined during the feasibility-level design and analysis. After the District Engineer provides notice of construction completion for the project or functional portion of the project, the Flood Control District will commence OMRR&R responsibilities associated with the project.

Benefit-Cost Analysis

Channel improvement is the economically superior plan, providing a much higher benefit cost ratio and excess benefits over costs. Of the plans analyzed, it is the least costly. Alternative C is also the NED plan and the LLP.

5.1.4 RISK & UNCERTAINTY ANALYSIS

Risk and uncertainty are vital to water resource project planning and design. Risk factors were evaluated to the fullest extent with available data and details. Analysis of the considered risk factors can be found in the risk registries in Appendix C: Engineering, Cost Engineering. Risk and uncertainty will be further considered during the feasibility level design and analysis.

5.1.4.1 *HUMAN ENVIRONMENT FACTORS*

The TSP will provide the most positive impacts to the human environment. These positive impacts are provided through the protection of existing business and neighborhoods from future disruption and destruction of a major flooding event. This alternative will also enhance the future ability of the community to further develop its business and neighborhood activity. Increased

community development will increase tax revenues, property values, provide jobs, and further the development of public services and facilities, thereby strengthening community stability and enhancing the overall business, employment, and industrial activity. These increases will be the result of the development of the associated riverfront resulting from channel improvement and weir construction. The newly created riverfront from the channel improvement with the confines of the existing levee structure will allow for expanded riverfront access and development, along with recreational opportunities. These new activities will serve to stimulate community development to a greater degree.

5.1.4.2 *ENGINEERING FACTORS*

As previously stated, existing levees will be upgraded or relocated. Upgrading the levees and the large amounts of fill placed adjacent to the levees will provide significant risk management of the existing structures. The levee sections features will be constructed to meet the USACE standards.

5.2 IMPLEMENTATION REQUIREMENTS

5.2.1 PRECONSTRUCTION ENGINEERING AND DESIGN

Detailed design of the TSP will be shared between the Flood Control District and the USACE. All detail design will be in accordance with USACE's regulations and standards.

5.2.2 CONSTRUCTION AND LERRD

Construction would be in accordance with the USACE's regulations and standard. LERRD would be the responsibility of the Flood Control District. The USACE will be constructing this project, and as a new project incorporating components of an existing federal project, a 408 permit is not required.

5.2.3 COST SHARING

The Flood Control District is the non-federal sponsor for the FS/EIS carried out under Section 211 WRDA 1996. Cost sharing will be determined as a part of the final feasibility design.

5.3 MITIGATION PLAN

Mitigation Plan Objectives

- Target properties that will provide opportunities to offset specific habitat unit losses identified by the Habitat Evaluation Procedures (HEP) analysis to insure that the highest level of total habitat losses are provided.
- Prioritize available properties within the Pearl River Basin providing the greatest habitat replacement opportunities.

- Obtain and utilize properties providing a higher degree of habitat restoration and regeneration across all of the specific habitat unit losses.
- Insure the mitigation plan implementation will provide no net loss of wetlands as a result of the project construction.
- Insure that mitigation for bottomland hardwood forestland habitat losses are done "in-kind" and within the same basin.

Implementation of the TSP requires compensatory mitigation for unavoidable adverse impacts that will require replacement or the provision of substitute resources. The project specific TSP mitigation plan will be fully developed during the feasibility level design and analysis and included in the final report. However, mitigation and management measures were identified during the impact analysis completed for the Draft EIS documentation. The HEP analysis was employed to complete the mitigation assessment for the applicable effected resource categories analyzed for both structural alternatives, Alternative B and Alternative C. A copy of the Habitat Evaluation Procedures (HEP) Report is included in Appendix D. Further mitigation and management measures have been identified to minimize and maintain potential adverse effects of the TSP at acceptable or minimal levels.

"Management measures" are best defined as routine Best Management Practices (BMPs) and/or regulatory compliance measures that will be implemented as part of the proposed activities associated with the implementation of the TSP. The feasibility level design for the TSP will identify the appropriate BMPs and other management measures that will satisfy all applicable regulatory requirements in association with the construction and operation of the TSP. Other important management measures specifically associated with the affected threatened species will also be developed and implemented during the feasibility level design process. In general, the identification and implementation of the management measures will maintain effects at acceptable levels for all resource areas analyzed.

The HEP is routinely utilized by the USACE Vicksburg District Planning Division as the primary assessment methodology to quantify the potential impacts to both terrestrial and aquatic habitats during the development of the FS/EIS for specific projects. The HEP was utilized as the primary methodology for assessing the habitat losses associated with both Alternative B and Alternative C, the proposed structural alternatives. The HEP that was completed identifies the projected habitat losses associated with both the structural alternatives and also identifies the range of habitat replacement requirements needed to offset the habitat losses. A copy of the HEP documentation is included in Appendix D. A project specific mitigation plan that will address the habitat losses and replacement for the TSP, Alternative C, and the specific methods to accomplish the replacement of habitats will be fully developed as a part of the feasibility level design and analysis and included in the final report.

The HEP analysis developed the range of compensation acres required to offset losses to all the evaluation species that were considered during the process. The range of compensation acres varied depending upon the species habitat losses and the type of management plan alternative that could be implemented. The HEP Report included in Appendix D details for both action alternatives the range of replacement acreage for the management plan alternatives that may be implemented. The specific properties obtained for the compensation purposes and the habitat conditions present on those properties will dictate the management approach that can be utilized. The specific acreage that will be purchased cannot be identified until the specific properties are identified for purchase and the site specific management plans developed. However, currently available properties both within the project area, upstream, and downstream have been tentatively identified, and the currently available properties will meet the range of compensation acres that have been developed through the HEP analysis.

Based upon the HEP analysis performed, the range of compensation acres for the Levee Plan (Alternative B) ranges from approximately 916.0 acres for the Regeneration Alternative, to approximately 1,282.0 acres for the Restoration Alternative, and up to approximately 5,122.0 acres for the Acquisition Alternative. Under the Channel Improvements Plan (Alternative C), the TSP, those compensation acres for the same management alternatives are approximately 1,169.0 acres for the Regeneration Alternative, approximately 3,205.0 acres for the Restoration Alternative, and up to approximately 31,294.0 acres under the Acquisition Alternative, the preservation option. The management alternatives set forth in HEP range include the complete regeneration of habitat for agricultural properties, the restoration of properties that have been manipulated in some fashion in the past back to the preferred habitat types, and the acquisition or preservation of properties that have existing habitat conditions. Based upon the preliminary review of potential properties that can be obtained, it is apparent that the compensation acreage will most likely be a combination of all three (3) management options with the priority placed upon obtaining properties that contain habitats that can either be fully restored or enhanced. As noted, more site specific management plans will be developed once the properties are specifically identified and can be obtained. As noted, the focus of the mitigation plan will be the replacement of the specific habitat unit losses within the Pearl River Basin.

The focus of the proposed mitigation plan for both the structural alternatives will be the restoration, enhancement, or preservation of the predominant riverine bottomland hardwood ecosystem that now exists through the project area. The primary goal will be to establish or enhance native plant communities indigenous to the site to re-establish, enhance, or preserve the historic conditions. As noted, site specific restoration, enhancement, and management planning will be completed for each individual property purchased to provide compensation acres to the level that is acceptable based on the project impacts. Restoration will be accomplished through the planting of native bottomland hardwood tree species. Vegetative

enhancement will be accomplished by inter-planting native bottomland hardwood tree species and eliminating noxious and invasive species such as Chinese tallow and Chinese privet. Natural colonization by herbaceous and shrub species is expected to occur within the restoration and enhancement areas. Areas that contain the appropriate density and diversity of bottomland hardwood species will be designated as preservation areas with no prescribed treatment other than monitoring to ensure the species integrity. If colonization of invasive/exotic species is found, proper management actions will be implemented to eliminate infestation.

For the most part, the bottomland hardwood restoration process includes areas lacking overstory canopy or lacking a desirable species composition within the overstory canopy. The species composition utilized will be consistent with the "target forest" habitat established within the project area through the completion of the HEP Analysis. Topography of each of the mitigation sites purchased will dictate the species to be used for planting and specific microtopography will determine individual species placement. For the Pearl River Basin in general, in and around the bottom of the swales and sloughs, water tupelo and bald cypress will be planted. At slightly higher elevations, species planted will include overcup oak, water oak, willow oak, and swamp chestnut oak. Cherrybark oak and persimmon will be planted in the areas of higher elevations. Elevation data will be utilized to establish the planting zones. Other native species such as sweetgum, red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), black willow (*Salix nigra*) and American elm (*Ulmus americana*) are typically abundant, and natural colonization by these species is anticipated. Species will be hand planted on 12' x 12' spacing yielding approximately 302 seedlings per acre. Areas that are lacking the appropriate stocking density of desirable species will be enhanced as needed. The same species composition established during the HEP Analysis will be utilized and areas requiring enhancement will be interplanted.

Any upland areas included within the compensation acreage will be enhanced to ensure the longevity of adequate upland buffers. These activities include the removal of exotic, nuisance, or noxious species through forestry mowing, injection, or other stem specific measures. Further, the upland habitat will be inter-planted with desirable species in areas with inadequate density and areas where undesirable species were removed.

As noted, the target forest conditions established during the HEP Analysis will be the basis for the long-term monitoring of the compensation acreage tracts. Success criteria will be established to include a measure of performance for the restoration and enhancement sites which will be defined as a vegetative community of species where more than 50% of all dominant species meet the target forest composition. For the restoration and enhancement sites, monitoring will take place on an annual basis over the first ten (10) year period since successful restoration is generally established during that period of time. At Year 10, the overall stand density shall be composed, on average, of seven (7) to ten (10) target tree species/acre or greater at a minimum density of

120 trees/acre, including desirable natural recruits. Demonstration of a minimum of three years of positive growth of planted tree species through increased growth of planted tree root collars, diameters and/or height will be utilized. The average height of the planted canopy shall be a minimum of five (5) feet or greater, excluding fast growing genera such as *Platanus* and *Populus*. Exotic and nuisance species (Chinese tallow tree and Chinese privet) species shall not comprise more than 5% cover and noxious species (e.g., honey locust, black willow, cotton wood, thistle, and baccharis) shall not comprise more than 20% of the total stem density. Following the first ten year period, the sites will be monitored through time on a five (5) year basis to ensure the species mix and habitat conditions are maintained.

One (1) permanent monitoring plot will be established per 75 acres of habitat. Additionally, at each monitoring event, one (1) additional randomly located monitoring plot will be implemented per 75 acres of habitat. The GPS coordinates of the randomly identified plots will also be recorded. Each habitat type (i.e. cypress slough, bottomland hardwoods, etc.) shall have representation through monitoring plots. The GPS referenced locations for all required monitoring plots will be established at the first monitoring event.

The Local Sponsor shall conduct surveys of living seedlings of the tract according to the monitoring protocol. Sampling shall be done between April 15th and September 15th following the initial planting of each site. Seedling survival shall be documented by performing monitoring at the vegetative plots established. For each monitoring event, density of all trees within the monitoring plots (including natural recruitment), species composition, diameter or DBH, and height of all planted trees will be collected and recorded to determine the survivability and growth rate. Monitoring data for species, density of exotic or invasive species within all strata, the species composition, and coverage of shrub and herbaceous strata will also be documented and recorded. In addition, the Local Sponsor shall perform a cursory examination of the entire tract to determine if the site is meeting the performance standard survival rate of at least 240 trees per acre at Year 3 and 120 trees per acre at Year 10.

As noted above, the predominance of the proposed mitigation plan will include the replacement of bottomland hardwood forestland habitats with the inclusion of other habitat types to offset the specific habitat unit losses determined by the HEP analysis. The plan's other objective will be to prioritize the purchase of properties providing a higher degree of habitat replacement and regeneration over acquisition of existing habitat types; however, all three replacement habitat alternatives will be utilized and the acreage provided will vary accordingly. Since HEP was utilized to determine losses, the success or failure of the mitigation activities will be measured through the previously discussed success criteria, relative to species stocking, etc. Mitigation activity will also be gaged by the completion of HEP field assessments to measure success relative to the actual habitat units being replaced. The baseline measurements from the HEP analysis for the

specific habitat unit losses will be used to assess the success or failure of the habitat replacement efforts.

The mitigation plan for the sites of compensation acres also includes the assumption that the success criteria may not be met in all cases. In the event any site does not achieve any of the criteria, the Local Sponsor will implement the necessary contingency plans or Adaptive Management Plan to execute the appropriate remedial actions in coordination with the USACE. In most cases, the Adaptive Management Plan will include specifics for corrective restoration measures that will include replanting of the targeted species in the event that the target trees per acre have not been met. In addition, exotic or nuisance species control can become a factor both short and long-term and plans to control this species back to target coverage will be implemented. Force majeure events, including natural disasters or any other "Act of God" that affect the long term viability of the compensation acres will also be addressed through appropriate restoration efforts.

As noted in Sections 2 and 4, the Project Area includes habitat for two listed aquatic species, the Gulf sturgeon and the ringed sawback (map) turtle. As discussed, the portion of the Pearl River within the Project Area and upstream of the Project Area is a part of the designated Critical Habitat for the Gulf sturgeon. However, an analysis of the most recent survey data and other information that is available indicates that it is not likely that the Gulf sturgeon utilize the available spawning habitat within the Project Area and that the upstream migration currently appears to be limited to portions of the lower Pearl River. As also noted, the survey efforts on the upstream portions of the Pearl River have also been limited and very little quantifiable data exists.

It was also noted that the stretch of the Pearl River within the Project Area does not include what is considered as preferred habitat for the ringed sawback (map) turtle. Past dredging activities within this portion of the river associated with the previous flood control projects has resulted in an overall degradation in habitat for the ringed sawback (map) turtle and the nesting habitat within this portion of the river is almost non-existent. In addition, the basking habitat is also very limited. As a result, the ongoing survey activities conducted by the USFWS and the MDWFP do not include the portion of the river that is within the proposed Project Area.

The United States Department of Interior (USDOI) as a whole has implemented what is referred to as adaptive management as a systematic approach to resource management that utilizes alternatives to management actions based upon monitoring. Given the limited amount of survey efforts and the lack of significant data, it appears that the adaptive management approach can provide the optimal opportunity to monitor the potential utilization of the Project Area by the two listed species and, at the same time, provide alternative management activities and/or design features that can be incorporated into the TSP.

As noted previously, the Section 7 consultation process has been initiated with the USFWS Jackson, Mississippi, Field Office relative to the potential impacts for the listed species and their habitats. As a part of this consultation process, options for implementing adaptive management practices and design features for the proposed weir structure that will help minimize or avoid habitat losses for both species will be assessed and coordinated. Since the potential adaptive management options aimed at habitat include structural options such as a fish passage, the development of the specific adaptive management plan details will be completed following the completion of the USFWS Biological Opinion and coordination with the USFWS. The preliminary weir design has been further modified to be a trapezoidal shape with 200 feet of primary weir and 650 feet on each side to obtain the required 1,500 feet of weir length. As noted, there is no evidence Gulf sturgeon are currently utilizing the project area as upstream migrations are limited by the downstream sills in the lower Pearl River. However, because of the Critical Habitat designation through the project area, this adaptive management plan will be put into place to allow for the implementation of a weir structure allowing potential upstream migration through the project area should the Gulf sturgeon return.

The review of available information indicates that adding a 1:20 slope within the 200 foot primary weir would provide upstream migration to continue for bottom dwelling fish species like the Gulf sturgeon. The design opportunities will be discussed in detail with the USFWS during the Section 7 consultation process to determine which adaptive measures may work best and which modifications can be implemented within the weir structure.

In addition, the potential mitigation options will include the implementation of an ongoing monitoring program for both aquatic species. The extent of the monitoring and the specific monitoring protocols will be developed in consultation with the USFWS, and detailed specifics of the adaptive management plan will be developed at that time.

An adaptive management plan developed in conjunction with the USFWS during the Section 7 consultation can provide the alternative management measures, the weir design features, and potential mitigation measures that will insure that the potential adverse impacts to the listed species are minimized. In collaboration with the USFWS, the adaptive management measures will be established. Upon determination of these measures, ongoing monitoring of these adaptive management measures will be coordinated to observe their progress and to insure the success or failure of those efforts.

Further coordination and consultation with all pertinent natural resources agencies, as it relates to all aspects of the mitigation plan implementation, monitoring, and the adaptive management plan implementation, will begin during the feasibility level design. During that process, the natural resources agencies will be included in the assessment of specific mitigation properties and the development of specific on-site restoration or regeneration plan details. Ongoing

coordination and consultation with pertinent natural resources agencies will continue through implementation of the plan specifics on an annual basis, unless a more frequent rate is necessary. This coordination will continue throughout the ongoing monitoring activities to determine the level of success or failure.

5.4 VIEWS OF THE NON-FEDERAL SPONSOR

The Flood Control District along with the State of Mississippi recognizes the importance of flood risk management in the Jackson metropolitan area. Following many attempts to provide flood risk management after the Flood of Record in 1979, the local sponsor, the local community, and the State of Mississippi have come together to help support and fund this FS/EIS. As a part of this team, the USACE has worked with other stakeholders to develop a feasible, comprehensive plan that will provide the citizens of this area with a flood risk management plan that has additional benefits to the local, regional, and national economies. The construction of this project will immediately reduce flood risk and provide flood risk management to over 3,000 structures, improving existing protection while providing recreational and economic benefits to the region.

6.0 ENVIRONMENTAL LAWS & COMPLIANCE

There are many federal and state laws pertaining to the enhancement, management, and protection of the environment. Federal projects must comply with environmental laws, regulations, policies, rules, and guidance. Coordination with federal and state resource agencies will continue throughout project planning and execution. The following sections present brief summaries of federal and state environmental laws, regulations, and coordination requirements applicable to this FS/EIS. Compliance with laws will be accomplished upon review of this report by appropriate agencies and the public and with the signing of a Record of Decision by the Assistant Secretary of the Army for Civil Works.

Clean Air Act of 1972 (Air Quality)

The Clean Air Act sets goals and standards for the quality and purity of air. It requires the Environment Protection Agency to set National Ambient Air Quality Standards for pollutants considered harmful to public health and the environment.

Clean Water Act of 1972- Section 401 (Water Quality)

The Clean Water Act (CWA) sets and maintains goals and standards for water quality and purity. Section 401 requires a Water Quality Certification from the Mississippi Department of Environmental Quality that a proposed project does not violate established effluent limitations and water quality standards. Section 401 compliance will be documented in the final report.

Clean Water Act of 1972- Section 404(b)(1) (Wetlands)

The USACE administers regulations under Section 404(b)(1) of the CWA, which establishes a program to regulate the discharge of dredged and fill material into waters of the U.S., including wetlands. Potential project-induced impacts subject to these regulations will be evaluated during feasibility level design. A complete 404(b)(1) evaluation will be included in the final report.

Endangered Species Act of 1973 (Threatened and Endangered Species)

The Endangered Species Act is designed to protect and recover threatened and endangered species of fish, wildlife and plants.

Bald and Golden Eagle Protection Act of 1940 (Bald Eagles)

The Bald and Golden Eagle Protection Act protects two eagle species.

Magnuson-Stevens Fishery Conservation and Management Act

Congress enacted amendments to the Magnuson-Stevens Fishery Conservation and Management Act in 1996 that established procedures for identifying essential fish habitat (EFH) and required interagency coordination to further the conservation of federally managed

fisheries. Rules published by the NMFS (50 CFR 600.805 through 600.930) specify that any federal agency that authorizes, funds, or undertakes, or proposes to authorize, fund or undertake, an activity that could adversely affect EFH is subject to the consultation provisions of the act.

National Historic Preservation Act of 1966 (Cultural and Historic Resources)

In compliance with Section 106 of the National Historic Preservation Act and 36 CFR §800, federal agencies are required to identify and consider the potential effects that their undertakings might have on significant historic properties, districts, sites, buildings, structures, or objects that are included in or are eligible for inclusion in the National Register. Additionally, a federal agency shall consult with any tribe that attaches religious and cultural significance to such properties. Agencies shall afford the State Historic Preservation Officer and tribes a reasonable opportunity to comment before decisions are made.

Tribal Consultation (Tribal Interests)

In partial fulfillment of EO 13175 ("Consultation and Coordination with Indian Tribal Governments"), NEPA and Section 106, consultation was initiated with federally-recognized tribes: Alabama-Coushatta Tribe of Texas, Caddo Nation of Oklahoma, Chitimacha Tribe of Louisiana, Choctaw Nation of Oklahoma, Coushatta Tribe of Louisiana, Jena Band of Choctaw Indians, Mississippi Band of Choctaw Indians, Quapaw Tribe of Oklahoma, Seminole Nation of Oklahoma, Seminole Tribe of Florida and Tunica-Biloxi Tribe of Louisiana.

Resource Conservation and Recovery Act of 1976, as amended by the Hazardous and Solid Waste Amendments of 1984

A Phase I Environmental Site Assessment is required for all USACE Civil Works Projects to facilitate early identification and appropriate consideration of potential HTRW problems. HTRW includes any material listed as a "Hazardous Substance" under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Other regulated contaminants include those substances that are omitted under CERCLA but pose a potential health or safety hazard and are federally monitored. Examples include, but are not limited to, many industrial wastes, naturally occurring radioactive materials, herbicides, pesticides, and many substances associated with the oil and gas industry. ER 1165-2-132 and Division Regulation 1165-2-9 established policies for conducting HTRW reviews for USACE Civil Works Projects.

Coastal Zone Management Program

In an effort to encourage states to better manage coastal areas, Congress enacted the Coastal Zone Management Act in 1972, which created the Coastal Zone Management Program.

Executive Order 11514, Protection and Enhancement of Environmental Quality

EO 11514 directs federal agencies to "initiate measures needed to direct their policies, plans and programs so as to meet national environmental goals."

National Environmental Policy Act

This FS/EIS has been prepared in accordance with CEQ regulations in compliance with NEPA provisions. Impacts to the human environment, including those to terrestrial and aquatic resources and socioeconomic facts, have been identified, evaluated, and disclosed in this document.

Fish and Wildlife Coordination Act of 1934 (Fish & Wildlife)

The Fish and Wildlife Coordination Act provides authority for the USFWS involvement in evaluating impacts to fish and wildlife from proposed water resource development projects. It requires that fish and wildlife resources receive equal consideration to other project features. It requires federal agencies that construct, license, or permit water resource development projects to first consult with the USFWS, NMFS, and state resource agencies regarding the impacts on fish and wildlife resources and potential measures to mitigate these impacts. Section 2(b) requires the USFWS to produce a Coordination Act Report that details existing fish and wildlife resources in a project area, potential impacts due to a proposed project, and recommendations for a project.

Federal Water Project Recreation Act

This 1995 Act requires consideration of opportunities for outdoor recreation and fish and wildlife rehabilitation in planning water-resource projects.

Farmland Protection Policy Act of 1981 (Farmland)

In 1980, the CEQ issued an Environmental Statement memorandum "Prime and Unique Agricultural Lands" as a supplement to the NEPA procedures. In 1981, the Farmland Protection Policy Act was enacted. This act is intended to minimize the impact of federal programs on the unnecessary and irreversible conversion of farmland to nonagricultural uses. Projects are subject to requirements if they may irreversibly convert farmland to nonagricultural use and are completed by a federal agency or with assistance from a federal agency.

Executive Order 11988, Floodplain Management

EO 11988 directs agencies to evaluate the potential effects of proposed actions on floodplains. Such actions should not be undertaken that directly or indirectly induce growth in the floodplain unless there is no practical alternative.

Executive Order 11990, Protection of Wetlands

EO 11990 directs federal agencies to avoid, to the extent possible, the long and short term, adverse impacts associated with the destruction or modification of wetlands. Also, ER 11990 directs these agencies to avoid direct or indirect support of new construction in wetlands wherever there is a practical alternative. Mitigation planning was integrated into the project by considering, individually and collectively, each of the NEPA mitigation actions of avoiding,

minimizing, reducing, and rectifying potential adverse impacts to wetlands to the fullest extent practicable.

Executive Order 12898 Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

EO 12898 requires agencies to make achieving environmental justice (EJ) part of their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of programs, policies, and activities on minority populations and low-income populations. Potential EJ issues have been considered throughout planning.

Executive Order 13112, Invasive Species

EO 13112 directs federal agencies to prevent the introduction of invasive species; provide for their control; and minimize the economic, ecological, and human health impacts caused by invasive species. By law, the TSP is subject to the availability of appropriations and must be within Administration budgetary limits. Relevant authorities and programs to prevent the introduction of invasive species will be utilized during construction. The USACE will not authorize, fund, or carry out actions likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless the USACE has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species, and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

Migratory Bird Treaty Act of 1918; Migratory Bird Conservation Act; Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds

The Migratory Bird Treaty Act of 1918 (as amended) and the Migratory Bird Conservation Act extends federal protection to migratory birds and their habitat. Among other activities, non-regulated 'take' of migratory birds is prohibited under this Act in a manner similar to the ESA prohibition of 'take' of threatened and endangered species. Additionally, EO 13186 "Responsibility of Federal Agencies to Protect Migratory Birds" requires federal activities to assess and consider potential effects of their actions on migratory birds (including, but not limited to cranes, ducks, geese, shorebirds, hawks and songbirds). Many important habitats in the Project Area provide migratory bird shelter, nesting, feeding, and roosting habitat.

Federal Aviation Administration (FAA) – Hazardous Wildlife Attractants On or Near Airports

In accordance with FAA Advisory Circular 150/5200-33 and the Memorandum of Agreement among the FAA, USACE, and other federal agencies (July 2003), the TSP was evaluated to determine whether proposed land uses could increase wildlife hazards to aircraft using public use airports in the Study Area.

Mississippi Solid & Hazardous Waste

Miss. Code Ann. §§ 17-17-1 et seq. govern the handling and disposal of solid wastes by local governments and private entities, including the operating and closing of landfills. The statutes also address management and disposal of hazardous waste, requiring among other things that hazardous waste be disposed of using specific methods. Specific requirements regarding investigations, corrective action, closing out of facilities, and other actions are contained in Mississippi Department of Environmental Quality regulations, Title 11 Miss. Admin. Code Part 6, Chapters 3 and 4.

Mississippi Wastewater & Storm Water

Miss. Code Ann. §§ 49-17-1 et seq. govern wastewater and the prevention of pollution in the waters of the state. Mississippi wastewater and storm water permits are administered by MDEQ and are governed by its regulations found at Title 11 Miss. Admin. Code Part 6, Chapter 1, Subchapter 1. For storm water permits, Mississippi regulations require a Storm Water Pollution Prevention Plan along with a Notice of Intent for coverage, pursuant to 40 CFR § 122.26(c). Title 11 Miss. Admin. Code Part 6, 1.1.4.I.

Mississippi Section 401 Water Quality Certification

Section 401 Water Quality Certification is administered by MDEQ and is governed by its regulations found at Title 11 Miss. Admin. Code Part 6, Chapter 1, Subchapter 3. MDEQ's authority to oversee the 401 certification process derives from Miss. Code Ann. § 49-17-28.

Mississippi Dams and Obstructions

Miss. Code Ann. § 51-1-4, delineating certain waters as "public waterways," specifies that it is not intended to prohibit "the construction of dams and reservoirs by the State of Mississippi or any of its agencies or political subdivisions." The construction, enlargement, repair, or alteration of dams or reservoirs requires prior written authorization from the Permit Board. Miss. Code Ann. §51-3-39.

Mississippi Archives and History

Miss. Code Ann. §39-5-5 authorizes the Department of Archives and History to, among other things, determine the location of places of historical interest within the state and to acquire, preserve, restore or operate any property deemed significant for historical, archaeological, or cultural reasons. The Department is also charged with determining the sites of and designating Mississippi landmarks, acting as the State Historical Preservation Officer for the National Historic Preservation Act, as well as protecting and preserving the archaeological, historical, and architectural resources of the state. Miss. Code Ann. §39-7-7.

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7.0 PUBLIC INVOLVEMENT

7.1 NEPA PUBLIC INVOLVEMENT PROCESS

NEPA emphasizes public involvement in government actions affecting the environment by requiring that the benefits and risks associated with each proposed action be assessed and publicly disclosed. In accordance with NEPA public involvement requirements, opportunities were presented for the public to provide oral or written comments on potentially affected resources, environmental issues to be considered, and the agency's approach to the analysis. Efforts to involve the public in accordance with NEPA procedures, included holding and providing public notice of the NEPA-related public re-scoping meeting, soliciting appropriate information from the public, and explaining procedures of how interested parties can obtain information on the NEPA process. A summary of the public involvement activities will be provided in the EIS document, including comments received and the other underlying documents involved in the re-scoping process. Section 2.3 of this document presents preliminary results.

7.2 NOTICE OF INTENT

The Notice of Intent (NOI) informing the public of the FE/EIS is the first formal step in the NEPA public involvement process. The NOI declaring the USACE's intent to complete this FS/EIS was published in the Federal Register on July 25, 2013. The NOI included a description of the proposed action and the name and address of the agency contact person.

7.3 RE-SCOPING PROCESS

The purpose of the re-scoping process was to provide the public with an opportunity to obtain information regarding the project and solicit public comments on issues or concerns that should be addressed in the FS/EIS. The public had several opportunities to obtain information and submit comments including group meetings, public meetings, and the project web site. The public was also invited to submit a survey specifically to identify resources already being utilized and future opportunities within the Project Area.

Coordination meetings with local, state, and federal agencies and environmental groups were held early in the process. An agency cooperation meeting was held at Flowood City Hall on May 15, 2013. An Environmental Organizations Group meeting was held on June 27, 2013, at the Willie Morris Library in Jackson, MS. A planning charrette for additional agency input was held at the offices of Watkins & Eager PLLC on September 26, 2013.

A public re-scoping meeting was held at the Agriculture Museum in Jackson, MS, on August 29,

2013. The public re-scoping meeting aimed to provide an overview of the FS/EIS, identify project purpose and need, identify preliminary measures, and describe the NEPA process. Over 150 people attended the meeting and were provided the opportunity to provide verbal and/or written comments.

Another public meeting was held on October 29, 2013, at the Picayune High School Auditorium in Picayune, MS. This was to inform the public of the ongoing study and to make them aware of the re-scoping process. Opportunities to express concerns or comments regarding downstream concerns were provided.

The public comment period was open from August 29, 2013, to November 29, 2013. As the public notice and re-scoping comments were received, the Flood Control District recorded and cataloged each comment. All original copies, including transcripts of verbal comments, are being incorporated into the administrative record for this project. The comments were organized with respect to the topic at issue and used to identify public and agency concerns related to the proposed project. Appendix G includes information about the total number of comments received during the public comment period.

To further encourage public participation and involvement in the Study Area, the Flood Control District developed a survey to solicit specific input on issues, concerns, and opportunities for the Study Area. Sixty-eight surveys were completed and a summary of individual items is included in Appendix F. The value indicates the total number of times each topic was checked and the level of importance that was indicated by the surveys received. Each communication may include several comments regarding different elements of the FS/EIS. These specific comments were analyzed and categorized into themes, a summary of which is included within the Appendix F. Based upon public re-scoping meetings, environmental group meetings, agency meetings, planning charrette, and previous information from prior studies, a combined list of comments was developed and is included in Appendix G.

The Flood Control District has continued to encourage public participation and involvement throughout the process of developing the integrated draft FS/EIS. Representatives met with officials of St. Tammany Parish, LA, and the public on November 20, 2013, with members of the Mississippi Department of Marine Resources on March 6, 2014, and with representatives of the EPA on May 15, 2014. After updates as to the progress of this integrated draft FS/EIS report, officials and members of the public present were given the opportunity to ask questions and contribute comments regarding their concerns.

Public comments were considered in the initial screening process. Due to previous studies in the area, many of the issues and concerns were already documented. Those previously documented issues and concerns were also used as a basis for initial screening.

7.4 DRAFT REPORT RECIPIENTS

MISSISSIPPI CONGRESSIONAL DELEGATES	LOUISIANA CONGRESSIONAL DELEGATES
Senator Roger Wicker	Senator Bill Cassidy
Senator Cindy Hyde Smith	Senator John Kennedy
Congressman Gregg Harper	Representative Ralph Abraham
Congressman Steven Palazzo	Representative Steve Scalise
Congressman Bennie Thompson	
Congressman Trent Kelly	
MISSISSIPPI ELECTED LEADERSHIP	
Governor Phil Bryant	Copiah County Board of Supervisors
Lt. Governor Tate Reeves	Hancock County Board of Supervisors
Speaker of the House Philip Gunn	Hinds County Board of Supervisors
Secretary of State Delbert Hosemann	Madison County Board of Supervisors
City of Columbia – Mayor Justin McKenzie	Marion County Board of Supervisors
Town of Georgetown – Mayor Russel DuBose	Pearl River County Board of Supervisors
Town of Monticello – Mayor Martha Watts	Rankin County Board of Supervisors
City of Picayune – Mayor Dr. Ed Pinero	Simpson County Board of Supervisors
FEDERAL AGENCIES	**STATE OF MISSISSIPPI AGENCIES AND OFFICES**
Department of Commerce, National Marine Fisheries	Mississippi Department of Agriculture and Commerce
Department of Commerce, National Oceanic Atmosphere Administration	Mississippi Department of Archives and History
Department of Defense, Dept. of the Army, U.S. Army Corps of Engineers	Mississippi Department of Environmental Quality / Commission on Environmental Quality
Department of Defense, Dept. of the Navy, Naval Meteorology and Oceanography Command	Mississippi Department of Marine Resources
Department of Defense, Dept. of the Navy, Naval Small Craft Instruction and Technical Training School	Mississippi Department of Transportation
Department of Defense, Dept. of the Navy, Naval Special Warfare - Stennis	Mississippi Department of Wildlife, Fisheries, and Parks
Department of Homeland Security, Federal Emergency Management Agency	Mississippi Development Authority
Department of Interior, Fish and Wildlife Service	Mississippi Emergency Management Agency

FEDERAL AGENCIES (continued)	STATE OF MISSISSIPPI AGENCIES AND OFFICES (continued)
Department of Transportation	Mississippi Insurance Department
Environmental Protection Agency	Mississippi Soil and Water Conservation Commission
National Aeronautics and Space Administration, Stennis Space Center	Pearl River Valley Water Supply District
	Hancock County Port and Harbor Commission
STATE OF LOUISIANA AGENCIES AND OFFICES	**LIBRARIES**
Coastal Protection and Restoration Authority	Eudora Welty Library, Jackson, Mississippi
Louisiana Department of Environmental Quality	G. Chastaine Flynt Memorial Library, Flowood, Mississippi
Louisiana Department of Natural Resources	Margaret Reed Crosby Memorial Library, Picayune, Mississippi
Louisiana Department of Wildlife and Fisheries	St. Tammany Parish Library, Slidell Branch, Slidell, Louisiana
NATIVE AMERICAN TRIBES	
Alabama-Coushatta Tribe of Texas	Jena Band of Choctaw Indians
Caddo Indian Tribe of Oklahoma	Louisiana Bureau of Indian Affairs
Chickasaw Nation	Quapaw Tribe of Oklahoma
Choctaw Nation of Oklahoma	Tunica-Biloxi Tribe of Louisiana
Department of Homeland Affairs of Chickasaw Nation (Oklahoma)	United South and Eastern Tribes, Inc.
Governor of Chickasaw Nation (Oklahoma)	

8.0 RECOMMENDATIONS

8.1 PLAN RECOMMENDATION

This Integrated Draft Feasibility and Environmental Impact Statement (Feasibility Report) recommends that the TSP be carried forward, in accordance with the implementation and cost-sharing options outlined hereafter. Further TSP plan refinements and recommendations, as applicable, will be included in the final report.

8.2 PLAN IMPLEMENTATION & COST-SHARING

The project is authorized by section 401(e)(3) of the Water Resources Development Act (WRDA) of 1986 (100 STAT. 4132), as amended by section 3104 of WRDA 2007 (121 STAT 1134). This Feasibility Report is being completed under authority of Section 211 of WRDA 1996, pursuant to terms prescribed in the Memorandum of Agreement executed July 19, 2012, between the Flood Control District, as the non-Federal sponsor, and the USACE. The MOA specifies that this Section 211 Feasibility Report will serve as the decision document for review and approval by the Assistant Secretary of the Army for Civil Works (ASACW).

Following approval of the project by the ASACW, the project will move to the Preconstruction, Engineering and Design (PED) phase and, subsequently, the construction phase. The Flood Control District will continue to be the non-federal sponsor throughout these steps. Current law and associated guidance allow the project to be carried out with either the USACE or the Flood Control District as the lead entity. Regardless of who has the primary implementing role, the requirements and responsibilities of each party will be defined in the appropriate written partnership agreement, in accordance with Section 221 of WRDA 1970, as amended.

8.2.1 USACE AS LEAD ENTITY

Proceeding under traditional processes, the USACE would serve as the lead entity for project implementation, with the Flood Control District's roles and responsibilities defined through the appropriate agreement. Since the project has been authorized by Congress, the next step in the process of implementation would be for the Flood Control District and the USACE to execute a Design Agreement. The Design Agreement would define the specific roles of the two parties in completion and approval of design documents. On approval of project design plans and on receipt of construction funding, the two parties then would enter into a Project Partnership Agreement (PPA) that would define the roles and responsibilities under which they would collaborate in construction of the project. The Government, subject to the availability of funds and using those funds provided by the non-Federal sponsor, shall expeditiously construct the

project, applying those procedures usually applied to federal projects, pursuant to federal laws, regulations, and policies. With respect to such policy, it is noted, that with approval of this Feasibility Report by the ASACW, both the Government and the non-Federal sponsor, regardless of the approach chosen for design and construction, have satisfied the requirements necessary to reach the PED phase of the project, including compliance with Section 408 (33 U.S.C. 408).

8.2.2 FLOOD CONTROL DISTRICT AS LEAD ENTITY

Under this option, the Flood Control District would be the primary lead for carrying project activities forward. The provisions under 3104(c)(2) of WRDA 2007 relate directly to Section 211 of WRDA 1996, under which the current Feasibility Phase effort is being carried out. Upon receipt of the ROD, the Flood Control District would execute a new agreement to proceed to PED and construction under the authority of Section 211 of WRDA 1996 or Section 204 of WRDA 1986 (amended by WRRDA 2014 and WRDA 2016).

Prior to initiating construction, the Flood Control District would be required to produce project preconstruction documents that would meet USACE review requirements in establishing the technical validity of the project. Additionally, the Flood Control District would be required to comply with all applicable provisions of the Clean Water Act and other federal laws in force at the time related to permitting of water resources development projects. Given that the project is a Congressionally-authorized water resources development project, any permitting can be expected to proceed in accordance with Regulatory Guidance Letters 84-13 and 88-09.

The Flood Control District would be eligible for reimbursement of the federal share of the costs for the feasibility study, PED, and construction of the project or separable element(s). Both Sections 211 of WRDA 1996 and Section 204 of WRDA 1986, as amended, provide authority under which the Flood Control District could implement separable elements of the project, if desired. For instance, Policy Guidance Letter No. 53 (PGL-53), providing implementation guidance for Section 211, authorizes the non-Federal sponsor "to be reimbursed an amount equal to the estimate of the Federal share . . . of the design and construction cost of the project or separable element thereof." Under the authority of Section 211 of WRDA 1986, the Flood Control District would be eligible to receive reimbursement of the federal share upon completion of all project construction, while Section 204 of WRDA 1986, as amended, would allow reimbursement of the federal share for completion of discreet segments, or separable elements of the project.

8.3 NON-FEDERAL RESPONSIBILITIES

Regardless of which entity serves as lead, implementation of the project will be subject to the non-Federal sponsor agreeing to comply with applicable federal laws and policies, prescribed in

the model Partnership Agreement for Specifically-Authorized Structural Flood Risk Management Projects. Under the agreement, the non-Federal sponsor shall:

1. Contribute 50 percent of the costs of the feasibility phase of the study. It is noted here that through completion of the Feasibility Report, the non-Federal sponsor has contributed 100 percent of the costs of the feasibility phase;
2. Contribute 35 percent of the costs of preconstruction, engineering and design costs in accordance with the terms of the design agreement entered into prior to commencement of design work for the project;
3. Contribute a minimum of 35 percent, up to a maximum of 50 percent, of construction costs, as follows:
    a. Pay 5 percent of construction costs;
    b. Provide all lands, easements, and rights of way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material as determined by the Government to be required or to be necessary for the construction, operation, and maintenance of the project; and
    c. Pay any additional amount of funds required from the Non-Federal Sponsor to meet its minimum 35 percent cost share;
4. Not use funds from other federal programs, including any non-federal contribution required as a matching share therefore, to meet any of the non-federal obligations for the project unless the federal agency providing the federal portion of such funds verifies in writing that expenditure of such funds for such purpose is authorized;
5. Inform affected interests of the extent of protection afforded by the project not less than once each year;
6. Agree to participate in and comply with applicable federal floodplain management and flood insurance programs;
7. Comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), which requires a non-federal interest to prepare a floodplain management plan within one year after the date of signing a project partnership agreement, and to implement such plan not later than one year after completion of construction of the project;
8. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other

actions, to prevent unwise future development and to ensure compatibility with protection levels provided by the project;

9. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the level of protection the project affords, hinder operation and maintenance of the project, or interfere with the project's proper function;

10. Comply with all applicable provisions of the uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4601-4655), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way required for construction, operation, and maintenance of the project, including those necessary for relocations, the borrowing of materials, or the disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

11. OMRR&R the project or functional portions of the project, including any mitigation features, for so long as the project remains authorized at no cost to the federal government, in a manner compatible with the project's authorized purposes and in accordance with applicable federal and state laws and regulations and any specific directions prescribed by the federal government;

12. Give the federal government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;

13. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, rehabilitation, and replacement of the project and any betterments, except for damages due to the fault or negligence of the United States or its contractors;

14. Keep and maintain books, records, documents, or other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, or other evidence are required, to the extent and in such detail as will properly reflect total project costs, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 CFR Section 33.20;

15. Comply with all applicable federal and state laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; and all applicable federal labor standards and requirements including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701 – 3708 (revising, codifying and enacting without substantial change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c et seq.);

16. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the CERCLA, Public Law 96-510, as amended (42 U.S.C. 9601-9675), that may exist in, on, or under lands, easements, or rights-of-way that the federal government determines to be required for construction, operation, and maintenance of the project. However, for lands that the federal government determines to be subject to the navigation servitude, only the federal government shall perform such investigations unless the federal government provides the NFS with prior specific written direction, in which case the NFS shall perform such investigations in accordance with such written direction;

17. Assume as between the federal government and the NFS, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, or rights-of-way that the federal government determines to be required for construction, operation, and maintenance of the project;

18. Agree as between the federal government and the NFS, that the NFS shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, rehabilitate, and replace the project in a manner that will not cause liability to arise under the CERCLA;

19. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5b), and Section 103(j) of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 2213(j)), which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until each non-federal interest has entered into a written agreement to furnish its required cooperation for the project or separable element;

20. Not use any project features or lands, easements, and rights-of-way required for such features as a wetlands bank or mitigation credit for any other project; and

21. Pay all costs due for any project betterments or any additional work requested by the sponsor, subject to the sponsor's identification and request that the Government accomplish such betterments or additional work, and acknowledgement that if the Government in its sole discretion elects to accomplish the requested betterments or additional work, or any portion thereof, the Government shall so notify the NFS in writing that sets forth any applicable terms and conditions.

9.0 LIST OF PREPARERS (NEPA REQUIRED)

Person	Firm	Position
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Dallas Quinn	Pearl River Vision Foundation	Consultant
Gary Miller	Rankin-Hinds Pearl River Flood and Drainage Control District	Executive Director
Caleb Dana, P.E.	Allen Engineering and Science	Environmental/Solid Waste
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David Biedenharn, P.E.	Biedenharn Group, LLC	River Engineer
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11.0 ACRONYMS AND ABBREVIATIONS

°F .....degrees Fahrenheit
ug/L .....micrograms per liter
ADT.....Average Daily Traffic
ASACW .....Assistant Secretary of the Army for Civil Works
BA .....Biological Assessment
BCR .....Benefit-cost ratio
BMP.....Best Management Practice
BU.....beneficial use
BUG .....Beneficial Use Group
CAA.....Clean Air Act
CALM .....Consolidated Assessment and Listing Methodology
CBD.....Central Business District
CCP .....Composite Correction Program
CEQ.....Council on Environmental Quality
CERCLA .....Comprehensive Environmental Response, Compensation, and Liability Act
CFR .....Code of Federal Regulations
cfs .....Cubic feet per second
CO.....carbon monoxide
COC.....chemical of concern
CPE .....Comprehensive Performance Evaluation
CT .....census tract
CWA.....Clean Water Act
cy .....cubic yards
D/A .....disposal area
DA.....Department of the Army
DFEIS .....Draft Feasibility Environmental Impact Statement
DMMP .....Dredged Material Management Plan
DO .....Dissolved oxygen
DOT .....Department of Transportation
EA .....Environmental Assessment
EFH .....Essential Fish Habitat
EIS.....Environmental Impact Statement
EJ .....Environmental justice
EO.....Executive Order

EPA .....U.S. Environmental Protection Agency
EQ.....Environmental Quality
ER .....Engineering Regulation
ESA .....Endangered Species Act
FAA .....Federal Aviation Administration
FCSA .....Feasibility Cost-Sharing Agreement
FEIS.....Final Environmental Impact Statement
FEMA.....Federal Emergency Management Agency
FHWA .....Federal Highway Administration
FIA .....Flood Insurance Administration
Flood Control District.....Rankin-Hinds Pearl River Flood and Drainage Control District
FMP .....Fishery Management Plan
FONSI.....Finding of No Significant Impact
FPPA .....Farm and Protection Policy Act
FR.....Federal Register
FS/EIS .....Feasibility Study and Environmental Impact Statement
GHG .....Greenhouse Gas
HAP.....Hazardous Air Pollutant
HAPC.....Habitat Areas of Particular Concern
HEC-FDA .....Hydrologic Engineering Center- Flood Damage Analysis model
HEP .....Habitat Evaluation Procedures
HTRW .....Hazardous, Toxic, and Radiological Waste
Hwy .....highway
LEDPA .....least environmentally damaging practicable alternative
LERRD .....Lands, easements and rights of ways, relocations and disposal areas
LiDAR .....Light Detection and Ranging
LPP.....Locally Preferred Plan
MBTA.....Migratory Bird Treaty Act
mcy.....million cubic yards
MDA .....Mississippi Development Authority
MDAH.....Mississippi Department of Archives and History
MDEQ.....Mississippi Department of Environmental Quality
MDES.....Mississippi Department of Employment Security
MDMR .....Mississippi Department of Marine Resources
MDOT .....Mississippi Department of Transportation
MDPS.....Mississippi Department of Public Safety

MDWFP .....Mississippi Department of Wildlife, Fisheries, and Parks
mg/L .....milligrams per liter
mgd .....Million gallons per day
mL.....milliliter
MMNS .....Mississippi Museum of Natural Science
MNHP .....Mississippi Natural Heritage Program
mph .....miles per hour
MSA.....Metropolitan statistical area
msl.....mean sea level
NAAQS.....National Ambient Air Quality Standards
NED.....National Economic Development
NEPA.....National Environmental Policy Act
NFIP .....National Flood Insurance Program
NGVD.....National Geodetic Vertical Datum
NHPA .....National Historic Preservation Act
NLEB .....Northern Long-eared Bat
NMFS.....National Marine Fisheries Services
NO .....nitric oxide
NO_2..... nitrogen dioxide
NO_x..... nitrogen oxide
NOAA.....National Oceanic and Atmospheric Administration
NOI .....Notice of Intent
NORM.....naturally occurring radioactive materials
NPDES.....National Pollutant Discharge Elimination System
NPS .....National Park Service
NRC.....National Response Center
NRCS.....Natural Resources Conservation Service
NRHP .....National Register of Historic Places
NWI .....National Wetland Inventory
NWP .....Nationwide Permit
O_3 ..... ozone
OMRR&R .....operation, maintenance, repair, rehabilitation, and replacement
OSE .....other social effects
P&G .....Economic and Environmental Principles and Guidelines for Water and Related Land Implementation Studies
PAH.....polycyclic aromatic hydrocarbon
Pb .....lead

PCBs.....polychlorinated biphenyls
PCE .....primary constituent element
PED .....Pre-construction engineering and design
PEL.....probable equivalency level
PGL .....Policy Guidance Letter
PL.....Public Law
ppm .....parts per million
PMP .....Project Management Plan
PPA .....Project Partnership Agreement
ppt.....parts per thousand
PRBDD .....Pearl River Basin Development District
PRVWSD .....Pearl River Valley Water Supply District
RCRA.....Resource Conservation and Recovery Act
RCRIS .....Resource Conservation and Recovery Information System
RED .....Regional economic development
REP .....Real estate plan
RFI.....RCRA (Resource Conservation Recovery Act) Facility Investigation
RHPRFDCD.....Rankin-Hinds Pearl River Flood and Drainage Control District
RM .....River Mile
ROD .....Record of Decision
ROI.....Region of Influence
SAFETEA-LU.....Safe, Accountable, Flexible, Efficient Transportation Equity Act- A Legacy for Users
SCS.....Soil Conservation Service
SHPO .....State Historic Preservation Officer
SHWS.....State Hazardous Waste Sites records
SIP.....State Implementation Plan
SO_2..... sulfur dioxide
SO_X..... sulfur oxide
TMDL.....Total Maximum Daily Load
TN .....Total Nitrogen
TNC.....The Nature Conservancy
TOC.....Total Organic Carbon
TP.....Total Phosphorus
TSP.....Tentatively Selected Plan
TSS.....Total Suspended Solids
USACE.....U.S. Army Corps of Engineers

USACE-MVK.....U.S. Army Corps of Engineers, Vicksburg, MS, District
USC.....United States Code
USCG .....U.S. Coast Guard
USDA .....U.S. Department of Agriculture
USDOI.....U.S. Department of the Interior
USFWS.....U.S. Fish and Wildlife Service
USGS.....U.S. Geological Survey
VOC .....volatile organic compounds
WBI.....West Bank Interceptor
The WIIN Act .....The Water Infrastructure Improvements for the Nation Act
WLA.....Waste load allocation
WRDA.....Water Resources Development Act
WWTP .....Wastewater Treatment Plant

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12.0 INDEX (NEPA REQUIRED)